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(54) Title: COMPOSITIONS AND METHODS FOR MODIFICATION OF TARGET MOLECULES

(57) Abstract: The present disclosure provides a method for chemoselective modification of a target molecule. A subject method includes contacting a target molecule comprising a thiol moiety with a biomolecule comprising a reactive moiety, wherein the reactive moiety is generated by reaction of a biomolecule comprising a phenol moiety or a catechol with an enzyme capable of oxidizing the phenol or the catechol moiety. The contacting is carried out under conditions sufficient for conjugation of the target molecule to the biomolecule, thereby producing a modified target molecule. The present disclosure provides compositions comprising a subject target molecule comprising a thiol moiety, and a biomolecule comprising a phenol moiety or a catechol moiety. The present disclosure provides kits for carrying out a subject method. The present disclosure also provides modified target molecules and methods for using same.

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COMPOSITIONS AND METHODS FOR MODIFICATION OF TARGET MOLECULES

CROSS-REFERENCE

[0001] This application claims the benefit of U.S. Provisional Patent Application No. 62/822,616, filed March 22, 2019, and U.S. Provisional Patent Application No. 62/910,836, filed October 4, 2019, which applications are incorporated herein by reference in their entirety.

INCORPORATION BY REFERENCE OF SEQUENCE LISTING PROVIDED AS A TEXT FILE

[0002] A Sequence Listing is provided herewith as a text file, "BERK-405WO_SEQ_LISTING_ST25.txt" created on March 17, 2020 and having a size of 8,056 KB. The contents of the text file are incorporated by reference herein in their entirety.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH

[0003] This invention was made with government support under Grant Nos. 1059083 and 1808189 awarded by the National Science Foundation. The government has certain rights in the invention.

INTRODUCTION

[0004] Coupling biomolecules to target molecules, to generate conjugates, while preserving the function of the biomolecule and the target molecule, has long been a goal of chemical biology and biopharmaceutical research. Examples of conjugates include protein-peptide conjugates for vaccine development, antibody-drug, and antibody-protein conjugates for immunotherapeutics.

[0005] While many techniques have been developed to allow for attachment of moderately sized molecules to proteins, it has been challenging to develop a simple biomolecule modification procedure that can attach proteins or biomolecules in a site-specific manner to any position on a protein's surface.

[0006] There is a need for improved target molecule modification procedures that can modify a target molecule in a simple yet site specific manner.

SUMMARY

[0007] The present disclosure provides a method for chemoselective modification of a target molecule. A subject method includes contacting a target molecule comprising a thiol moiety with a biomolecule comprising a reactive moiety, wherein the reactive moiety is generated by reaction of a biomolecule comprising a phenol moiety or a catechol with an enzyme capable of oxidizing the phenol or the catechol moiety. The contacting is carried out under conditions sufficient for

conjugation of the target molecule to the biomolecule, thereby producing a modified target molecule. The present disclosure provides compositions comprising a subject target molecule comprising a thiol moiety, and a biomolecule comprising a phenol moiety or a catechol moiety. The present disclosure provides kits for carrying out a subject method. The present disclosure also provides modified target molecules and methods for using same.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The invention is best understood from the following detailed description when read in conjunction with the accompanying figures. It is emphasized that, according to common practice, the various features of the figures are not to-scale. On the contrary, the dimensions of the various features are arbitrarily expanded or reduced for clarity. Included in the drawings are the following figures. It is understood that the figures, described below, are for illustration purposes only. The figures are not intended to limit the scope of the present teachings in any way.

[0009] **FIG. 1A** illustrates activation of phenol and catechol moieties with a tyrosinase enzyme to provide a quinone intermediate, and subsequent reaction of the quinone intermediate with potential nucleophiles.

[0010] **FIG. 1B** illustrates an exemplary subject chemoselective modification reaction of a target protein with solvent exposed thiol (A) with a tyrosine/phenol containing coupling partner (B) to provide a covalently bound conjugation product (C).

[0011] **FIG. 2, panel A** depicts ESI-TOF data showing MS2 N87C modified with alpha-endorphin peptide, as well as maleimide blocking experiments, illustrating that capping the thiols via a maleimide on the protein blocks addition via tyrosinase catalyzed reaction, and that where tyrosinase is performed first this also blocks the reaction of maleimide. This Figure demonstrates that the surface cysteines are the residues being modified. **FIG. 2, panel B** depicts stability studies for protein-peptide conjugates under various conditions. All samples were stored in 50 mM phosphate buffer at the stated conditions.

[0012] **FIG. 3** illustrates exemplary examples of biomolecules comprising a phenol moiety compatible in the subject methods.

[0013] **FIG. 4** illustrates ESI-TOF data showing coupling of various peptides to cysteine-containing mutants of the MS2 viral capsid. The peptides consisted of the following sequences with acylated N-termini: 2NLS: Ac-YGPKKKRKVGGSPKKKRKV (SEQ ID NO: 943); IL13: Ac-GYACGEMGWVRCGGSK (SEQ ID NO: 944); R8: Ac-YGRRRRRRRR (SEQ ID NO: 945); and HIV-Tat: Ac-YGRKKRRQRRRPPQ (SEQ ID NO: 946).

[0014] **FIG. 5, panel A** illustrates ESI-TOF data showing Cas9 (C80, C574) is modified twice by endorphin. **FIG. 5, panel B** depicts an in vitro DNA cleavage assay, demonstrating that Cas9 (RNP) modified with peptide (End) retains cleavage activity even if modified prior to addition to guide RNA (apo). For each treatment RNP was added across a concentration gradient to determine activity on target DNA strands. **FIG. 5, panel C** illustrates ESI-TOF data showing successful Cas9-GFP conjugation. The sequences are set forth as follows: GYGGS (SEQ ID NO: 1021), MYGGS (SEQ ID NO: 1022). **FIG. 5, panel D** depicts an in vitro cleavage assay, showing that Cas9 modified with GFP retains activity compared to controls. The sequences are set forth as follows: MYGGS (SEQ ID NO: 1022), SGGGGY (SEQ ID NO: 1040).

[0015] **FIG. 6** illustrates that Cas9 modified by peptides containing two copies of the SV40 nuclear localization sequence were able to enter and edit neural progenitor cells, allowing for a 20-fold increase in editing efficiency.

[0016] **FIG. 7** illustrates ESI-TOF data showing modification of a phenol containing protein with small molecule thiols.

[0017] **FIGS. 8 and 9** provide mushroom tyrosinase amino acid sequences. The sequence of FIG. 8 is set forth in SEQ ID NO: 971. The sequence of FIG. 9 is set forth in SEQ ID NO: 972.

[0018] **FIGS. 10A-10Z** and **10AA-10VV** provide *Bacillus megaterium* tyrosinase amino acid sequences. The sequences of FIGs. 10A-10Z are set forth in SEQ ID NOs: 973-998. The sequences of FIGs. 10AA-10VV are set forth in SEQ ID NOs: 999-1020.

[0019] **FIG. 11** illustrates an abTYR-Peptide Charge Screen: 5-Mer tyrosine containing peptides were coupled to Y182C GFP and pAF MS2 using abTYR. The resulting reaction mixture was analyzed using Q-TOF Mass Spectrometry. Reaction Conditions: 50M μM GFP, 250 μM Peptide, 0.167 μM Tyrosinase, 10mM Buffer pH 6.5, 30 Min @ RT, all reactions were quenched with 10mM tropolone. The sequences are set forth as follows: GGGGY (SEQ ID NO: 1024), RGGGY (SEQ ID NO: 1025), RGRGY (SEQ ID NO: 1026), RRRGY (SEQ ID NO: 1027), RRRRY (SEQ ID NO: 1028), EGGGY (SEQ ID NO: 1029), EGEGY (SEQ ID NO: 1030), EEEGY (SEQ ID NO: 1031), EEEEY (SEQ ID NO: 1032), GGGWY (SEQ ID NO: 1033), GGWGY (SEQ ID NO: 1034), RRRWY (SEQ ID NO: 1035), RRWRY (SEQ ID NO: 1036), EEEWY (SEQ ID NO: 1037), EEWEY (SEQ ID NO: 1038).

[0020] **FIGS. 12A-12B** illustrate abTYR and bmTYR models: abTYR (a) has an overall negative charge (red residues) around its active site due to the abundance of glutamate and aspartate residues. In contrast bmTYR (b) has a slight positive charge (blue residues) around its active site.

[0021] **FIG. 13** illustrates a bmTYR Charge Screen: 5-Mer tyrosine containing peptides were coupled to Y182C GFP using bmTYR. The resulting reaction mixture was analyzed using Q-TOF Mass Spectrometry, indicating that bmTYR prefers negatively charged substrates. Reaction Conditions: 50M μM GFP, 250 μM Peptide, 0.2 μM Tyrosinase, 10mM Buffer pH 6.5, 30 Min at 37 Celsius, all reactions were quenched with 10mM tropolone. The sequences are set forth as follows: GGGGY (SEQ ID NO: 1024), GGGWY (SEQ ID NO: 1033), EEEGY (SEQ ID NO: 1031), RRRGY (SEQ ID NO: 1027).

[0022] **FIG. 14** illustrates a comparison between abTYR and bmTYR with respect to the EGGGY (SEQ ID NO: 1029) and EEEEY (SEQ ID NO: 1032) peptides. Reaction Conditions (abTYR): 50M μM GFP, 250 μM Peptide, 0.167 μM Tyrosinase, 10mM Buffer pH 6.5, 30 Min at RT. Reaction Conditions(bmTYR): 10M μM GFP, 50 μM Peptide, 0.8 μM Tyrosinase, 10mM Buffer pH 6.5, 1H at RT, all reactions were quenched with 10mM tropolone.

[0023] **FIG. 15A-15C** show oxidative coupling strategies for protein modification. **a**) Chemical and physical methods of accessing *o*-quinones and *o*-iminoquinones for coupling to N-terminal proline residues and aminophenyl groups. **b**) Tyrosinase-mediated oxidation of phenols for coupling to N-terminal proline residues. **c**) Tyrosine-tagging proteins for selective tyrosinase-mediated generation of *o*-quinones at protein N or C termini followed by coupling with exogenous amine nucleophiles.

[0024] **FIG. 16A-16B** show attachment of Tyr containing peptides to p-aminophenylalanine-containing MS2 (pAF-MS2). *N*-Ac-α-endorphin has an accessible tyrosine residue at its N-terminus. This site can be oxidized by tyrosinase and coupled to pAF-MS2 capsids, which contain aniline groups introduced using the Schultz amber codon suppression method. The sequences are set forth as follows: GGFMTSEKSQTPLVT (SEQ ID NO: 1039) (b) The positions of the 180 aniline groups are shown in pink on the full viral capsid (PDB ID: 2MS2). ESI-TOF MS analysis showed virtually complete conversion to the expected product (expected: 15589 Da). No overmodification was observed.

[0025] **FIG. 17A-17E** show efficiency of *A. bisporus* tyrosinase-mediated coupling with amine nucleophiles **a**) The C-terminally -GGY tagged Trastuzumab scFv was used as a model coupling partner. **b**) Crystal structure of Trastuzumab heavy and light chain variable domains that make up the scFv. **c**) Representative mass spectra of starting scFv-GGY before and after coupling with 150 μM Aniline. **d**) 4-Aminophenyl-derived nucleophiles were screened at concentrations from 25 μM to 750 μM. **e**) Pyrrolidine and Piperazine-derived nucleophiles were screened at concentrations from 100 μM to 5000 μM. Conversion was approximated via integration of TOF-LCMS. See Supporting Figure X for representative spectra.

[0026] **FIG. 18** shows tyrosine-tagged protein substrates successfully coupled using *A. bisporus* tyrosinase. C-termini are highlighted in red and internal tyrosine residues in orange. Reactions were performed with tyrosinase, and aniline in phosphate buffer at pH 6.5. a) N-terminally Tagged Ubiquitin. b) C-terminally -$(GGGGS)_2$GGY-tagged sfGFP. (SEQ ID NO: 947) c) C-terminally-GGY-tagged Trastuzumab scFv. The sequences are set forth as follows: SGGGGY (SEQ ID NO: 1040).

[0027] **FIG. 19A-19C** show flow cytometry study of fluorophore-coupled Trastuzumab scFv binding SKBR3 (HER2+) cells. **a**) Oxidative coupling of GGY-tagged scFv with 12 U/L A. bisporus Tyrosinase and 50 μM Aniline-Oregon Green 488. **b**) ESI TOF-MS indicates that scFv-GGY was coupled with 85% conversion. A non-tagged version of the scFv was unmodified.

[0028] **FIG. 20A-20B** show an exploration of C-terminal linkers and utility of *B. megaterium* tyrosinase. **a**) A variety of types and lengths of linkers were appended to the C-terminus of protein L, including two that utilized the natural inter-domain linker sequence of domains 4 and 5. Protein L-variants were subject to the standard coupling reaction with B. megaterium tyrosinase. The sequence is set forth in SEQ ID NO: 1041. **b**) Conversion observed by TOF-LCMS after treatment with *B. megaterium* tyrosinase. None of the variants could be modified by *A. bisporus* tyrosinase. The sequences are set forth as follows: $(G_4S)_2$GGY (SEQ ID NO: 947), $(G_4S)_3$GGY (SEQ ID NO: 1042), A$(EAAAK)_2$AGGY (SEQ ID NO: 1043), $(AP)_3$GGY (SEQ ID NO: 1044), AN_{20}GGY (SEQ ID NO: 1045), EIKRTGGY (SEQ ID NO: 1046), G_4SGGY (SEQ ID NO: 968).

[0029] **FIG. 21A-21C** show *B. megaterium*-mediated oxidative coupling of C-terminally tyrosine-tagged MBP. **a**) Crystal structure of MBP with C-terminus highlighted in red. Tyrosine residues in orange. Bound maltose in yellow. b) data with MBP-SSGGGGY (SEQ ID NO: 948); c) data with MBP-GGY.

[0030] **FIG. 22A-22D** show the detection of HER2+ cells using a protein-L - O.G. 488 conjugate "Secondary" affinity reagent. **a**) Detection scheme: non-tyrosine tagged trastuzumab scFv binds to HER2+ SK-BR-3 cell and is recognized by O.G. 488-modified protein-L. **b**) Secondary affinity reagent was made from -AN20GGY terminated protein-L variant using 25 μM O.G. 488-Aniline, with *B. megaterium* tyrosinase. **c**) Mass spectra of the Protein-L-AN20GGY before and after modification. **d**) Flow cytometry fluorescence data of SK-BR-3 cells treated according to the scheme above and negative controls. MDA-MB-468 cells were used as the HER2- control. The sequences are set forth as follows: AN_{20}GGY (SEQ ID NO: 1045).

[0031] **FIG. 23** shows a C-Terminally -GGY tyrosine-tagged and non-tagged Trastuzumab scFv subjected to oxidative coupling conditions. 12 U/mL abTYR, 150 μM Aniline, 20 mM sodium phosphate buffer, pH 6.5, 1 hour.

[0032] **FIG. 24A-24D** show a variation of abTyr and Aniline concentration on conversion of -GGY tagged Trastuzumab scFv. a) Reaction scheme b) Representative mass spectra: 1000 M Aniline with variable abTYR concentration c) Tabulated % conversion of Trastuzumab ("Tras.") scFv-GGY to Aniline-coupled product. d) Graphical representation of conversion of Tras. scFv-GGY to Aniline-coupled product.

[0033] **FIG. 25** shows a late nucleophile addition experiment. Aniline was added to the abTYR mediated oxidative coupling 5, 10, 20, 40, or 60 minutes after the tyrosinase enzyme.

[0034] **FIG. 26** shows a representative spectra of oxidative coupling reactions with 4-Aminophenyl derived, nucleophiles. a) o-Toluidine, b) 2,6-Dimethylanaline, c) 4-Aminophenyl-*N*-methylamide.

[0035] **FIG. 27** shows representative spectra of oxidative coupling reactions.

[0036] **FIG. 28** shows oxidative coupling reactions of Protein L variants. The sequences are set forth as follows: $(G_4S)_2$GGY (SEQ ID NO: 947); $(G_4S)_3$GGY (SEQ IDNO: 1042), A$(EAAAK)_2$AGGY (SEQ ID NO: 1043), $(AP)_3$GGY (SEQ ID NO: 1044).

[0037] **FIG. 29A-29B** show a stability study of Trastuzumab scFv-GGY in protein storage buffer (20 mM Na_2HPO_4, 150 mM NaCl, with 15% glycerol, pH 7.4) plus 10 mM dithiothreitol (DTT), stored at 4 °C. TOF-LCMS spectra in each column were from the same aliquot of protein sampled at the indicated timepoints. Disulfide-reduced scFv-GGY for the uncoupled and coupled proteins have calculated masses of 26,337.2 Da and 26,442.2 Da respectively. Aniline coupled + reduced + DTT = 26,594.45 Da **a**) Subject to abTYR mediated oxidative coupling with Aniline. **b**) Not subject to the oxidative coupling reaction.

[0038] **FIG. 30A-30B** show a stability study of Trastuzumab scFv-GGY in protein storage buffer (20 mM Na2HPO4, 150 mM NaCl, with 15% glycerol, pH 7.4), stored at 4 °C. TOF-LCMS spectra in each column were from the same aliquot of protein sampled at the indicated timepoints. Disulfide-reduced scFv-GGY for the uncoupled and coupled proteins have calculated masses of 26,337.2 Da and 26,442.2 Da respectively. **a**) Subject to abTYR mediated oxidative coupling with aniline and exchanged into protein storage buffer. **b**) Not subject to the oxidative coupling reaction.

[0039] **FIG. 31A-31B** show a stability study of Trastuzumab scFv-GGY in protein storage buffer (20 mM Na_2HPO_4, 150 mM NaCl, with 15% glycerol, pH 7.4) plus 10 mM Glutathione, stored at 4 °C. TOF-LCMS spectra in each column were from the same aliquot of protein sampled at the

indicated timepoints. Disulfide-reduced scFv-GGY for the uncoupled and coupled proteins have calculated masses of 26,337.2 Da and 26,442.2 Da respectively. Aniline coupled + reduced + 1x Glutathione = 26,747.58 Da; Aniline coupled + reduced + 2x Glutathione = 27,052.89 Da **a**) Subject to abTYR mediated oxidative coupling with Aniline. **b**) Not subject to the oxidative coupling reaction.

[0040] **FIG. 32** shows a study of thiol exchange in oxidative coupling reaction product. Trastuzumab scFv-GGY was exchanged into protein storage buffer (20 mM Na_2HPO_4, 150 mM NaCl, with 15% glycerol, pH 7.4) plus 10 mM Glutathione, and stored at 4 °C. After 24 hours, a portion of the sample was submitted to TOF-LCMS analysis, and the remainder was exchanged into protein storage buffer plus 10 mM DTT and stored at 4 °C for an additional 24 hours. A second sample was then submitted to TOF-LCMS analysis.

[0041] **FIG. 33** shows the average mass of protein constructs. The sequences are set forth as follows: GGGGSGGY (SEQ ID NO: 968); $(GGGGS)_2GGY$ (SEQ ID NO: 947); $(AP)_4GGY$ (SEQ ID NO: 1061); $AN_{20}GGY$ (SEQ ID NO: 1045), SSGGGGY (SEQ ID NO: 948), $(GGGGS)_3GGY$ (SEQ ID NO: 1042), AEAAAKEAAAKAGGY (SEQ ID NO: 1043), $(AP)_3GGY$ (SEQ ID NO: 1044), EIKRTGGY (SEQ ID NO: 1046), GGGGSGGY (SEQ ID NO: 968).

[0042] **FIGS. 34A-34E** provides the amino acid sequences for protein constructs. The sequences of FIGs. 34A-34E are set forth in SEQ ID NOs: 1049-1053.

[0043] **FIG. 35** depicts use of a D55K mutant of *Bacillus megaterium* tyrosinase (bmTYR) to couple phenol-labeled nucleic acid to a cysteine-containing protein.

[0044] **FIG. 36A-36C** depict coupling of nucleic acids to polypeptides using methods of the present disclosure.

[0045] **FIG. 37A-37C** depict the impact of various mutations to bmTYR on its preference for charged substrates.

[0046] **FIG. 38** depicts lack of activity of abTYR on activating a negatively charged substrate.

[0047] **FIG. 39A-39G** schematically depict concatenation of proteins using a method of the present disclosure.

[0048] **FIG. 40A-40C** depict stability of target molecule-biomolecule conjugates in human serum.

[0049] **FIG. 41** depicts coupling of Cas9 to: i) an Ig Fc polypeptide; ii) and to a nanobody, using a method of the present disclosure.

[0050] **FIG. 42** depicts time-of-flight mass-spectroscopy data for a Cas9-nanobody conjugate.

[0051] **FIG. 43A-43B** depict: i) a method for the direct labeling of live mammalian cell surfaces (FIG. 43A); and ii) coupling of a polypeptide to a cell surface, using a method of the present disclosure.

[0052] **FIG. 44A-44B** depict reactions in which a target molecule includes two thiol moieties.

DEFINITIONS

[0053] Before the present invention is further described, it is to be understood that this invention is not limited to particular embodiments described, as such may, of course, vary. It is also to be understood that the terminology used herein is for the purpose of describing particular embodiments only, and is not intended to be limiting, since the scope of the present invention will be limited only by the appended claims.

[0054] Where a range of values is provided, it is understood that each intervening value, to the tenth of the unit of the lower limit unless the context clearly dictates otherwise, between the upper and lower limit of that range and any other stated or intervening value in that stated range, is encompassed within the invention. The upper and lower limits of these smaller ranges may independently be included in the smaller ranges, and are also encompassed within the invention, subject to any specifically excluded limit in the stated range. Where the stated range includes one or both of the limits, ranges excluding either or both of those included limits are also included in the invention.

[0055] Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. Although any methods and materials similar or equivalent to those described herein can also be used in the practice or testing of the present invention, the preferred methods and materials are now described. All publications mentioned herein are incorporated herein by reference to disclose and describe the methods and/or materials in connection with which the publications are cited.

[0056] It must be noted that as used herein and in the appended claims, the singular forms "a," "an," and "the" include plural referents unless the context clearly dictates otherwise. Thus, for example, reference to "a thiol group" includes a plurality of such thiol groups and reference to "the thiol group" includes reference to one or more thiol groups and equivalents thereof known to those skilled in the art, and so forth. It is further noted that the claims may be drafted to exclude any optional element. As such, this statement is intended to serve as antecedent basis for use of such exclusive terminology as "solely," "only" and the like in connection with the recitation of claim elements, or use of a "negative" limitation.

[0057] It is appreciated that certain features of the invention, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features of the invention, which are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable sub-combination. All

combinations of the embodiments pertaining to the invention are specifically embraced by the present invention and are disclosed herein just as if each and every combination was individually and explicitly disclosed. In addition, all sub-combinations of the various embodiments and elements thereof are also specifically embraced by the present invention and are disclosed herein just as if each and every such sub-combination was individually and explicitly disclosed herein.

[0058] The publications discussed herein are provided solely for their disclosure prior to the filing date of the present application. Nothing herein is to be construed as an admission that the present invention is not entitled to antedate such publication by virtue of prior invention. Further, the dates of publication provided may be different from the actual publication dates which may need to be independently confirmed.

[0059] As used herein, the term "affinity tag" refers to a member of a specific binding pair, i.e. two molecules where one of the molecules through chemical or physical means specifically binds to the other molecule. The complementary member of the affinity tag may be immobilized (e.g., to a chromatography support, a bead or a planar surface) to produce an affinity chromatography support that specifically binds the affinity tag. Tagging a compound of interest with an affinity tag allows the compound to be separated from a mixture of untagged compounds by affinity, e.g., using affinity chromatography. Examples of specific binding pairs include biotin and streptavidin (or avidin), and antigen and antibody, although binding pairs, e.g., nucleic acid hybrids, polyhistidine and nickel, and azido and alkynyl (e.g., cyclooctynyl) or phosphino groups are also envisioned. The specific binding pairs may include analogs, derivatives and fragments of the original specific binding members.

[0060] As used herein, the term “biotin moiety” refers to an affinity tag that includes biotin or a biotin analogue such as desthiobiotin, oxybiotin, 2’-iminobiotin, diaminobiotin, biotin sulfoxide, biocytin, etc. Biotin moieties bind to streptavidin with an affinity of at least 10^{-8}M. A biotin moiety may also include a linker, e.g., —LC-biotin, —LC-LC-Biotin, —SLC-Biotin or —PEG_{n^1}-Biotin where n^1 is 3-12.

[0061] By "linking" or "linker" as in "linking group," "linker moiety," etc., is meant a linking moiety that connects two groups via covalent bonds. The linker may be linear, branched, cyclic or a single atom. Examples of such linking groups include alkyl, alkenylene, alkynylene, arylene, alkarylene, aralkylene, and linking moieties containing functional groups including, without limitation: amido (-NH-CO-), ureylene (-NH-CO-NH-), imide (-CO-NH-CO-) , epoxy (-O-), epithio (-S-), epidioxy (-O-O-), epidithio (-S-S-), carbonyldioxy (-O-CO-O-), alkyldioxy (-O-(CH2)n-O-), epoxyimino (-O-NH-), epimino (-NH-), carbonyl (-CO-), etc. In certain cases, one, two, three, four or five or more carbon atoms of a linker backbone may be optionally substituted with a sulfur, nitrogen or oxygen heteroatom. The bonds between backbone atoms may be

saturated or unsaturated, usually not more than one, two, or three unsaturated bonds will be present in a linker backbone. The linker may include one or more substituent groups, for example with an alkyl, aryl or alkenyl group. A linker may include, without limitations, poly(ethylene glycol) unit(s) (e.g., -(CH_2-CH_2-O)-); ethers, thioethers, amines, alkyls (e.g., (C_1-C_{12})alkyl) , which may be straight or branched, e.g., methyl, ethyl, n-propyl, 1-methylethyl (iso-propyl), n-butyl, n-pentyl, 1,1-dimethylethyl (t-butyl), and the like. The linker backbone may include a cyclic group, for example, an aryl, a heterocycle or a cycloalkyl group, where 2 or more atoms, e.g., 2, 3 or 4 atoms, of the cyclic group are included in the backbone. A linker may be cleavable or non-cleavable. Any convenient orientation and/or connections of the linkers to the linked groups may be used.

[0062] "Alkyl" refers to monovalent saturated aliphatic hydrocarbyl groups having from 1 to 10 carbon atoms, e.g., from 1 to 6 carbon atoms. This term includes, by way of example, linear and branched hydrocarbyl groups such as methyl (CH_3-), ethyl (CH_3CH_2-), n-propyl ($CH_3CH_2CH_2$-), isopropyl ((CH_3)$_2$CH-), n-butyl ($CH_3CH_2CH_2CH_2$-), isobutyl ((CH_3)$_2$$CHCH_2$-), sec-butyl (($CH_3$)($CH_3CH_2$)CH-), t-butyl (($CH_3$)$_3$C-), n-pentyl ($CH_3CH_2CH_2CH_2CH_2$-), and neopentyl (($CH_3$)$_3$$CCH_2$-).

[0063] The term "substituted alkyl" refers to an alkyl group as defined herein wherein one or more carbon atoms in the alkyl chain (except the C_1 carbon atom) have been optionally replaced with a heteroatom such as -O-, -N-, -S-, -S(O)$_n^2$- (where n^2 is 0 to 2), -NR- (where R is hydrogen or alkyl) and having from 1 to 5 substituents selected from the group consisting of alkoxy, substituted alkoxy, cycloalkyl, substituted cycloalkyl, cycloalkenyl, substituted cycloalkenyl, acyl, acylamino, acyloxy, amino, aminoacyl, aminoacyloxy, oxyaminoacyl, azido, cyano, halogen, hydroxyl, oxo, thioketo, carboxyl, carboxylalkyl, thioaryloxy, thioheteroaryloxy, thioheterocyclooxy, thiol, thioalkoxy, substituted thioalkoxy, aryl, aryloxy, heteroaryl, heteroaryloxy, heterocyclyl, heterocyclooxy, hydroxyamino, alkoxyamino, nitro, -SO-alkyl, -SO-aryl, -SO-heteroaryl, -SO_2-alkyl, -SO_2-aryl, -SO_2-heteroaryl, and -NR^aR^b, wherein R' and R" may be the same or different and are chosen from hydrogen, optionally substituted alkyl, cycloalkyl, alkenyl, cycloalkenyl, alkynyl, aryl, heteroaryl and heterocyclic.

[0064] "Aryl" or "Ar" refers to a monovalent aromatic carbocyclic group of from 6 to 18 carbon atoms having a single ring (such as is present in a phenyl group) or a ring system having multiple condensed rings (examples of such aromatic ring systems include naphthyl, anthryl and indanyl) which condensed rings may or may not be aromatic, provided that the point of attachment is through an atom of an aromatic ring. This term includes, by way of example, phenyl and naphthyl. Unless otherwise constrained by the definition for the aryl substituent, such aryl groups can optionally be substituted with from 1 to 5 substituents, or from 1 to 3

substituents, selected from acyloxy, hydroxy, thiol, acyl, alkyl, alkoxy, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, substituted alkyl, substituted alkoxy, substituted alkenyl, substituted alkynyl, substituted cycloalkyl, substituted cycloalkenyl, amino, substituted amino, aminoacyl, acylamino, alkaryl, aryl, aryloxy, azido, carboxyl, carboxylalkyl, cyano, halogen, nitro, heteroaryl, heteroaryloxy, heterocyclyl, heterocyclooxy, aminoacyloxy, oxyacylamino, thioalkoxy, substituted thioalkoxy, thioaryloxy, thioheteroaryloxy, -SO-alkyl, -SO-substituted alkyl, -SO-aryl, -SO-heteroaryl, -SO_2-alkyl, -SO_2-substituted alkyl, -SO_2-aryl, -SO_2-heteroaryl and trihalomethyl.

[0065] "Amino" refers to the group –NH_2.

[0066] The term "substituted amino" refers to the group -NRR where each R is independently selected from the group consisting of hydrogen, alkyl, substituted alkyl, cycloalkyl, substituted cycloalkyl, alkenyl, substituted alkenyl, cycloalkenyl, substituted cycloalkenyl, alkynyl, substituted alkynyl, aryl, heteroaryl, and heterocyclyl provided that at least one R is not hydrogen.

[0067] In addition to the disclosure herein, the term "substituted," when used to modify a specified group or radical, can also mean that one or more hydrogen atoms of the specified group or radical are each, independently of one another, replaced with the same or different substituent groups as defined below.

[0068] In addition to the groups disclosed with respect to the individual terms herein, substituent groups for substituting for one or more hydrogens (any two hydrogens on a single carbon can be replaced with =O, =NR^{70}, =N-OR^{70}, =N_2 or =S) on saturated carbon atoms in the specified group or radical are, unless otherwise specified, -R^{60}, halo, =O, -OR^{70}, -SR^{70}, -$NR^{80}R^{80}$, trihalomethyl, -CN, -OCN, -SCN, -NO, -NO_2, =N_2, -N_3, -SO_2R^{70}, -$SO_2O^-M^+$, -SO_2OR^{70}, -OSO_2R^{70}, -$OSO_2O^-M^+$, -OSO_2OR^{70}, -$P(O)(O^-)_2(M^+)_2$, -$P(O)(OR^{70})O^-M^+$, -$P(O)(OR^{70})_2$, -$C(O)R^{70}$, -$C(S)R^{70}$, -$C(NR^{70})R^{70}$, -$C(O)O^-M^+$, -$C(O)OR^{70}$, -$C(S)OR^{70}$, -$C(O)NR^{80}R^{80}$, -$C(NR^{70})NR^{80}R^{80}$, -$OC(O)R^{70}$, -$OC(S)R^{70}$, -$OC(O)O^-M^+$, -$OC(O)OR^{70}$, -$OC(S)OR^{70}$, -$NR^{70}C(O)R^{70}$, -$NR^{70}C(S)R^{70}$, -$NR^{70}CO_2^-M^+$, -$NR^{70}CO_2R^{70}$, -$NR^{70}C(S)OR^{70}$, -$NR^{70}C(O)NR^{80}R^{80}$, -$NR^{70}C(NR^{70})R^{70}$ and -$NR^{70}C(NR^{70})NR^{80}R^{80}$, where R^{60} is selected from the group consisting of optionally substituted alkyl, cycloalkyl, heteroalkyl, heterocycloalkylalkyl, cycloalkylalkyl, aryl, arylalkyl, heteroaryl and heteroarylalkyl, each R^{70} is independently hydrogen or R^{60}; each R^{80} is independently R^{70} or alternatively, two R^{80}'s, taken together with the nitrogen atom to which they are bonded, form a 5-, 6- or 7-membered heterocycloalkyl which may optionally include from 1 to 4 of the same or different additional heteroatoms selected from the group consisting of O, N and S, of which N may have -H or C_1-C_3 alkyl substitution; and each M^+ is a counter ion with a net single positive charge. Each M^+ may independently be, for

example, an alkali ion, such as K^+, Na^+, Li^+; an ammonium ion, such as $^+N(R^{60})_4$; or an alkaline earth ion, such as $[Ca^{2+}]_{0.5}$, $[Mg^{2+}]_{0.5}$, or $[Ba^{2+}]_{0.5}$ ("subscript 0.5 means that one of the counter ions for such divalent alkali earth ions can be an ionized form of a compound of the invention and the other a typical counter ion such as chloride, or two ionized compounds disclosed herein can serve as counter ions for such divalent alkali earth ions, or a doubly ionized compound of the invention can serve as the counter ion for such divalent alkali earth ions). As specific examples, $-NR^{80}R^{80}$ is meant to include $-NH_2$, -NH-alkyl, *N*-pyrrolidinyl, *N*-piperazinyl, 4*N*-methyl-piperazin-1-yl and *N*-morpholinyl.

[0069] In addition to the disclosure herein, substituent groups for hydrogens on unsaturated carbon atoms in "substituted" alkene, alkyne, aryl and heteroaryl groups are, unless otherwise specified, $-R^{60}$, halo, $-O^-M^+$, $-OR^{70}$, $-SR^{70}$, $-S^-M^+$, $-NR^{80}R^{80}$, trihalomethyl, $-CF_3$, -CN, -OCN, -SCN, -NO, $-NO_2$, $-N_3$, $-SO_2R^{70}$, $-SO_3^-M^+$, $-SO_3R^{70}$, $-OSO_2R^{70}$, $-OSO_3^-M^+$, $-OSO_3R^{70}$, $-PO_3^{-2}(M^+)_2$, $-P(O)(OR^{70})O^-M^+$, $-P(O)(OR^{70})_2$, $-C(O)R^{70}$, $-C(S)R^{70}$, $-C(NR^{70})R^{70}$, $-CO_2^-M^+$, $-CO_2R^{70}$, $-C(S)OR^{70}$, $-C(O)NR^{80}R^{80}$, $-C(NR^{70})NR^{80}R^{80}$, $-OC(O)R^{70}$, $-OC(S)R^{70}$, $-OCO_2^-M^+$, $-OCO_2R^{70}$, $-OC(S)OR^{70}$, $-NR^{70}C(O)R^{70}$, $-NR^{70}C(S)R^{70}$, $-NR^{70}CO_2^-M^+$, $-NR^{70}CO_2R^{70}$, $-NR^{70}C(S)OR^{70}$, $-NR^{70}C(O)NR^{80}R^{80}$, $-NR^{70}C(NR^{70})R^{70}$ and $-NR^{70}C(NR^{70})NR^{80}R^{80}$, where R^{60}, R^{70}, R^{80} and M^+ are as previously defined, provided that in case of substituted alkene or alkyne, the substituents are not $-O^-M^+$, $-OR^{70}$, $-SR^{70}$, or $-S^-M^+$.

[0070] In addition to the groups disclosed with respect to the individual terms herein, substituent groups for hydrogens on nitrogen atoms in "substituted" heteroalkyl and cycloheteroalkyl groups are, unless otherwise specified, $-R^{60}$, $-O^-M^+$, $-OR^{70}$, $-SR^{70}$, $-S^-M^+$, $-NR^{80}R^{80}$, trihalomethyl, $-CF_3$, -CN, -NO, $-NO_2$, $-S(O)_2R^{70}$, $-S(O)_2O^-M^+$, $-S(O)_2OR^{70}$, $-OS(O)_2R^{70}$, $-OS(O)_2O^-M^+$, $-OS(O)_2OR^{70}$, $-P(O)(O^-)_2(M^+)_2$, $-P(O)(OR^{70})O^-M^+$, $-P(O)(OR^{70})(OR^{70})$, $-C(O)R^{70}$, $-C(S)R^{70}$, $-C(NR^{70})R^{70}$, $-C(O)OR^{70}$, $-C(S)OR^{70}$, $-C(O)NR^{80}R^{80}$, $-C(NR^{70})NR^{80}R^{80}$, $-OC(O)R^{70}$, $-OC(S)R^{70}$, $-OC(O)OR^{70}$, $-OC(S)OR^{70}$, $-NR^{70}C(O)R^{70}$, $-NR^{70}C(S)R^{70}$, $-NR^{70}C(O)OR^{70}$, $-NR^{70}C(S)OR^{70}$, $-NR^{70}C(O)NR^{80}R^{80}$, $-NR^{70}C(NR^{70})R^{70}$ and $-NR^{70}C(NR^{70})NR^{80}R^{80}$, where R^{60}, R^{70}, R^{80} and M^+ are as previously defined.

[0071] In addition to the disclosure herein, in a certain embodiment, a group that is substituted has 1, 2, 3, or 4 substituents, 1, 2, or 3 substituents, 1 or 2 substituents, or 1 substituent.

[0072] It is understood that in all substituted groups defined above, polymers arrived at by defining substituents with further substituents to themselves (e.g., substituted aryl having a substituted aryl group as a substituent which is itself substituted with a substituted aryl group, which is further substituted by a substituted aryl group, etc.) are not intended for inclusion herein. In such cases, the maximum number of such substitutions is three. For example, serial substitutions of

substituted aryl groups specifically contemplated herein are limited to substituted aryl-(substituted aryl)-substituted aryl.

[0073] As to any of the groups disclosed herein which contain one or more substituents, it is understood, of course, that such groups do not contain any substitution or substitution patterns which are sterically impractical and/or synthetically non-feasible. In addition, the subject compounds include all stereochemical isomers arising from the substitution of these compounds.

[0074] In certain embodiments, a substituent may contribute to optical isomerism and/or stereo isomerism of a compound. Salts, solvates, hydrates, and prodrug forms of a compound are also of interest. All such forms are embraced by the present disclosure. Thus the compounds described herein include salts, solvates, hydrates, prodrug and isomer forms thereof, including the pharmaceutically acceptable salts, solvates, hydrates, prodrugs and isomers thereof. In certain embodiments, a compound may be a metabolized into a pharmaceutically active derivative.

[0075] Unless otherwise specified, reference to an atom is meant to include isotopes of that atom. For example, reference to H is meant to include ^{1}H, ^{2}H (i.e., D) and ^{3}H (i.e., T), and reference to C is meant to include ^{12}C and all isotopes of carbon (such as ^{13}C).

[0076] As used herein, the term "cleavable linker" or "cleavably linked" refers to a linker or a linkage that is selectively breakable using a stimulus (e.g., a physical, chemical or enzymatic stimulus) that leaves the moieties to which the linkages joins intact. Several cleavable linkages have been described in the literature (e.g., Brown (1997) Contemporary Organic Synthesis 4(3); 216-237). And Guillier et al (Chem. Rev. 2000 1000:2091-2157). A disulfide bond (which can be broken by DDT) and a photo-cleavable linker are examples of cleavable linkages.

[0077] The term "fluorophore" refers to any molecular entity that is capable of absorbing energy of a first wavelength and re-emit energy at a different second wavelength. In certain embodiments, the subject biomolecule includes a fluorophore attached to one end of the biomolecule or at a central position. In some embodiments, the fluorophore may be attached to one end of the biomolecule. The fluorophore attached to the biomolecule need not be a single molecule, but may include multiple molecules.

[0078] The fluorophore may be synthetic or biological in nature, as known to those of skill in the art. More generally, any fluorophore can be used that is stable under coupling conditions and that can be sufficiently suppressed when in close proximity to the quencher such that a significant change in the intensity of fluorescence of the fluorophore is detectable in response to target specifically binding the probe. Examples of suitable fluorophores include, but are not limited to Oregon Green 488 dye, rhodamine and rhodamine derivatives, fluorescein isothiocyanate,

fluorescein, 6-carboxyfluorescein (6-FAM), coumarin and coumarin derivatives, cyanine and cyanine derivatives, Alexa Fluors, DyLight Fluors, and the like.

[0079] In certain embodiments, the biomolecule includes a metal-chelating agent. A "chelate" as used herein in reference to a complex between a metal and a chelating ligand, refers to a combination of a metallic ion bonded to one or more ligands to form a heterocyclic ring structure. Chelate formation through neutralization of the positive charge(s) of the metal ion may be through the formation of ionic, covalent or coordinate covalent bonding. In certain embodiments, the metal-chelating agent is includes, but are not limited to, 1,4,7,10-Tetraazacyclododecane-1,4,7,10-tetraacetic acid (also referred to as, DOTA, or tetraxetan).

[0080] The terms "polynucleotide" and "nucleic acid," used interchangeably herein, refer to a polymeric form of nucleotides of any length, either ribonucleotides or deoxyribonucleotides. Thus, this term includes, but is not limited to, single-, double-, or multi-stranded DNA or RNA, genomic DNA, cDNA, DNA-RNA hybrids, or a polymer comprising purine and pyrimidine bases or other natural, chemically or biochemically modified, non-natural, or derivatized nucleotide bases.

[0081] The terms "polypeptide" and "protein", used interchangeably herein, refer to a polymeric form of amino acids of any length, which can include coded and non-coded amino acids, chemically or biochemically modified or derivatized amino acids, and polypeptides having modified peptide backbones. The term "fusion protein" or grammatical equivalents thereof is meant to include a protein composed of a plurality of polypeptide components, that while typically unjoined in their native state, typically are joined by their respective amino and carboxyl termini through a peptide linkage to form a single continuous polypeptide. Fusion proteins may be a combination of two, three or even four or more different proteins.

[0082] In general, polypeptides may be of any length, e.g., 2 or greater amino acids, greater than 4 amino acids, greater than about 10 amino acids, greater than about 20 amino acids, greater than about 50 amino acids, greater than about 100 amino acids, greater than about 300 amino acids, usually up to about 500 or 1000 or more amino acids. "Peptides" are generally 2 or greater amino acids in length, such as greater than 4 amino acids, greater than about 10 amino acids, greater than about 20 amino acids, usually up to about 50 amino acids. In some embodiments, peptides are between 2 and 30 amino acids in length.

[0083] As used herein, the term "a target protein" refers to all members of the target family, and fragments and enantiomers thereof, and protein mimics thereof. The target proteins of interest that are described herein are intended to include all members of the target family, and fragments and enantiomers thereof, and protein mimics thereof, unless explicitly described otherwise. The target protein may be any protein of interest, such as a therapeutic or diagnostic target, including

but not limited to: hormones, growth factors, receptors, enzymes, cytokines, osteoinductive factors, colony stimulating factors and immunoglobulins. The term "target protein" is intended to include recombinant and synthetic molecules, which can be prepared using any convenient recombinant expression methods or using any convenient synthetic methods, or purchased commercially, as well as fusion proteins containing a target molecule.

[0084] The term "physiological conditions" is meant to encompass those conditions compatible with living cells, *e.g.*, predominantly aqueous conditions of a temperature, pH, salinity, *etc.* that are compatible with living cells.

[0085] "Solid support", "support", and "solid phase support" are used interchangeably and refer to a material or group of materials having a rigid or semi-rigid surface or surfaces. In many embodiments, at least one surface of the solid support will be substantially flat, although in some embodiments it may be desirable to physically separate synthesis regions for different compounds with, for example, wells, raised regions, pins, etched trenches, or the like. According to other embodiments, the solid support(s) will take the form of beads, resins, gels, microspheres, or other geometric configurations.

[0086] The terms "antibodies" and "immunoglobulin" include antibodies or immunoglobulins of any isotype, fragments of antibodies that retain specific binding to antigen, including, but not limited to, Fab, Fv, scFv, and Fd fragments, chimeric antibodies, humanized antibodies, single-chain antibodies (scAb), single domain antibodies (dAb), single domain heavy chain antibodies, a single domain light chain antibodies, nanobodies, bi-specific antibodies, multi-specific antibodies, and fusion proteins comprising an antigen-binding (also referred to herein as antigen binding) portion of an antibody and a non-antibody protein. The antibodies can be detectably labeled, *e.g.*, with a radioisotope, an enzyme that generates a detectable product, a fluorescent protein, and the like. The antibodies can be further conjugated to other moieties, such as members of specific binding pairs, *e.g.*, biotin (member of biotin-avidin specific binding pair), and the like. The antibodies can also be bound to a solid support, including, but not limited to, polystyrene plates or beads, and the like. Also encompassed by the term are Fab', Fv, $F(ab')_2$, and or other antibody fragments that retain specific binding to antigen, and monoclonal antibodies. As used herein, a monoclonal antibody is an antibody produced by a group of identical cells, all of which were produced from a single cell by repetitive cellular replication. That is, the clone of cells only produces a single antibody species. While a monoclonal antibody can be produced using hybridoma production technology, other production methods known to those skilled in the art can also be used (e.g., antibodies derived from antibody phage display libraries). An antibody can be monovalent or bivalent. An antibody can be an Ig monomer,

which is a "Y-shaped" molecule that consists of four polypeptide chains: two heavy chains and two light chains connected by disulfide bonds.

[0087] The term "humanized immunoglobulin" as used herein refers to an immunoglobulin comprising portions of immunoglobulins of different origin, wherein at least one portion comprises amino acid sequences of human origin. For example, the humanized antibody can comprise portions derived from an immunoglobulin of nonhuman origin with the requisite specificity, such as a mouse, and from immunoglobulin sequences of human origin (e.g., chimeric immunoglobulin), joined together chemically by conventional techniques (e.g., synthetic) or prepared as a contiguous polypeptide using genetic engineering techniques (e.g., DNA encoding the protein portions of the chimeric antibody can be expressed to produce a contiguous polypeptide chain). Another example of a humanized immunoglobulin is an immunoglobulin containing one or more immunoglobulin chains comprising a complementarity-determining region (CDR) derived from an antibody of nonhuman origin and a framework region derived from a light and/or heavy chain of human origin (e.g., CDR-grafted antibodies with or without framework changes). Chimeric or CDR-grafted single chain antibodies are also encompassed by the term humanized immunoglobulin. See, e.g., Cabilly et al., U.S. Pat. No. 4,816,567; Cabilly et al., European Patent No. 0,125,023 B1; Boss et al., U.S. Pat. No. 4,816,397; Boss et al., European Patent No. 0,120,694 B1; Neuberger, M. S. et al., WO 86/01533; Neuberger, M. S. et al., European Patent No. 0,194,276 B1; Winter, U.S. Pat. No. 5,225,539; Winter, European Patent No. 0,239,400 B1; Padlan, E. A. et al., European Patent Application No. 0,519,596 A1. See also, Ladner et al., U.S. Pat. No. 4,946,778; Huston, U.S. Pat. No. 5,476,786; and Bird, R. E. et al., Science, 242: 423-426 (1988)), regarding single chain antibodies.

[0088] The term "nanobody" (Nb), as used herein, refers to the smallest antigen binding fragment or single variable domain (V_{HH}) derived from naturally occurring heavy chain antibody and is known to the person skilled in the art. They are derived from heavy chain only antibodies, seen in camelids (Hamers-Casterman et al., (1993) *Nature* 363:446; Desmyter et al., (1996) *Nature Struct. Biol.* 3:803). In the family of "camelids" immunoglobulins devoid of light polypeptide chains are found. "Camelids" comprise old world camelids (*Camelus bactrianus* and *Camelus dromedarius*) and new world camelids (for example, *Llama paccos*, *Llama glama*, *Llama guanicoe* and *Llama vicugna*). A single variable domain heavy chain antibody is referred to herein as a nanobody or a V_{HH} antibody.

[0089] "Antibody fragments" comprise a portion of an intact antibody, for example, the antigen binding or variable region of the intact antibody. Examples of antibody fragments include Fab, Fab', $F(ab')_2$, and Fv fragments; diabodies; linear antibodies (Zapata et al., Protein Eng. 8(10): 1057-1062 (1995)); domain antibodies (dAb; Holt et al. (2003) *Trends Biotechnol.* 21:484); single-

chain antibody molecules; and multi-specific antibodies formed from antibody fragments. Papain digestion of antibodies produces two identical antigen-binding fragments, called "Fab" fragments, each with a single antigen-binding site, and a residual "Fc" fragment, a designation reflecting the ability to crystallize readily. Pepsin treatment yields an $F(ab')_2$ fragment that has two antigen combining sites and is still capable of cross-linking antigen.

[0090] "Fv" is the minimum antibody fragment that contains a complete antigen-recognition and -binding site. This region consists of a dimer of one heavy- and one light-chain variable domain in tight, non-covalent association. It is in this configuration that the three CDRS of each variable domain interact to define an antigen-binding site on the surface of the V_H-V_L dimer. Collectively, the six CDRs confer antigen-binding specificity to the antibody. However, even a single variable domain (or half of an Fv comprising only three CDRs specific for an antigen) has the ability to recognize and bind antigen, although at a lower affinity than the entire binding site.

[0091] The “Fab” fragment also contains the constant domain of the light chain and the first constant domain (CH_1) of the heavy chain. Fab fragments differ from Fab' fragments by the addition of a few residues at the carboxyl terminus of the heavy chain CH_1 domain including one or more cysteines from the antibody hinge region. Fab'-SH is the designation herein for Fab' in which the cysteine residue(s) of the constant domains bear a free thiol group. $F(ab')_2$ antibody fragments originally were produced as pairs of Fab' fragments which have hinge cysteines between them. Other chemical couplings of antibody fragments are also known.

[0092] The "light chains" of antibodies (immunoglobulins) from any vertebrate species can be assigned to one of two clearly distinct types, called kappa and lambda, based on the amino acid sequences of their constant domains. Depending on the amino acid sequence of the constant domain of their heavy chains, immunoglobulins can be assigned to different classes. There are five major classes of immunoglobulins: IgA, IgD, IgE, IgG, and IgM, and several of these classes can be further divided into subclasses (isotypes), e.g., IgG1, IgG2, IgG3, IgG4, IgA, and IgA2. The subclasses can be further divided into types, e.g., IgG2a and IgG2b.

[0093] "Single-chain Fv" or "sFv" or “scFv” antibody fragments comprise the V_H and V_L domains of antibody, wherein these domains are present in a single polypeptide chain. In some embodiments, the Fv polypeptide further comprises a polypeptide linker between the V_H and V_L domains, which enables the sFv to form the desired structure for antigen binding. For a review of sFv, see *Pluckthun in The Pharmacology of Monoclonal Antibodies, vol. 113, Rosenburg and Moore eds., Springer-Verlag, New York, pp. 269-315 (1994)*.

[0094] The term "diabodies" refers to small antibody fragments with two antigen-binding sites, which fragments comprise a heavy-chain variable domain (V_H) connected to a light-chain variable

domain (V_L) in the same polypeptide chain (V_H-V_L). By using a linker that is too short to allow pairing between the two domains on the same chain, the domains are forced to pair with the complementary domains of another chain and create two antigen-binding sites. Diabodies are described more fully in, for example, EP 404,097; WO 93/11161; and Hollinger et al. (1993) *Proc. Natl. Acad. Sci. USA* 90:6444-6448.

[0095] As used herein, the term "affinity" refers to the equilibrium constant for the reversible binding of two agents (e.g., an antibody and an antigen) and is expressed as a dissociation constant (K_D). Affinity can be at least 1-fold greater, at least 2-fold greater, at least 3-fold greater, at least 4-fold greater, at least 5-fold greater, at least 6-fold greater, at least 7-fold greater, at least 8-fold greater, at least 9-fold greater, at least 10-fold greater, at least 20-fold greater, at least 30-fold greater, at least 40-fold greater, at least 50-fold greater, at least 60-fold greater, at least 70-fold greater, at least 80-fold greater, at least 90-fold greater, at least 100-fold greater, or at least 1,000-fold greater, or more, than the affinity of an antibody for unrelated amino acid sequences. Affinity of an antibody to a target protein can be, for example, from about 100 nanomolar (nM) to about 0.1 nM, from about 100 nM to about 1 picomolar (pM), or from about 100 nM to about 1 femtomolar (fM) or more. As used herein, the term “avidity” refers to the resistance of a complex of two or more agents to dissociation after dilution. The terms “immunoreactive” and “preferentially binds” are used interchangeably herein with respect to antibodies and/or antigen-binding fragments.

[0096] The term “binding” refers to a direct association between two molecules, due to, for example, covalent, electrostatic, hydrophobic, and ionic and/or hydrogen-bond interactions, including interactions such as salt bridges and water bridges. “Specific binding” refers to binding with an affinity of at least about 10^{-7} M or greater, e.g., 5x 10^{-7} M, 10^{-8} M, 5 x 10^{-8} M, and greater. “Non-specific binding” refers to binding with an affinity of less than about 10^{-7} M, e.g., binding with an affinity of 10^{-6} M, 10^{-5} M, 10^{-4} M, etc.

[0097] An "isolated" polypeptide is one that has been identified and separated and/or recovered from a component of its natural environment. Contaminant components of its natural environment are materials that would interfere with diagnostic or therapeutic uses for the polypeptide, and may include enzymes, hormones, and other proteinaceous or nonproteinaceous solutes. In some embodiments, the polypeptide will be purified (1) to greater than 90%, greater than 95%, or greater than 98%, by weight of protein as determined by the Lowry method, for example, more than 99% by weight, (2) to a degree sufficient to obtain at least 15 residues of N-terminal or internal amino acid sequence by use of a spinning cup sequenator, or (3) to homogeneity by sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) under reducing or nonreducing conditions using Coomassie blue or silver stain. Isolated polypeptide includes the

polypeptide in situ within recombinant cells since at least one component of the polypeptide's natural environment will not be present. In some instances, isolated polypeptide will be prepared by at least one purification step.

[0098] As will be apparent to those of skill in the art upon reading this disclosure, each of the individual embodiments described and illustrated herein has discrete components and features which may be readily separated from or combined with the features of any of the other several embodiments without departing from the scope or spirit of the present invention. Any recited method can be carried out in the order of events recited or in any other order which is logically possible.

[0099] Where a range of values is provided, it is understood that each intervening value, to the tenth of the unit of the lower limit unless the context clearly dictates otherwise, between the upper and lower limit of that range and any other stated or intervening value in that stated range, is encompassed within the invention. The upper and lower limits of these smaller ranges may independently be included in the smaller ranges, and are also encompassed within the invention, subject to any specifically excluded limit in the stated range. Where the stated range includes one or both of the limits, ranges excluding either or both of those included limits are also included in the invention.

[00100] Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. Although any methods and materials similar or equivalent to those described herein can also be used in the practice or testing of the present invention, the preferred methods and materials are now described. All publications mentioned herein are incorporated herein by reference to disclose and describe the methods and/or materials in connection with which the publications are cited.

[00101] It must be noted that as used herein and in the appended claims, the singular forms "a," "an," and "the" include plural referents unless the context clearly dictates otherwise. Thus, for example, reference to "a target molecule" includes a plurality of such target molecules and reference to "the biomolecule" includes reference to one or more biomolecules and equivalents thereof known to those skilled in the art, and so forth. It is further noted that the claims may be drafted to exclude any optional element. As such, this statement is intended to serve as antecedent basis for use of such exclusive terminology as "solely," "only" and the like in connection with the recitation of claim elements, or use of a "negative" limitation.

[00102] It is appreciated that certain features of the invention, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single

embodiment. Conversely, various features of the invention, which are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable sub-combination. All combinations of the embodiments pertaining to the invention are specifically embraced by the present invention and are disclosed herein just as if each and every combination was individually and explicitly disclosed. In addition, all sub-combinations of the various embodiments and elements thereof are also specifically embraced by the present invention and are disclosed herein just as if each and every such sub-combination was individually and explicitly disclosed herein.

[00103] The publications discussed herein are provided solely for their disclosure prior to the filing date of the present application. Nothing herein is to be construed as an admission that the present invention is not entitled to antedate such publication by virtue of prior invention. Further, the dates of publication provided may be different from the actual publication dates which may need to be independently confirmed.

DETAILED DESCRIPTION

[00104] The present disclosure provides a method for chemoselective modification of a target molecule. The present disclosure provides compositions comprising a subject target molecule comprising a thiol moiety, and a biomolecule comprising a phenol moiety or a catechol moiety. The present disclosure provides kits providing a first container including a subject composition, and a second container including an enzyme capable of oxidizing the phenol moiety or the catechol moiety. The present disclosure also provides modified target molecules, that may find use in the delivery of biomolecules for gene therapy, novel immunotherapies through antibody conjugates, biomaterial construction and vaccine development.

METHODS

[00105] As summarized above, aspects of the present disclosure include a method for chemoselective modification of a target molecule. The subject method includes contacting a target molecule comprising a thiol moiety with a biomolecule comprising a reactive moiety, wherein the reactive moiety is generated by reaction of a biomolecule comprising a phenol moiety or a catechol moiety with an enzyme capable of oxidizing the phenol moiety or the catechol moiety. The contacting is carried out under conditions sufficient for conjugation of the target molecule to the biomolecule, thereby producing a modified target molecule.

[00106] In some cases, a subject method for chemoselective modification of a target molecule comprises contacting: i) a target molecule comprising a thiol moiety; ii) a biomolecule comprising a phenol moiety or a catechol moiety; and iii) an enzyme capable of oxidizing the phenol or catechol moiety; wherein the enzyme oxidizes the phenol or catechol moiety of the

biomolecule to generate a reactive moiety, thereby generating a biomolecule comprising the reactive moiety, and wherein the reactive moiety reacts with the thiol moiety, thereby conjugating the target molecule and the biomolecule to one another, thereby producing a modified target molecule. In some cases, the target molecule comprises a single thiol moiety. In some cases, the target molecule comprises two thiol moieties.

[00107] The target molecule can be any of a variety of molecules (e.g., polypeptides; nucleic acids; small molecules; etc.). Similarly, the biomolecule can be any of a variety of molecules (e.g., polypeptides; nucleic acids; small molecules; etc.). In some cases, the target molecule is a polypeptide; and the biomolecule is a nucleic acid. In some cases, the target molecule is a nucleic acid; and the biomolecule is a polypeptide. In some cases, the target molecule is a polypeptide; and the biomolecule is a small molecule (e.g., a cancer chemotherapeutic agent). In some cases, the target molecule is a first polypeptide; and the biomolecule is a second polypeptide, where the first polypeptide and the second polypeptide can be the same or different.

[00108] The subject methods provide a simple coupling procedure that can attach biomolecules of interest in a site-specific manner to any position on the surface of a target molecule, thereby producing a modified target molecule of interest. In some embodiments, the target molecule is a second biomolecule (e.g., as described herein). In some embodiments, the second biomolecule is a polypeptide.

[00109] Biomolecules of interest include, but are not limited to, polypeptides, polynucleotides, carbohydrates, lipids, fatty acids, steroids, purines, pyrimidines, derivatives, structural analogs thereof and combinations thereof. In certain instances, the biomolecule of interest is an antibody. In some instances, the biomolecule of interest is an antibody fragment or binding derivative thereof. In some cases, the antibody fragment or binding derivative thereof is selected from the group consisting of a Fab fragment, a F(ab')2 fragment, a single-chain Fv (scFv), a diabody, a nanobody, and a triabody. Suitable biomolecules include, e.g., small molecules (e.g., cancer chemotherapeutic agents, etc.), cytokines, hormones, immunomodulatory polypeptides, and the like. In some cases, the biomolecule is a nucleic acid; and the target molecule is an antibody (e.g., a scFv; a nanobody; and the like). In some cases, the biomolecule is a small molecule (e.g., a cancer chemotherapeutic agent); and the target molecule is an antibody (e.g., a scFv; a nanobody; and the like). In some cases, e.g., where the target molecule is an antibody, the biomolecule is attached to the Fc portion of the target molecule. In some cases, the target molecule is an immunoglobulin (Ig) Fc polypeptide.

[00110] In certain embodiments, the biomolecule comprising a phenol or catechol moiety further comprises, one or more moieties selected from a fluorophore, an active small molecule, an affinity tag, and a metal-chelating agent (e.g., as described herein). In certain instances, the

biomolecule of interest is a fluorescent protein. In certain cases, the fluorescent protein is a green fluorescent protein (GFP). In certain cases, the biomolecule is an enzyme. In certain cases, the biomolecule is a ligand for a receptor. In certain cases, the biomolecule is a receptor.

[00111] In some embodiments, the enzyme capable of oxidizing the phenol moiety or the catechol moiety is a phenol oxidase or a catechol oxidase. In certain cases, the enzyme is a tyrosinase.

[00112] The term "tyrosinase" is used herein to refer to monophenol monooxygenase (EC 1.14.18.1; CAS number: 9002-10-2), an enzyme that catalyses the oxidation of phenols (such as tyrosine). It is a copper-containing enzyme present in plant and animal tissues that catalyzes the production of melanin and other pigments from tyrosine by oxidation. Aall tyrosinases have in common a binuclear type 3 copper center within their active site. Here two copper atoms are each coordinated with three histidine residues. Matoba et al., "Crystallographic evidence that the dinuclear copper center of tyrosinase is flexible during catalysis," J Biol Chem. 2006 Mar 31;281(13):8981-90. Epub 2006 Jan 25, disclose a three dimensional model of a tyrosinase catalytic center.

[00113] In certain embodiments, the subject enzyme is affixed to a solid support system, such as beads, resins, gels, microspheres, or other geometric configurations. In certain cases, the solid support is a glass bead. In some cases, the solid support is a resin bead. Use of an enzyme affixed to a solid support system can allow for multiple use of the subject enzyme, and can facilitate purification of the subject target molecules by allowing for the enzyme to be easily removed from the reaction mixture. In certain embodiments, the subject enzyme affixed to a solid support system can allow for the subject methods to be carried out in a continuous flow system. In certain embodiments, the subject enzyme affixed to a solid support system can facilitate large batch processing of the subject methods.

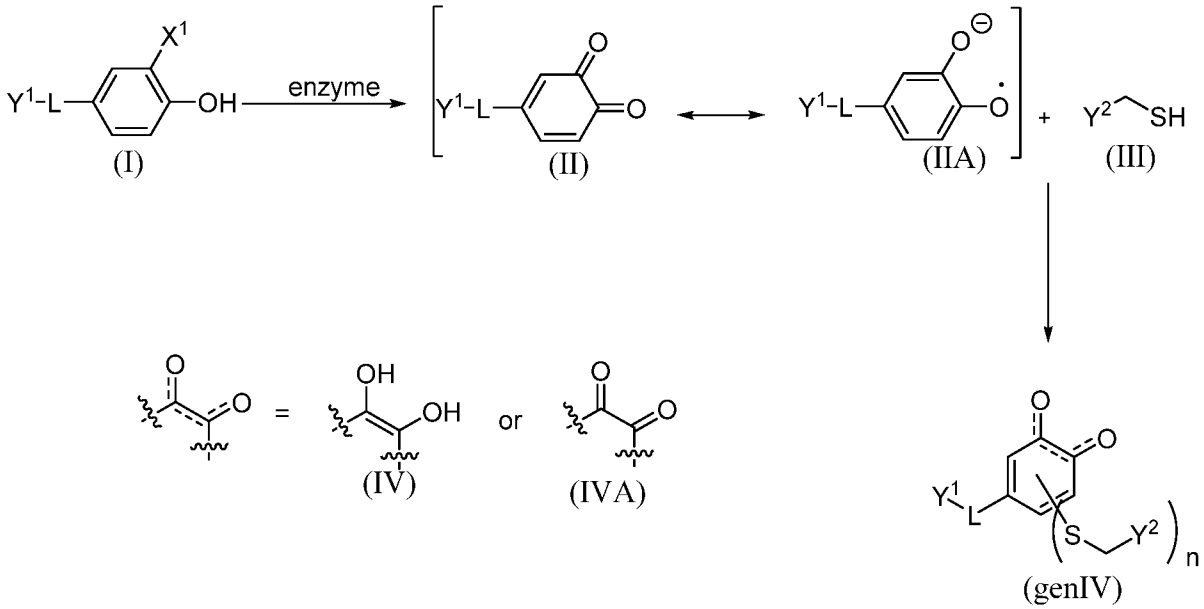
[00114] In certain cases, the subject phenol moiety is present in a tyrosine residue. In certain cases, the tyrosine residue is part of the biomolecule of interest. In certain cases, the tyrosine residue is synthetically introduced into the biomolecule of interest. In some other cases, the tyrosine residue is linked to the biomolecule of interest via a linker (e.g., as described herein). A tyrosine residue can be introduced using standard recombinant techniques, e.g., by modifying a nucleotide sequence encoding a polypeptide biomolecule such that a tyrosine residue is introduced into the polypeptide biomolecule.

[00115] In some cases, a phenol or catechol moiety is part of an unnatural (non-genetically encoded) amino acid that is introduced into a biomolecule of interest. For example, amber codon (TAG) suppression can be used to incorporate a non-genetically encoded amino acid residue that

comprises a phenol moiety or a catechol moiety. See, e.g., Chin et al. (2002) *J. Am. Chem. Soc.* 124:9026; Chin and Schultz (2002) *Chem. Biol. Chem.* 3:1135; Chin et al. (2002) *Proc. Natl. Acad. Sci. USA* 99:11020; U.S. 2015/0240249; and US 2018/0171321. As another example, an orthogonal RNA synthetase and/or an orthogonal tRNA can be used for introducing a non-genetically encoded amino acid into a biomolecule, where the non-genetically encoded amino acid comprises a phenol moiety or a catechol moiety.

[00116] In some embodiments of the subject methods, the thiol moiety present in the target molecule is part of a cysteine residue. In certain cases, the cysteine residue is a native cysteine residue. In certain cases, the cysteine residue is a residue synthetically introduced into the target molecule.

[00117] In certain embodiments, the reactive moiety is an orthoquinone or a semi-quinone radical, or a combination thereof. In certain embodiments, the subject methods provide a reaction between an orthoquinone reactive intermediate and a thiol moiety, as depicted in Scheme 1 below:



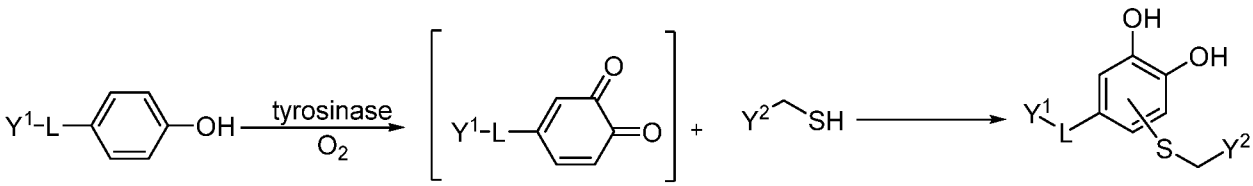
Scheme 1

where Y^1 is any convenient biomolecule optionally comprising one or more moieties selected from, an active small molecule, a cleavable probe, a fluorophore, and a metal chelator; L is an optional linker (e.g., as described herein); X^1 is selected from hydrogen and hydroxyl; Y^2 is any convenient biomolecule; and n is an integer from 1 to 3.

[00118] As depicted in Scheme 1, in certain embodiments, a biomolecule comprising a phenol or catechol moiety (e.g., of formula (I)), undergoes activation with an enzyme capable of oxidizing the phenol or catechol moiety. In some cases, activation is achieved with a tyrosinase enzyme in

the presence of oxygen to generate an intermediate comprising a reactive moiety (e.g., orthoquinone of formula (II) and/or semi-quinone radical of formula (IIA)), and the said reactive moiety reacts with a target molecule comprising a thiol based nucleophile (e.g., of formula (III)), to result in conjugation of the target molecule to the biomolecule, thereby producing a modified target molecule (e.g., of formula (genIV)). In certain embodiments, a target molecule of formula (III) may comprise any convenient biomolecule, e.g., as described herein. In certain cases, Y^2 in formula (III) is a polypeptide. In certain cases, the modified molecule is described by the formula (IV). In some cases, the modified target molecule is described by the formula (IVA). In certain cases, the modified target molecule is described by any one of formulae (IV)-(IVL), as described herein.

[00119] In certain embodiments, the subject methods provide a reaction between an orthoquinone reactive intermediate and a thiol moiety, as depicted in Scheme 2 below:



(IB) (II) (III) (IVM)

[00120] As depicted in Scheme 2, in certain embodiments, a biomolecule comprising a phenol moiety (e.g., of formula (IB)) undergoes activation with a tyrosinase enzyme in the presence of oxygen to generate an intermediate comprising a reactive moiety (e.g., orthoquinone of formula (II)), and the said reactive moiety reacts with a target molecule comprising a thiol based nucleophile (e.g., of formula (III)), to result in conjugation of the target molecule to the biomolecule, thereby producing a modified target molecule (e.g., of formula (IVM). In certain embodiments, a target molecule of formula (III) may comprise any convenient biomolecule, e.g., as described herein. In certain cases, Y^2 in formula (III) is a polypeptide. In certain cases of the modified molecule of formula (IVM), the thiol group is at the 3-position of the catechol ring. In certain cases of the modified molecule of formula (IVM), the thiol group is at the 5-position of the catechol ring. In certain cases of the modified molecule of formula (IVM), the thiol group is at the 6-position of the catechol ring.

[00121] In certain embodiments, the biomolecule of formula (I) may be any one of formulae (IA)-(IDb), e.g., as described herein and discussed in more detail below. In certain embodiments, the modified target molecule may be of any one of formulae (IV)-(IVL), e.g., as described herein and discussed in more detail below. In certain embodiments, the modified target molecule is a product of a single conjugation, e.g., as shown in formulae (IV1)-(IV3), (IVA1)-(IVA3), (IVB1)-(IVB3), (IVC1)-(IVC3), (IVD1)-(IVD3), (IVE1)-(IVE3), (IVF1)-

(IVF3), (IVG1)-(IVG3), (IVH1)-(IVH3) and (IVJ1)-(IVJ3). In certain cases, the modified target molecule is a product of double conjugation, e.g., as shown in formulae (IV4)-(IV5), (IVA4)-(IVA5), (IVB4)-(IVB5), (IVC4)-(IVC5), (IVD4)-(IVD5), (IVE4)-(IVE5), (IVF4)-(IVF5), (IVG4)-(IVG5), (IVH4)-(IVH5) and (IVJ4)-(IVJ5).

[00122] In certain embodiments, the subject method is carried out at a pH from 4 to 9, such as 4.2, 4.5, 4.8, 5.0, 5.2, 5.5, 5.8, 6.0, 6.2, 6.5, 6.8, 7.0, 7.2, 7.5, 7.8, 8.0, 8.2, 8.5, 8.8 or 9. In certain embodiments, the subject method is carried out at a pH of from 5 to 8, such as 5.2, 5.5, 5.8, 6.0, 6.2, 6.5, 6.8, 7.0, 7.2, 7.5, 7.8 or 8.0. In certain cases, the subject method is carried out at a pH of 6 to 7.5, such as 6.0, 6.3, 6.4, 6.5, 6.6, 6.8, 7.0, 7.2, 7.4, or 7.5. In certain embodiments, the subject method is carried out at neutral pH. As used herein, the expression "neutral pH" means a pH of about 7.0 to about 7.4. The expression "neutral pH" includes pH values of about 7.0, 7.05, 7.1, 7.15, 7.2, 7.25, 7.3, 7.35, and 7.4.

[00123] In certain embodiments, the subject methods may be carried out under physiological conditions. In some embodiments, the method is carried out on living cells *in vitro*. In other embodiments, the method is carried out on living cells *ex vivo*.

[00124] In certain embodiments, the subject methods may be carried out in aqueous media in the presence of one or more buffers. Buffers of interest include, but are not limited to, a phosphate buffer, 2-amino-2-(hydroxymethyl)propane-1,3-diol (TRIS), 4-[4-(2-hydroxyethyl)piperzin-1-yl]ethanesulfonic acid (HEPES), and the like. In certain embodiments, the subject methods may be carried out in an organic solvent. In certain cases, the organic solvent is a water miscible solvent. In certain cases, the organic solvent is a dipolar aprotic solvent. In certain cases, the organic solvent is selected from acetonitrile, dimethyl formamide, methanol and acetone. In certain cases, the organic solvent is present in an amount from 1 to 20%, relative to water, such as 2%, 5%, 10%, 15% or 20%. In some cases, the subject method is carried out in from 1% to 20% acetonitrile, such as 5%, 10%, 15% or 20%. In some cases, the subject method is carried out in from 1% to 20% dimethyl formamide, such as 5%, 10%, 15%, or 20%. In some cases, the subject method is carried out in from 1% to 20% methanol, such as 5%, 10%, 15%, or 20%. In some cases, the subject method is carried out in from 1% to 20% acetone, such as 5%, 10%, 15%, or 20%.

[00125] In certain embodiments of the subject methods, the modified target molecule is a product of double or triple conjugation (e.g., referring to formula (IV), when n is 2 or 3, referred to collectively herein as "multiple conjugation products"). In certain embodiments of the subject methods, multiple conjugation products are present in less than 1 part in 10 by weight of one or more multiple conjugation products relative to the single conjugation product (e.g., referring to formula (IV), when n is 1), such as less than 1 part in 20, less than 1 part in 25, less than 1 part in

50, less than 1 part in 75, less than 1 part in 100, or even less. In certain embodiments of the subject methods, no multiple conjugation products are observed.

[00126] In certain embodiments of the methods, the modified target molecule is stable at a range of pH and temperature values and in the presence of a number of additional molecules. In some cases, the modified target molecule is stable from 0 °C to 50 °C, such as 4 °C to 40 °C, such as 4 °C to 37 °C. In certain cases, the modified target molecule is stable over a pH range of 4 to 9, such as at pH 4, 4.5, 5, 5.5, 6, 6.5, 7, 7.5, 8, 8.5 or 9. In certain cases, the modified target molecule is stable in the presence of biologically relevant molecules. In certain cases, the modified target molecule is stable in the presence of molecules such as, the guanidinium group of an arginine residue, the primary amine of a lysine residue, and aniline moieties. In some cases, the modified target molecule is stable in physiological conditions; for example, in some cases, the modified target molecule is stable in human serum. In some cases, the modified target molecule (also referred to herein as a "target molecule-biomolecule conjugate") is stable in human serum at 37°C for a period of time of at least 2 days, at least 3 days, at least 4 days, at least 5 days, at least 6 days, at least 7 days, at least 10 days, or at least 14 days. In some cases, the modified target molecule (also referred to herein as a "target molecule-biomolecule conjugate") is stable in human serum at 37°C for a period of time of from about 2 days to about 7 days, from about 7 days to about 10 days, or from about 10 days to about 14 days.

[00127] As noted above, in some cases, the target molecule includes a single thiol moiety. In other instances, the target molecule includes two thiol moieties. In addition to being competent in an initial oxidative coupling reaction, a nucleophile bearing a second thiol in proximity to the newly-formed catechol could add in a second time in the event of re-oxidation. The intramolecular nature of the second addition could prevent or minimize secondary addition by glutathione or other molecules bearing a free thiol in a biological milieu. An example of the use of a di-thiol nucleophile (di-thiol target molecule) is depicted schematically in FIG. 44A.

[00128] Another embodiment of this strategy could be protein coupling partners with two cysteine residues. The cysteine residues could be in close proximity to one another by virtue of their position in the amino acid sequence of the protein or they could be in close spatial proximity by virtue of their position in the three-dimensional structure of the protein. A polypeptide can include a di-thiol, where the polypeptide comprises, e.g.: a CC, a CGC, a CGGC (SEQ ID NO: 1055), or a CGGGC (SEQ ID NO: 1056) sequence. For example, a polypeptide can comprise an amino acid sequence of the general formula: $X_{n1}C(X)_{n2}CX_{n3}$ (SEQ ID NO: 1057), where X is any natural (coded) or unnatural (non-coded) amino acid, n1 and n3 are each independently zero or an integer from 1 to 5000 (or more than 5000), and n2 is zero or an integer

from 1 to about 10. An example of the use of such a di-thiol target molecule is depicted schematically in FIG. 44B.

Tyrosinase polypeptides

[00129] Tyrosinase polypeptides that are suitable for use in generating a reactive moiety (e.g., an orthoquinone) include a tyrosinase polypeptide having at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to any one of the tyrosinase amino acid sequences set forth in FIG. 8, FIG. 9, FIG. 10A-10Z, and FIG. 10AA-10VV. In some cases, the tyrosinase polypeptide is an *Agricus bisporus* tyrosinase polypeptide. In some cases, the tyrosinase polypeptide is a *Bacillus megaterium* tyrosinase polypeptide. In some cases, the tyrosinase polypeptide is a *Streptomyces castaneoglobisporus* tyrosinase polypeptide. In some cases, the tyrosinase polypeptide is a *Citrobacter freundii* tyrosinase polypeptide. In some cases, the tyrosinase polypeptide is a *Homo sapiens* tyrosinase polypeptide. In some cases, the tyrosinase polypeptide is a *Malus domestica* tyrosinase polypeptide. In some cases, the tyrosinase polypeptide is an *Aspergillus oryzae* tyrosinase polypeptide. In some cases, the tyrosinase polypeptide is a *Solanum lycopersicum* tyrosinase polypeptide. In some cases, the tyrosinase polypeptide is a *Burkholderia thailandensis* tyrosinase polypeptide. In some cases, the tyrosinase polypeptide is a *Juglans regia* tyrosinase polypeptide. See, e.g., Pretzler et al. Sci. Rep. 2017, 7 (1), 1810; Ren et al. BMC Biotechnol. 2013, 13, 18; Faccio et al. Process Biochem. 2012, 47 (12), 1749–1760; Fairhead et al. FEBS J. 2010, 277 (9), 2083–2095; Do et al. Sci. Rep. 2017, 7 (1), 17267; Elsayed and Danial J. Appl. Pharm. Sci. 2018, 8 (09), 93–101; Lopez-Tejedor and Palomo Protein Expr. Purif. 2018, 145, 64–70; and Fairhead et al. Nature Biotechnol. 2012, 29 (2), 183–191.

[00130] In some cases, the tyrosinase polypeptide selectively acts on (e.g., generates a reactive moiety such as an orthoquinone) a substrate (a biomolecule) comprising a phenol moiety (e.g., a tyrosine) or a catechol moiety, where the substrate is neutral or positively charged within 50 Å (e.g., within 50 Å, within 40 Å, within 30 Å, or within 20 Å) of the phenol or the catechol moiety. For example, a tyrosinase having at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to any one of the tyrosinase amino acid sequences set forth in FIG. 8 or FIG. 9 can selectively modify a phenol or catechol moiety on a substrate, where the substrate is neutral or positively charged within 50 Å (e.g., within 50 Å, within 40 Å, within 30 Å, or within 20 Å) of the phenol or the catechol moiety. For example, where the biomolecule is a polypeptide, in some cases, the biomolecule comprises at least 2 neutral or positively charged amino acids within 10 amino acids of the phenol moiety (e.g., a tyrosine) or a catechol moiety. For example, where the biomolecule is a polypeptide, in some cases, the biomolecule comprises 2, 3, 4, 5, 6, 7, 8, 9, or 10 neutral or

positively charged amino acids within 10 amino acids of the phenol moiety (e.g., a tyrosine) or a catechol moiety. For example, where the biomolecule is a polypeptide, in some cases, the biomolecule comprises the amino acid sequence RRRY (SEQ ID NO: 949), YRRR (SEQ ID NO: 950), RRRRY (SEQ ID NO: 951), or YRRRR (SEQ ID NO: 952).

[00131] In some cases, the tyrosinase polypeptide selectively acts on (e.g., generates a reactive moiety such as an orthoquinone) a substrate (a biomolecule) comprising a phenol moiety (e.g., a tyrosine) or a catechol moiety, where the substrate is negatively charged within 50 Å (e.g., within 50 Å, within 40 Å, within 30 Å, or within 20 Å) of the phenol or the catechol moiety. For example, a tyrosinase having at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to any one of the tyrosinase amino acid sequences set forth in FIG. 10A-10Z and FIG. 10AA-10VV can selectively modify a phenol or catechol moiety on a substrate, where the substrate is negatively charged within 50 Å (e.g., within 50 Å, within 40 Å, within 30 Å, or within 20 Å) of the phenol or the catechol moiety. For example, where the biomolecule is a polypeptide, in some cases, the biomolecule comprises at least 2 negatively charged amino acids within 10 amino acids of the phenol moiety (e.g., a tyrosine) or a catechol moiety. For example, where the biomolecule is a polypeptide, in some cases, the biomolecule comprises 2, 3, 4, 5, 6, 7, 8, 9, or 10 negatively charged amino acids within 10 amino acids of the phenol moiety (e.g., a tyrosine) or a catechol moiety. For example, where the biomolecule is a polypeptide, in some cases, the biomolecule comprises the amino acid sequence EEEY (SEQ ID NO: 953), YEEE (SEQ ID NO: 954), EEEEY (SEQ ID NO: 955), or YEEEE (SEQ ID NO: 956).

[00132] In some cases, the tyrosinase polypeptide comprises an amino acid sequence having at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the tyrosinase amino acid sequence depicted in FIG. 10M, where the tyrosinase polypeptide comprises an amino acid substitution of D55, e.g., where D55 is substituted with a Lys. Such a tyrosinase polypeptide is particularly useful where the biomolecule has a net negative charge and/or the region surrounding the phenol or catechol moiety has a net negative charge (e.g., where the phenol group is a Tyr, the Tyr can be present in an EEEEY (SEQ ID NO: 955) or EEEY (SEQ ID NO: 953) peptide). Such a tyrosinase polypeptide is particularly useful where the biomolecule is a nucleic acid.

[00133] In some cases, the tyrosinase polypeptide comprises an amino acid sequence having at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the tyrosinase amino acid sequence depicted in FIG. 10C, where the tyrosinase polypeptide comprises an amino acid substitution of R209, e.g., where R209 is substituted with a His. Such a tyrosinase polypeptide is particularly useful where the

biomolecule has a net positive charge and/or the region surrounding the phenol or catechol moiety has a net positive charge (e.g., where the phenol group is a Tyr, the Tyr can be present in an RRRY (SEQ ID NO: 949) or RRRRY (SEQ ID NO: 951) peptide).

Cell surface modification

[00134] In some embodiments, a subject method is used to modify the surface of a cell. Thus, in one aspect, the invention features a method of modifying the surface of cell *in vitro*. The method generally involves reacting a thiol group in a target molecule with a biomolecule comprising a reactive moiety to provide for chemoselective conjugation at the cell surface. In some embodiments, the method comprises modifying a target molecule on a cell surface with a thiol moiety; and reacting the thiol moiety in the target molecule with a biomolecule comprising a reactive moiety (e.g., an orthoquinone moiety). In other embodiments, the method comprises activation of a biomolecule comprising a phenol moiety on a cell surface to generate a biomolecule comprising a reactive moiety; and reacting the reactive moiety in the biomolecule with a target molecule comprising a thiol moiety.

Modification of a target molecule with detectable labels, drugs, and other molecules

[00135] In some embodiments, the present disclosure provides for attachment of a biomolecule of interest to a target molecule comprising a thiol moiety. The methods generally involve reacting thiol containing target molecules with a subject biomolecule comprising a reactive moiety (e.g., an orthoquinone moiety). Target molecules and biomolecules of interest include, but are not limited to, polypeptides, polynucleotides, carbohydrates, fatty acids, steroids, purines, pyrimidines, derivatives; and the like.

Attachment of biomolecule of interest to a support

[00136] The biomolecule comprising the reactive moiety can also comprise one or more hydrocarbon linkers (*e.g.*, an alkyl group or derivative thereof such as an alkyl ester or PEG) conjugated to a moiety providing for attachment to a solid substratum (*e.g.*, to facilitate assays), or to a moiety providing for easy separation (e.g., a hapten recognized by an antibody bound to a magnetic bead). In one embodiment, the methods of the invention are used to provide for attachment of a protein (or other molecule that contains or can be modified to contain a thiol) to a chip in a defined orientation. For example, the methods and compositions of the disclosure can be used to deliver a tag or other moiety (e.g., as described herein) to the thiol of a target molecule, e.g., a polypeptide having a thiol moiety at a selected site (*e.g.*, at or near the N-terminus). The tag or other moiety can then be used as the attachment site for affixing the molecule to a support (*e.g.*, solid or semi-solid support, e.g., a support suitable for use as a microchip in high-throughput assays).

Attachment of biomolecules for delivery to a target site

[0001] The biomolecule comprising a reactive moiety will in some embodiments comprise a small molecule drug, toxin, or other molecule for delivery to a cell. The small molecule drug, toxin, or other molecule will in some embodiments provide for a pharmacological activity. The small molecule drug, toxin, or other molecule will in some embodiments serve as a target for delivery of other molecules.

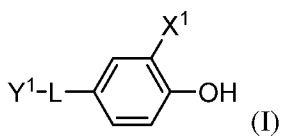
[0002] Small molecule drugs may be small organic or inorganic compounds having a molecular weight of more than 50 and less than about 2,500 daltons. Small molecule drugs may comprise functional groups necessary for structural interaction with proteins, particularly hydrogen bonding, and may include at least an amine, carbonyl, hydroxyl or carboxyl group, and may contain at least two of the functional chemical groups. The drugs may comprise cyclical carbon or heterocyclic structures and/or aromatic or polyaromatic structures substituted with one or more of the above functional groups. Small molecule drugs are also found among biomolecules including peptides, saccharides, fatty acids, steroids, purines, pyrimidines, derivatives, structural analogs or combinations thereof.

[00137] In another embodiment, a subject biomolecule comprising a reactive moiety comprises one of a pair of binding partners (*e.g.*, a ligand; a ligand-binding portion of a receptor; an antibody; an antigen-binding fragment of an antibody; an antigen; a hapten; a lectin; a lectin-binding carbohydrate; *etc.*). For example, the biomolecule can comprise a polypeptide that serves as a viral receptor and, upon binding with a viral envelope protein or viral capsid protein, facilitates attachment of virus to the cell surface on which the biomolecule is displayed. Alternatively, the biomolecule comprises an antigen that is specifically bound by an antibody (*e.g.*, monoclonal antibody), to facilitate detection and/or separation of host cells displaying the antigen on the cell surface. In another example, the biomolecule comprises a ligand binding portion of a receptor, or a receptor-binding portion of a ligand.

COMPOUNDS

Biomolecule comprising a phenol moiety or a catechol moiety

[00138] In certain embodiments of the subject methods, the biomolecule comprising a phenol moiety or a catechol moiety is described by the formula (I).

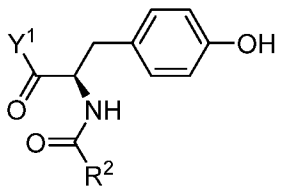


(I)

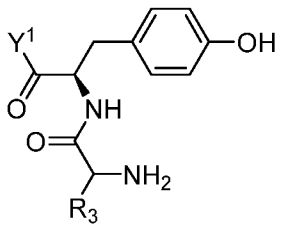
where Y^1 is a biomolecule, optionally comprising one or more moieties selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent; X^1 is selected from hydrogen and hydroxyl; and L is an optional linker.

[00139] In certain embodiments of formula (I), X^1 is hydrogen, such that the biomolecule comprises a phenol moiety. In other embodiments of formula (I), X^1 is hydroxyl, such that the biomolecule comprises a catechol moiety.

[00140] In some embodiments of formula (I), the phenol moiety is present in a tyrosine residue. In certain cases, the biomolecule comprising a phenol moiety of formula (I), is of the formula (IB) or (IC):



(IB)



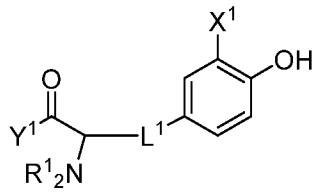
(IC)

Wherein R^2 is selected from alkyl, and substituted alkyl; and R^3 is selected from hydrogen, alkyl, substituted alkyl, a peptide, and a polypeptide.

[00141] In certain embodiments of the subject methods, the biomolecule comprising a phenol moiety or a catechol (e.g., of formula (I)) includes a linker (e.g., as described herein). Suitable linkers include, but are not limited to, a carboxylic acid, an alkyl ester, an aryl ester, a substituted aryl ester, an aldehyde, an amide, an aryl amide, an alkyl halide, a thioester, a sulfonyl ester, an alkyl ketone, an aryl ketone, a substituted aryl ketone, a halosulfonyl, a nitrile, a nitro, a PEG, and a peptide linker.

[00142] Exemplary linkers for use in linking the phenol moiety to the subject biomolecule of interest will in some embodiments include a PEG linker. As used herein the term "PEG" refers to a polyethylene glycol or a modified polyethylene glycol. Modified polyethylene glycol polymers include a methoxypolyethylene glycol, and polymers that are unsubstituted or substituted at one end with an alkyl, a substituted alkyl or a functional group (e.g., as described herein). Any convenient linking groups may be utilized at the terminal of a PEG to connect the group to a moiety of interest including but not limited to, alkyl, aryl, hydroxyl, amino, acyl, acyloxy, carboxyl ester and amido terminal and/or substituent groups. In certain instances, the linker includes more than 1 PEG unit, such as 2, 3, 4, 5, 6, 7, 8, 9 or 10 PEG units. In certain instances, the linker includes less than 10 PEG units, such as 9, 8, 7, 6, 5, 4, 3, 2 or 1 PEG unit. In certain cases, linker is composed of 4 or fewer PEG units.

[00143] In certain cases, the biomolecule comprising a phenol moiety is described by the formula (IA):



(IA)

wherein:

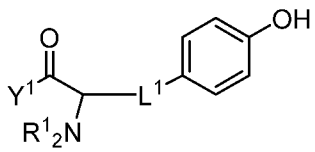
Y^1 is a biomolecule optionally comprising one or more groups selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

each R^1 is independently selected from hydrogen, acyl, substituted acyl, alkyl, and substituted alkyl;

X^1 is selected from hydrogen and hydroxyl; and

L^1 is a linker selected from a straight or branched alkyl, a straight or branched substituted alkyl, a polyethylene glycol (PEG), a substituted PEG, and one or more peptides.

[00144] In certain embodiments, X^1 is hydrogen, such that the compound of formula (IA) is of the formula (IAa):



(IAa).

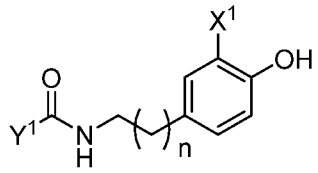
[00145] In certain embodiments of any of formulae (IA)-(IAa), at least one R^1 is hydrogen. In certain cases, both R^1 groups are hydrogen. In certain cases, one R^1 group is hydrogen, and the other R^1 group is selected from alkyl, substituted alkyl, acyl and substituted acyl. In certain cases, one R^1 group is hydrogen and the other R^1 group is alkyl. In some cases, one R^1 group is hydrogen and the other R^1 group is substituted alkyl. In some cases, one R^1 group is hydrogen and the other R^1 group is acyl. In some cases, one R^1 group is hydrogen, and the other R^1 group is substituted acyl. In some cases the acyl group is of the formula $-C(O)R^4$, wherein R^4 is a lower alkyl group, e.g., methyl, ethyl, propyl, butyl, pentyl, or hexyl. In some cases, the substituted acyl group is of the formula $-C(O)R^4NH_2$, wherein R^4 is a lower alkyl group, e.g., methyl, ethyl, propyl, butyl, pentyl or hexyl. In some cases, the substituted acyl group is of the formula $-C(O)CH_2NH_2$.

[00146] In certain embodiments of any of formulae (IA)-(IAa), L^1 is a straight or branched alkyl. In certain cases, L^1 is a lower alkyl group, e.g., methyl, ethyl, propyl, butyl, pentyl, or hexyl. In certain cases, L^1 is a substituted alkyl group. In certain cases, L^1 is a substituted lower alkyl group. In certain cases, L^1 is a PEG or substituted PEG (e.g., as described herein). In certain other cases, L^1 is a peptide. In certain other cases, L^1 is a polypeptide. In certain cases, L^1 is a linear linker of 1-12 atoms in length, such as 1-10, 1-8 or 1-6 atoms in length, e.g., 1, 2, 3, 4, 5 or

6 atoms in length. The linker L^1 can be a (C_{1-6})alkyl linker or a substituted (C_{1-6})alkyl linker, optionally substituted with a heteroatom or linking functional group, such as an ester ($-CO_2-$), amido (CONH), carbamate (OCONH), ether (-O-), thioether (-S-) and/or amino group (-NR- where R is H or alkyl). In certain cases, the linker L^1 can include a keto (C=O) group. In certain cases, the keto group together with an amino, thiol or ether group in the linker chain can provide an amido, an ester or thioester group linkage.

[00147] In certain embodiments, the linking group L or L^1 is a cleavable linker, e.g., as described herein.

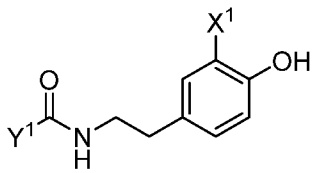
[00148] In certain embodiments, the biomolecule comprising a phenol or catechol moiety is described by the formula (ID):



(ID)

where Y^1 is a biomolecule optionally comprising one or more groups selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent; X^1 is selected from hydrogen and hydroxyl; and n is an integer from 0 to 20. In certain cases, n is 10 or less, such as 9, 8, 7, 6, 5, 4, 3, 2, 1 or 0. In certain cases, n is 5. In certain cases, n is 4. In certain cases, n is 3. In certain cases, n is 2. In certain cases, n is 1. In certain cases, n is 0.

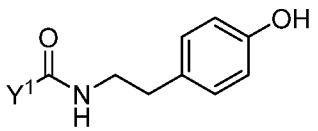
[00149] In certain embodiments, n is 1, such that the compound of formula (ID) is of the formula (IDa):



(IDa).

[00150] In certain cases of formula (ID) or (IDa), X^1 is hydrogen, such that the biomolecule comprises a phenol moiety. In other embodiments of formula (ID) or (IDa), X^1 is hydroxyl, such that the biomolecule comprises a catechol moiety.

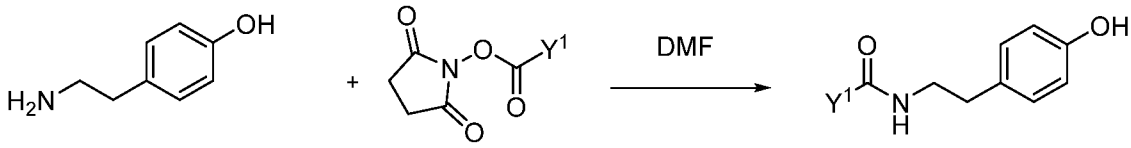
[00151] In certain cases, the compound of formula (IDa) is of the formula (IDb):



(IDb).

[00152] Compounds of any of formula (ID)-(IDb) may be prepared by reacting tyramine, or a corresponding phenol or catechol containing amine, to a biomolecule including a N-hydroxysuccinimide (NHS) ester or maleimide group in a suitable solvent. For example, a

compound of formula (IDb) may be prepared by reaction of NHS-ester (Y^1-NHS) with tyramine in dry dimethylformamide (DMF) to provide compound (IDb), as depicted in Scheme 3 below:



Tyramine (Y^1-NHS) (IDb)

Scheme 3

[00153] It will be understood that the biomolecule comprising a phenol moiety or a catechol moiety (e.g., of any of formulae (I)-(IDb)) may be prepared by any convenient methods. Many general references providing commonly known chemical synthetic schemes and conditions useful for synthesizing the subject phenol and catechol containing moieties are available (see, e.g., Smith and March, March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, Fifth Edition, Wiley-Interscience, 2001; or Vogel, A Textbook of Practical Organic Chemistry, Including Qualitative Organic Analysis, Fourth Edition, New York: Longman, 1978). As disclosed herein, in certain cases the subject phenol moiety is present in a tyrosine residue. The tyrosine residue may be part of the biomolecule of interest. In other cases, the tyrosine moiety may be synthetically introduced into the biomolecule of interest. For example, where the biomolecule is a peptide or a polypeptide, the tyrosine residue may be introduced by standard solid-phase Fmoc peptide chemistry (Fields GB, Noble RL. Solid phase peptide synthesis utilizing 9-fluorenylmethoxycarbonyl amino acids. Int J Pept Protein Res 35: 161–214, 1990). In some cases, a phenol or catechol moiety is part of an unnatural (non-genetically encoded) amino acid that is introduced into a biomolecule of interest. For example, amber codon (TAG) suppression can be used to incorporate a non-genetically encoded amino acid residue that comprises a phenol moiety or a catechol moiety. See, e.g., Chin et al. (2002) *J. Am. Chem. Soc.* 124:9026; Chin and Schultz (2002) *Chem. Biol. Chem.* 3:1135; Chin et al. (2002) *Proc. Natl. Acad. Sci. USA* 99:11020; U.S. 2015/0240249; and US 2018/0171321. As another example, an orthogonal RNA synthetase and/or an orthogonal tRNA can be used for introducing a non-genetically encoded amino acid into a biomolecule, where the non-genetically encoded amino acid comprises a phenol moiety or a catechol moiety.

[00154] In some embodiments of any one of formulae (I)-(IDb), the biomolecule of interest comprises one or more groups selected from an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent. In certain cases, the fluorophore is a rhodamine dye. In certain cases, the fluorophore is a xanthene dye. In certain cases, the fluorophore is Oregon Green 488. In certain cases, the metal-chelating agent is 1,4,7,10-Tetraazacyclododecane-

1,4,7,10-tetraacetic acid (also referred to as, DOTA, or tetraxetan). In certain cases, the affinity tag is a biotin moiety (e.g., as described herein).

[00155] In certain cases, the biomolecule comprising a phenol moiety is described by a structure as depicted in FIG. 3.

Target molecule comprising a thiol moiety

[00156] Molecules comprising a thiol moiety and suitable for use in the subject methods, as well as methods for producing thiol-comprising molecules suitable for use in the subject methods, are well known in the art.

[00157] The target molecules can be naturally occurring, or may be synthetically or recombinantly produced, and may be isolated, substantially purified, or present within the native milieu of the unmodified molecule upon which the thiol-containing target molecule is based (*e.g.*, on a cell surface or within a cell, including within a host animal, *e.g.*, a mammalian animal, such as a murine host (*e.g.*, rat, mouse), hamster, canine, feline, bovine, swine, and the like). In some embodiments, the target molecule is present *in vitro* in a cell-free reaction. In other embodiments, the target molecule is present in a cell and/or displayed on the surface of a cell. In many embodiments of interest, the target molecule is in a living cell; on the surface of a living cell; in a living organism, e.g., in a living multicellular organism. Suitable living cells include cells that are part of a living multicellular organism; cells isolated from a multicellular organism; immortalized cell lines; and the like.

[00158] The target molecule may be composed of D-amino acids, L-amino acids, or both, and may be further modified, either naturally, synthetically, or recombinantly, to include other moieties. For example, the target molecule may be a lipoprotein, a glycoprotein, or other such modified protein.

[00159] In general, the target molecule comprises at least one thiol moiety for reaction with a biomolecule comprising a reactive moiety according to the invention, but may comprise 2 or more, 3 or more, 5 or more, 10 or more thiol moieties. The number of thiol moieties that may be present in a target molecule will vary according to the intended application of the modified target molecule of the reaction, the nature of the target molecule itself, and other considerations which will be readily apparent to the ordinarily skilled artisan in practicing the methods as disclosed herein.

[00160] The target molecule can be modified to comprise a thiol moiety at the point at which linkage to the biomolecule comprising a reactive moiety is desired. For example, when the target molecule is a peptide or a polypeptide, the target molecule substrate may be modified to contain an N-terminal thiol moiety, thereby producing a subject target peptide or polypeptide

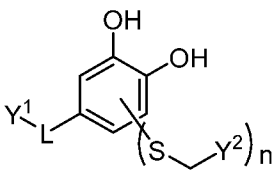
comprising a thiol moiety. It will be understood that any convenient location on a peptide or a polypeptide substrate may be modified to contain a thiol moiety and thereby produce a target peptide or polypeptide for use in the subject methods.

[00161] In certain embodiments, the target molecule comprising a thiol moiety is a CRISPR-Cas effector polypeptide.

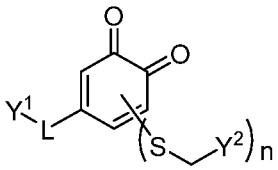
[00162] In certain cases, the thiol moiety is present in a cysteine residue. In certain cases, the cysteine residue is native to the CRISPR-Cas effector polypeptide. In other cases, the cysteine residue is introduced into the CRISPR-Cas effector polypeptide. For example, the cysteine residue may be introduced by standard solid-phase Fmoc peptide chemistry (Fields GB, Noble RL. Solid phase peptide synthesis utilizing 9-fluorenylmethoxycarbonyl amino acids. Int J Pept Protein Res 35: 161–214, 1990).

Modified target molecule

[00163] In certain embodiments of the subject methods, the modified target molecule produced is of the formula (IV) or (IVA), or a combination thereof. Accordingly, aspects of the disclosure include a compound of formula (IV) or (IVA):



(IV)

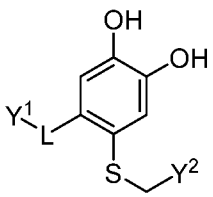


(IVA)

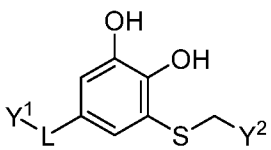
[00164] where Y1 is a biomolecule, optionally comprising one or more moieties selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent; L is an optional linker; Y2 is a second biomolecule; and n is an integer from 1 to 3.

[00165] In certain embodiments of formula (IV) or (IVA), n is less than 3, such as 2 or 1. In certain cases, n is 2. In certain cases, n is 1. In certain cases, the subject modified target molecule is a compound of formula (IV). In certain cases, the subject modified target molecule is a compound of formula (IVA).

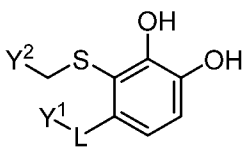
[00166] In some embodiments, the modified target molecule of formula (IV), n is 1 and the compounds is described by any of formulae (IV1)-(IV3):



(IV1)

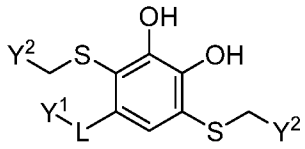


(IV2)

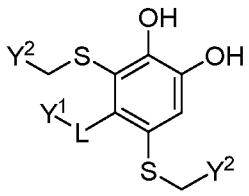


(IV3).

[00167] In some embodiments, the modified target molecule of formula (IV), n is 2 and the compounds is described by any of formulae (IV4)-(IV5):

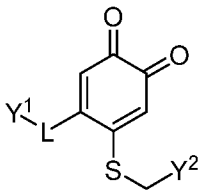


(IV4)

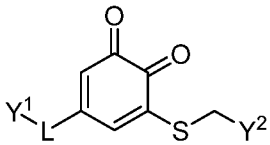


(IV5).

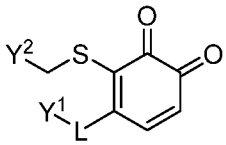
[00168] In some embodiments, the modified target molecule is of formula (IVA), n is 1, and the compound is described by any of formulae (IVA1)-(IVA3):



(IVA1)

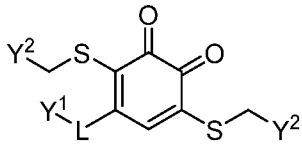


(IVA2)

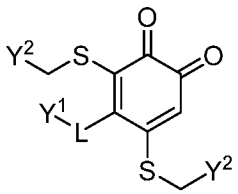


(IVA3).

[00169] In some embodiments, the modified target molecule is of formula (IVA), n is 2, and the compound is described by any of formulae (IVA4)-(IVA5):



(IVA4)



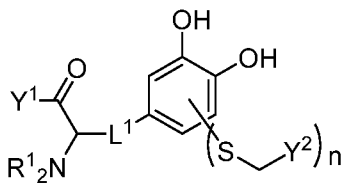
(IVA5).

[00170] In certain embodiments, the modified target molecule includes a linker (e.g., as described herein). Suitable linkers include, but are not limited to, a carboxylic acid, an alkyl ester, an aryl ester, a substituted aryl ester, an aldehyde, an amide, an aryl amide, an alkyl halide, a thioester, a sulfonyl ester, an alkyl ketone, an aryl ketone, a substituted aryl ketone, a halosulfonyl, a nitrile, a nitro, and a peptide linker.

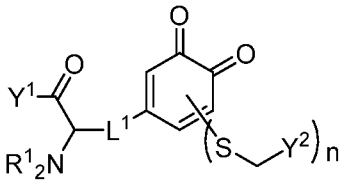
[00171] Exemplary linkers for use in linking the orthoquinone to the biomolecule (Y^1) will in some embodiments include an amide, such as $-(CR^1_2)_mNHC(O)-$, wherein R^1 is selected from hydrogen, or a substituent (e.g., as described herein) and m is an integer from 1 to 20. Exemplary linkers may also include a PEG or a substituted PEG linker, e.g., as described herein.

[00172] In certain embodiments, the linker is a cleavable linker, e.g., as described herein.

[00173] In certain embodiments, the modified target molecule is described by the formula (IVB) or (IVC):



(IVB)

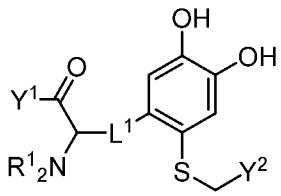


(IVC)

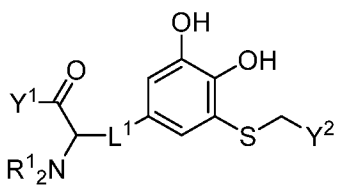
where Y^1 is a biomolecule optionally comprising one or more groups selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent; each R^1 is independently selected from hydrogen, acyl, substituted acyl, alkyl, and substituted alkyl; Y^2 is a second biomolecule; L^1 is a linker selected from a straight or branched alkyl, a straight or branched substituted alkyl, a polyethylene glycol (PEG), a substituted PEG, and one or more peptides; and n is an integer from 1 to 3.

[00174] In certain embodiments of formula (IVB) or (IVC), n is less than 3, such as 2 or 1. In certain cases, n is 2. In certain cases, n is 1. In certain cases, the subject modified target molecule is a compound of formula (IVB). In certain cases, the subject modified target molecule is a compound of formula (IVC).

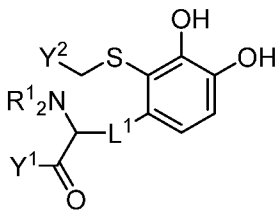
[00175] In some embodiments, the modified target molecule of formula (IVB), n is 1 and the compounds is described by any of formulae (IVB1)-(IVB3):



(IVB1)

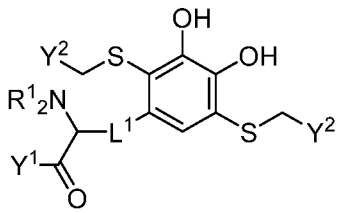


(IVB2)

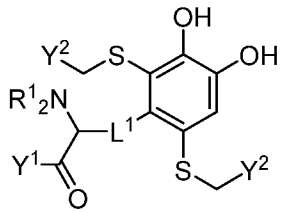


(IVB3).

[00176] In some embodiments, the modified target molecule of formula (IVB), n is 2 and the compounds is described by any of formulae (IVB4)-(IVB5):

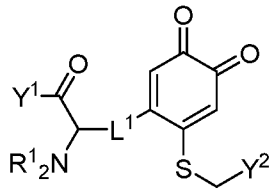


(IVB4)

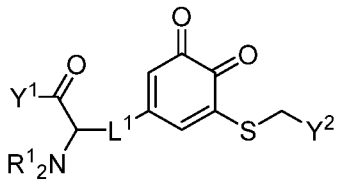


(IVB5).

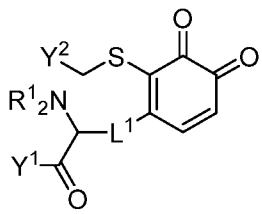
[00177] In some embodiments, the modified target molecule is of formula (IVC), n is 1, and the compound is described by any of formulae (IVC1)-(IVC3):



(IVC1)

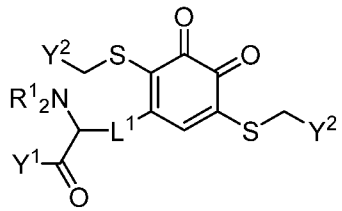


(IVC2)

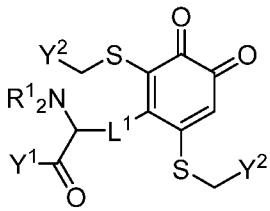


(IVC3).

[00178] In some embodiments, the modified target molecule is of formula (IVC), n is 2, and the compound is described by any of formulae (IVC4)-(IVC5):



(IVC4)



(IVC5).

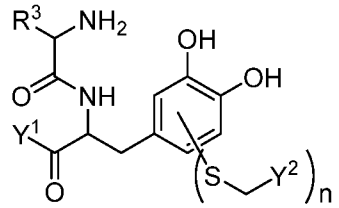
[00179] In certain embodiments of any of formulae (IVB)-(IVC5), at least one R^1 is hydrogen. In certain cases, both R^1 groups are hydrogen. In certain cases, one R^1 group is hydrogen, and the other R^1 group is selected from alkyl, substituted alkyl, acyl and substituted acyl. In certain cases, one R^1 group is hydrogen and the other R^1 group is alkyl. In some cases, one R^1 group is hydrogen and the other R^1 group is substituted alkyl. In some cases, one R^1 group is hydrogen and the other R^1 group is acyl. In some cases, one R^1 group is hydrogen, and the other R^1 group is substituted acyl. In some cases the acyl group is of the formula $-C(O)R^4$, wherein R^4 is a lower alkyl group, e.g., methyl, ethyl, propyl, butyl, pentyl, or hexyl. In some cases, the substituted acyl group is of the formula $-C(O)R^4NH_2$, wherein R^4 is a lower alkyl group, e.g., methyl, ethyl, propyl, butyl, pentyl or hexyl. In some cases, the substituted acyl group is of the formula $-C(O)CH_2NH_2$.

[00180] In certain embodiments of any of formulae (IVB)-(IVC5), L^1 is a straight or branched alkyl. In certain cases, L^1 is a lower alkyl group, e.g., methyl, ethyl, propyl, butyl, pentyl, or hexyl. In certain cases, L^1 is a substituted alkyl group. In certain cases, L^1 is a substituted lower alkyl group. In certain cases, L^1 is a PEG or substituted PEG (e.g., as described herein). In certain other cases, L^1 is a peptide. In certain other cases, L^1 is a polypeptide. In certain cases, L^1 is a linear linker of 1-12 atoms in length, such as 1-10, 1-8 or 1-6 atoms in length, e.g., 1, 2, 3, 4, 5 or 6 atoms in length. The linker L^1 can be a (C_{1-6})alkyl linker or a substituted (C_{1-6})alkyl linker, optionally substituted with a heteroatom or linking functional group, such as an ester ($-CO_2-$), amido (CONH), carbamate (OCONH), ether (-O-), thioether (-S-) and/or amino group (-NR- where R is H or alkyl). In certain cases, the linker L^1 can include a keto (C=O) group. In

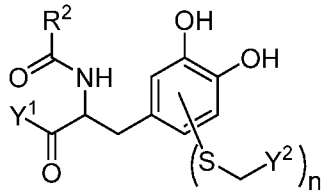
certain cases, the keto group together with an amino, thiol or ether group in the linker chain can provide an amido, an ester or thioester group linkage.

[00181] In certain embodiments, the linking group L^1 is a cleavable linker, e.g., as described herein.

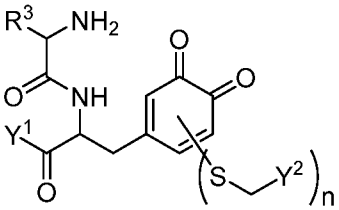
[00182] In certain embodiments, the modified target molecule is described by any of the formulae (IVD)-(IVG):



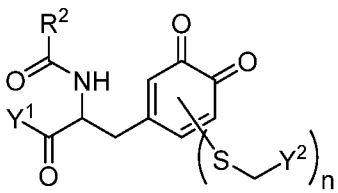
(IVD)



(IVE)



(IVF)

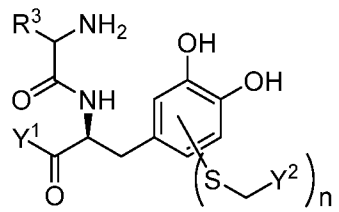


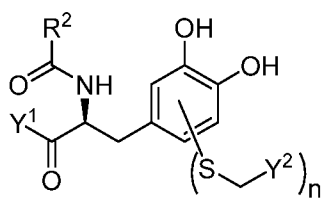
(IVG)

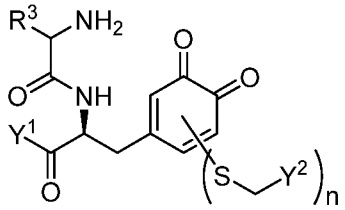
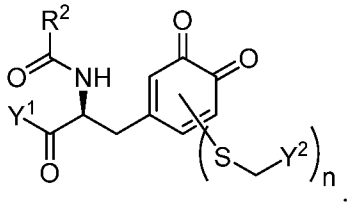
where R^2 is selected from alkyl, and substituted alkyl; R^3 is selected from, hydrogen, alkyl substituted alkyl, a peptide, and a polypeptide; and n is an integer from 1 to 3.

[00183] In certain embodiments of any of formulas (IVD)-(IVG), n is less than 3, such as 2 or 1. In certain cases, n is 2. In certain cases, n is 1. In certain cases, the subject modified target molecule is a compound of formula (IVD). In certain cases, the subject modified target molecule is a compound of formula (IVE). In certain cases, the subject modified target molecule is a compound of formula (IVF). In certain cases, the subject modified target molecule is a compound of formula (IVG).

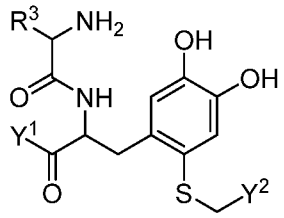
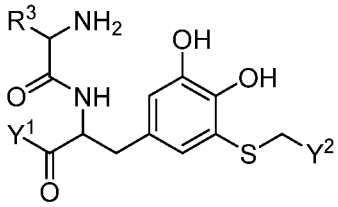
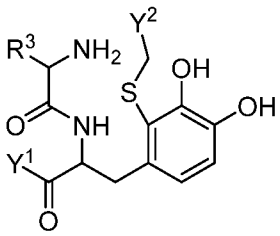
[00184] In certain embodiments, any of formulae (IVD)-(IVG) may have relative stereochemistry as shown in the following structures:





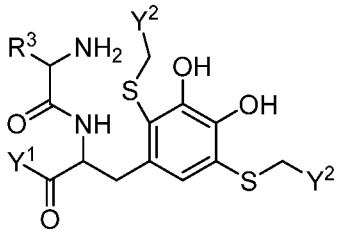
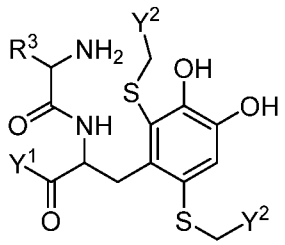



[00185] In some embodiments, the modified target molecule of formula (IVD), n is 1 and the compounds is described by any of formulae (IVD1)-(IVD3):

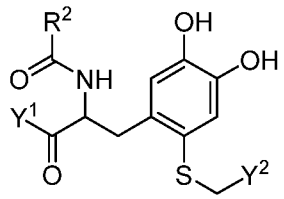
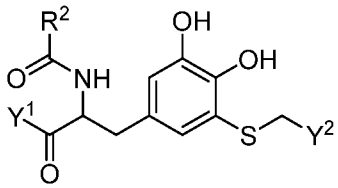
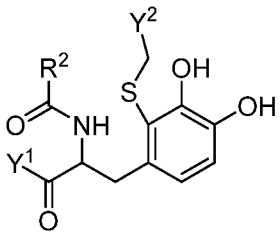
(IVD1) (IVD2) (IVD3).

[00186] In some embodiments, the modified target molecule of formula (IVD), n is 2 and the compounds is described by any of formulae (IVD4)-(IVD5):

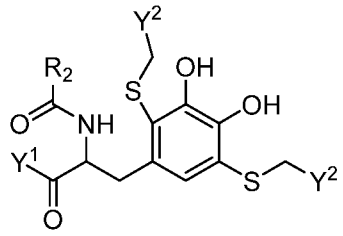
(IVD4) (IVD5).

[00187] In some embodiments, the modified target molecule of formula (IVE), n is 1 and the compounds is described by any of formulae (IVE1)-(IVE3):

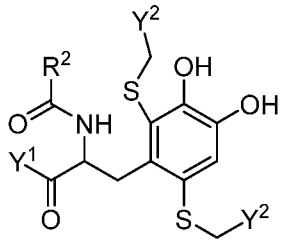




(IVE1) (IVE2) (IVE3).

[00188] In some embodiments, the modified target molecule of formula (IVE), n is 2 and the compounds is described by any of formulae (IVE4)-(IVE5):

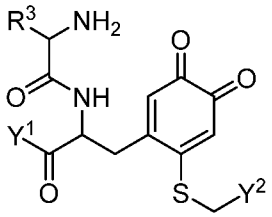


(IVE4)

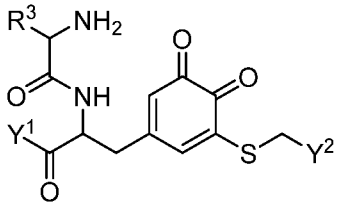


(IVE5).

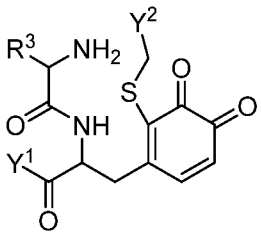
[00189] In some embodiments, the modified target molecule of formula (IVF), n is 1 and the compounds is described by any of formulae (IVF1)-(IVF3):



(IVF1)

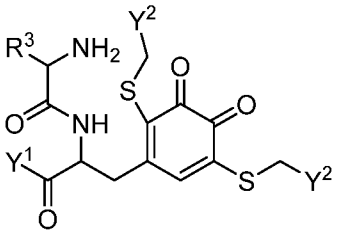


(IVF2)

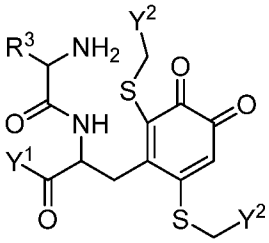


(IVF3).

[00190] In some embodiments, the modified target molecule of formula (IVF), n is 2 and the compounds is described by any of formulae (IVF4)-(IVF5):

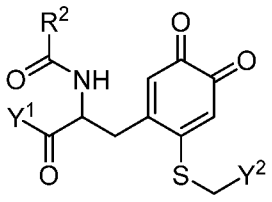


(IVF4)

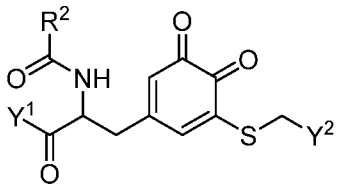


(IVF5).

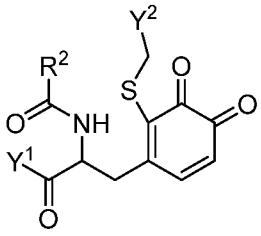
[00191] In some embodiments, the modified target molecule of formula (IVG), n is 1 and the compounds is described by any of formulae (IVG1)-(IVG3):



(IVG1)

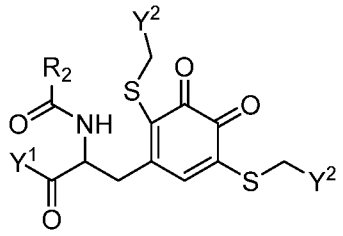


(IVG2)

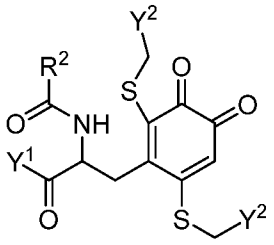


(IVG3).

[00192] In some embodiments, the modified target molecule of formula (IVG), n is 2 and the compounds is described by any of formulae (IVG4)-(IVG5):



(IVG4)

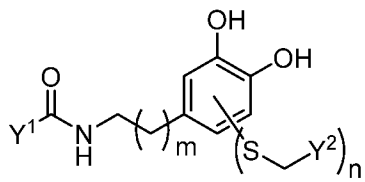


(IVG5).

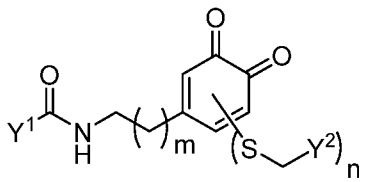
[00193] In certain embodiments of the target molecules described herein, R^2 is an alkyl group. In certain cases, R^2 is a substituted alkyl group. In certain cases, the alkyl group is a lower alkyl group, e.g., methyl, ethyl, propyl, butyl, pentyl or hexyl.

[00194] In certain embodiments of the target molecules described herein, R^3 is hydrogen. In certain cases, R^3 an alkyl group. In certain cases, R^3 is a substituted alkyl group. In certain cases the alkyl group is a lower alkyl group, e.g., methyl, ethyl, propyl, butyl, pentyl or hexyl. In certain cases, R^3 is a peptide. In certain cases, R^3 is a polypeptide.

[00195] In certain embodiments, the modified target molecule is described by the formula (IVH) or (IVJ):



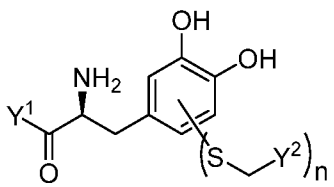
(IVH)



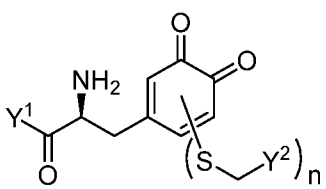
(IVJ)

where Y^1 is a biomolecule optionally comprising one or more groups selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent; Y^2 is a second biomolecule; n is an integer from 1 to 3; and m is an integer from 0 to 20. In certain cases, m is 10 or less, such as 9, 8, 7, 6, 5, 4, 3, 2, 1 or 0. In certain cases, m is 5. In certain cases, m is 4. In certain cases, m is 3. In certain cases, m is 2. In certain cases, m is 1. In certain cases, m is 0.

[00196] In certain embodiments of the subject methods, the modified target molecule is described by the formula (IVK) or IVL):



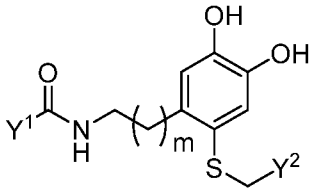
(IVK)



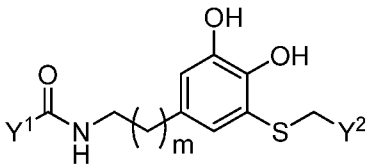
(IVL).

[00197] In certain embodiments of any of formulae (IVH)-(IVJ), n is less than 3, such as 2 or 1. In certain cases, n is 2. In certain cases, n is 1.

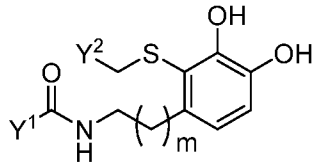
[00198] In some embodiments, the modified target molecule of formula (IVH), n is 1 and the compounds is described by any of formulae (IVH1)-(IVH3):



(IVH1)

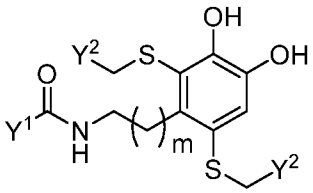


(IVH2)

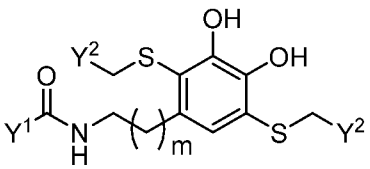


(IVH3).

[00199] In some embodiments, the modified target molecule of formula (IVH), n is 2 and the compounds is described by any of formulae (IVH4)-(IVH5):

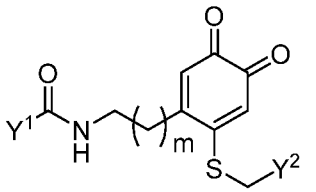


(IVH4)

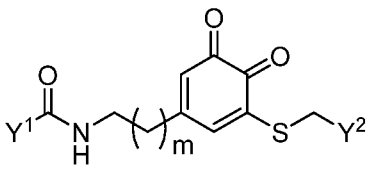


(IVH5).

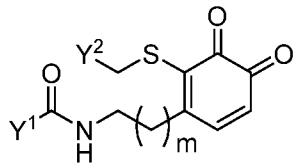
[00200] In some embodiments, the modified target molecule of formula (IVJ), n is 1 and the compounds is described by any of formulae (IVJ1)-(IVJ3):



(IVH1)

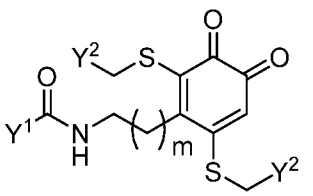


(IVH2)

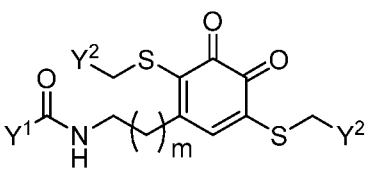


(IVH3).

[00201] In some embodiments, the modified target molecule of formula (IVJ), n is 2 and the compounds is described by any of formulae (IVJ4)-(IVJ5):



(IVJ4)



(IVJ5).

[00202] In certain embodiments, the target molecule comprising a thiol group is a CRISPR-Cas effector polypeptide (e.g., as described herein).

[00203] In certain embodiments of any one of formulae (IV) to (IVJ5), Y^1 is a polypeptide. In certain cases, the Y^1 polypeptide is selected from a fluorescent protein, an antibody, and an enzyme. In certain cases, the fluorescent protein is a green fluorescent protein. Other suitable polypeptides are described elsewhere herein.

Cleavable linkers

[00204] Cleavable linkers that may be employed in the subject molecules of interest include electrophilically cleavable linkers, nucleophilically cleavable linkers, photocleavable linkers, metal cleavable linkers, electrolytically-cleavable, and linkers that are cleavable under reductive and oxidative conditions. In certain cases, the cleavable linker is cleaved under acidic conditions. In certain cases, the cleavable linker is cleaved by an enzyme. In certain cases, the cleavable linker is a linker that is cleaved under reducing conditions. In certain cases, the cleavable linker is cleaved rapidly by glutathione reduction. In certain cases, the cleavable linker includes a disulfide bond. In certain cases, the cleavable linker is cleaved by a physical stimulus. In certain cases, the cleavable linker is photocleavable.

[00205] In certain cases, L or L^1 is an acid-labile linker. In certain cases, the linker cleaves at a pH of 6 or less, such as, 6.0, 5.95, 5.9, 5.85, 5.8, 5.75, 5.7, 5.65, 5.6, 5.55, 5.5, 5.45, 5.4, 5.35, 5.3, 5.25, 5.2, 5.15, 5.1, 5.05, 5.0, 4.9, 4.85, 4.80, 4.75, 4.7, 4.65, 4.6, 4.55, 4.5 or even less.

[00206] In certain cases, L or L^1 is a photocleavable linker. Suitable photocleavable linkers include ortho-nitrobenzyl-based linkers, phenacyl linkers, alkoxybenzoin linkers, chromium arene complex linkers, NpSSMpact linkers and pivaloylglycol linkers, as described in Guillier et al. (Chem. Rev. 2000 1000:2091-2157).

[00207] In some cases, L or L^1 is a proteolytically cleavable linker.

[00208] The proteolytically cleavable linker can include a protease recognition sequence recognized by a protease selected from the group consisting of alanine carboxypeptidase, Armillaria mellea astacin, bacterial leucyl aminopeptidase, cancer procoagulant, cathepsin B, clostripain, cytosol alanyl aminopeptidase, elastase, endoproteinase Arg-C, enterokinase, gastricsin, gelatinase, Gly-X carboxypeptidase, glycyl endopeptidase, human rhinovirus 3C protease, hypodermin C, IgA-specific serine endopeptidase, leucyl aminopeptidase, leucyl endopeptidase, lysC, lysosomal pro-X carboxypeptidase, lysyl aminopeptidase, methionyl aminopeptidase, myxobacter, nardilysin, pancreatic endopeptidase E, picornain 2A, picornain 3C, proendopeptidase, prolyl aminopeptidase, proprotein convertase I, proprotein convertase II, russellysin, saccharopepsin, semenogelase, T-plasminogen activator, thrombin, tissue kallikrein, tobacco etch virus (TEV), togavirin, tryptophanyl aminopeptidase, U-plasminogen activator, V8, venombin A, venombin AB, and Xaa-pro aminopeptidase.

[00209] For example, the proteolytically cleavable linker can comprise a matrix metalloproteinase cleavage site, e.g., a cleavage site for a MMP selected from collagenase-1, -2, and -3 (MMP-1, -8, and -13), gelatinase A and B (MMP-2 and -9), stromelysin 1, 2, and 3 (MMP-3, -10, and -11), matrilysin (MMP-7), and membrane metalloproteinases (MT1-MMP and

MT2-MMP). For example, the cleavage sequence of MMP-9 is Pro-X-X-Hy (SEQ ID NO: 1054) (wherein, X represents an arbitrary residue; Hy, a hydrophobic residue), e.g., Pro-X-X-Hy-(Ser/Thr) (SEQ ID NO: 847), e.g., Pro-Leu/Gln-Gly-Met-Thr-Ser (SEQ ID NO:848) or Pro-Leu/Gln-Gly-Met-Thr (SEQ ID NO:849). Another example of a protease cleavage site is a plasminogen activator cleavage site, e.g., a uPA or a tissue plasminogen activator (tPA) cleavage site. In some cases, the cleavage site is a furin cleavage site. Specific examples of cleavage sequences of uPA and tPA include sequences comprising Val-Gly-Arg. Another example of a protease cleavage site that can be included in a proteolytically cleavable linker is a tobacco etch virus (TEV) protease cleavage site, e.g., ENLYTQS (SEQ ID NO:850), where the protease cleaves between the glutamine and the serine. TEV protease recognizes a linear amino acid sequence of the general formula $EX_1X_2YX_3Q(G/S)$ (SEQ ID NO:), where each of X_1, X_2, and X_3 is any amino acid, and where cleavage occurs between Q and G or Q and S. A TEV protease-cleavable linker can include, ENLYFQG (SEQ ID NO:957); ENLYTQS (SEQ ID NO:958); ENLYFQGGY (SEQ ID NO:959); ENLYFQS (SEQ ID NO:960); and the like. Another example of a protease cleavage site that can be included in a proteolytically cleavable linker is an enterokinase cleavage site, e.g., DDDDK (SEQ ID NO:851), where cleavage occurs after the lysine residue. Another example of a protease cleavage site that can be included in a proteolytically cleavable linker is a thrombin cleavage site, e.g., LVPR (SEQ ID NO:852). Additional suitable linkers comprising protease cleavage sites include linkers comprising one or more of the following amino acid sequences: LEVLFQGP (SEQ ID NO:853), cleaved by PreScission protease (a fusion protein comprising human rhinovirus 3C protease and glutathione-S-transferase; Walker et al. (1994) *Biotechnol.* 12:601); a thrombin cleavage site, e.g., CGLVPAGSGP (SEQ ID NO:854); SLLKSRMVPNFN (SEQ ID NO:855) or SLLIARRMPNFN (SEQ ID NO:856), cleaved by cathepsin B; SKLVQASASGVN (SEQ ID NO:857) or SSYLKASDAPDN (SEQ ID NO:858), cleaved by an Epstein-Barr virus protease; RPKPQQFFGLMN (SEQ ID NO:859) cleaved by MMP-3 (stromelysin); SLRPLALWRSFN (SEQ ID NO:860) cleaved by MMP-7 (matrilysin); SPQGIAGQRNFN (SEQ ID NO:861) cleaved by MMP-9; DVDERDVRGFASFL SEQ ID NO:862) cleaved by a thermolysin-like MMP; SLPLGLWAPNFN (SEQ ID NO:863) cleaved by matrix metalloproteinase 2(MMP-2); SLLIFRSWANFN (SEQ ID NO:864) cleaved by cathespin L; SGVVIATVIVIT (SEQ ID NO:865) cleaved by cathepsin D; SLGPQGIWGQFN (SEQ ID NO:866) cleaved by matrix metalloproteinase 1(MMP-1); KKSPGRVVGGSV (SEQ ID NO:867) cleaved by urokinase-type plasminogen activator; PQGLLGAPGILG (SEQ ID NO:868) cleaved by membrane type 1 matrixmetalloproteinase (MT-MMP); HGPEGLRVGFYESDVMGRGHARLVHVEEPHT (SEQ ID NO:869) cleaved by stromelysin 3 (or MMP-11), thermolysin, fibroblast collagenase and

stromelysin-1; GPQGLAGQRGIV (SEQ ID NO:870) cleaved by matrix metalloproteinase 13 (collagenase-3); GGSGQRGRKALE (SEQ ID NO:871) cleaved by tissue-type plasminogen activator(tPA); SLSALLSSDIFN (SEQ ID NO:872) cleaved by human prostate-specific antigen; SLPRFKIIGGFN (SEQ ID NO:873) cleaved by kallikrein (hK3); SLLGIAVPGNFN (SEQ ID NO:874) cleaved by neutrophil elastase; and FFKNIVTPRTPP (SEQ ID NO:875) cleaved by calpain (calcium activated neutral protease).

[00210] In some cases, the linker comprises a disulfide bond and is cleavable under reducing conditions, e.g., using β-mercaptoethanol, cysteine-HCl, Tris (2-carboxyethyl) phosphine hydrochloride, or another reducing agent.

[00211] In some cases, the linker comprises a dipeptide such as a valine-citrulline dipeptide or a valine-lysine dipeptide.

BIOMOLECULES

[00212] Biomolecules that are suitable for use in a method or conjugate of the present disclosure include polypeptides, polynucleotides, carbohydrates, lipids, fatty acids, steroids, purines, pyrimidines, derivatives, structural analogs thereof and combinations thereof.

[00213] Suitable biomolecules include, but are not limited to, polypeptides, nucleic acids, glycoproteins, small molecules, carbohydrates, lipids, glycolipids, lipoproteins, lipopolysaccharides, sugars, amino acids, organic dyes, synthetic polymers, and the like.

[00214] Suitable lipids include, e.g., 3-N-[(methoxypoly(ethylene glycol) 2000) carbamoyl]-1,2-dimyristyloxy-propylamine (PEG-C-DMA), 1,2-dilinoleyloxy-N,N-dimethyl-3-aminopropane (DLinDMA), 1,2-distearoyl-sn-glycero-3-phosphocholine (DSPC), cholesterol, dipalmitoylphosphatidylcholine, 3-N-[(w-methoxy poly(ethylene glycol)2000)carbamoyl]-1,2-dimyrestyloxypropylamine, 1,2-dilinoleyloxy-3-N,Ndimethylaminopropane, 1,2-distearoyl-sn-glycero-3-phosphocholine, PEG-cDMA, 1,2-dilinoleyloxy-3-(N;N-dimethyl)aminopropane (DLinDMA), 2,2-dilinoleyl-4-dimethylaminoethyl-[1,3]-dioxolane (DLin-KC2-DMA), and the like.

[00215] Suitable biomolecules include affinity moieties. Suitable affinity moieties include His5 (HHHHH) (SEQ ID NO:876); HisX6 (HHHHHH) (SEQ ID NO:877); c-myc (EQKLISEEDL) (SEQ ID NO:878); Flag (DYKDDDDK) (SEQ ID NO:879); StrepTag (WSHPQFEK) (SEQ ID NO:880); hemagglutinin, e.g., HA Tag (YPYDVPDYA) (SEQ ID NO:881); glutathione-S-transferase (GST); thioredoxin; cellulose binding domain, RYIRS (SEQ ID NO:882); Phe-His-His-Thr (SEQ ID NO:883); chitin binding domain; S-peptide; T7 peptide; SH2 domain; C-end RNA tag, WEAAAREACCRECCARA (SEQ ID NO:884); metal binding domains, e.g., zinc binding domains or calcium binding domains such as those from calcium-binding proteins, e.g.,

calmodulin, troponin C, calcineurin B, myosin light chain, recoverin, S-modulin, visinin, VILIP, neurocalcin, hippocalcin, frequenin, caltractin, calpain large-subunit.S100 proteins. parvalbumin, calbindin D9K, calbindin D28K, and calretinin; biotin; streptavidin; MyoD; leucine zipper polypeptides; and maltose binding protein. In some cases, a suitable biomolecule is biotin.

[00216] In some cases, a biomolecule suitable for conjugating to a target polypeptide is a dimerization domain. Non-limiting examples of suitable dimerization domains include polypeptides of the following dimerization pairs:

[00217] a) FK506 binding protein (FKBP) and FKBP;

[00218] b) FKBP and calcineurin catalytic subunit A (CnA);

[00219] c) FKBP and cyclophilin;

[00220] d) FKBP and FKBP-rapamycin associated protein (FRB);

[00221] e) gyrase B (GyrB) and GyrB;

[00222] f) dihydrofolate reductase (DHFR) and DHFR;

[00223] g) DmrB and DmrB;

[00224] h) PYL and ABI;

[00225] i) Cry2 and CIB1; and

[00226] j) GAI and GID1.

[00227] For example, in some cases, the biomolecule is a polypeptide comprising at least about 85%, at least about 90%, at least about 95%, at least about 98%, or 100% amino acid sequence identity to the following amino acid FKBP amino acid sequence: MGVQVETISPGDGRTFPKRGQTCVVHYTGMLEDGKKFDSSRDRNKPFKFMLGKQEVIR GWEEGVAQMSVGQRAKLTISPDYAYGATGHPGIIPPHATLVFDVELLKLE (SEQ ID NO:885).

[00228] In some cases, a biomolecule suitable for conjugating to a target polypeptide is a member of a specific binding pair. Specific binding pairs include, e.g.: i) antibody-antigen; ii) cell adhesion molecule-extracellular matrix; iii) ligand-receptor; iv) biotin-avidin; and the like.

[00229] Suitable synthetic polymers include, but are not limited to, polyalkylenes such as polyethylene and polypropylene and polyethyleneglycol (PEG); polychloroprene; polyvinyl ethers such as poly(vinyl acetate); polyvinyl halides such as poly(vinyl chloride); polysiloxanes; polystyrenes; polyurethanes; polyacrylates such as poly(methyl (meth)acrylate), poly(ethyl (meth)acrylate), poly(n-butyl(meth)acrylate), poly(isobutyl (meth)acrylate), poly(tert-butyl (meth)acrylate), poly(hexyl(meth)acrylate), poly(isodecyl (meth)acrylate), poly(lauryl (meth)acrylate), poly(phenyl (meth)acrylate), poly(methyl acrylate), poly(isopropyl acrylate), poly(isobutyl acrylate), and poly(octadecyl acrylate); polyacrylamides such as poly(acrylamide),

poly(methacrylamide), poly(ethyl acrylamide), poly(ethyl methacrylamide), poly(N-isopropyl acrylamide), poly(n, iso, and tert-butyl acrylamide); and copolymers and mixtures thereof.

[00230] In some cases, a biomolecule to be conjugated to a target polypeptide is a polypeptide. Suitable polypeptides include, e.g., fluorescent proteins; receptors; enzymes; structural proteins; affinity tags; and the like.

[00231] Suitable fluorescent proteins include, but are not limited to, green fluorescent protein (GFP) or variants thereof, blue fluorescent variant of GFP (BFP), cyan fluorescent variant of GFP (CFP), yellow fluorescent variant of GFP (YFP), enhanced GFP (EGFP), enhanced CFP (ECFP), enhanced YFP (EYFP), GFPS65T, Emerald, Topaz (TYFP), Venus, Citrine, mCitrine, GFPuv, destabilized EGFP (dEGFP), destabilized ECFP (dECFP), destabilized EYFP (dEYFP), mCFPm, Cerulean, T-Sapphire, CyPet, YPet, mKO, HcRed, t-HcRed, DsRed, DsRed2, DsRed-monomer, J-Red, dimer2, t-dimer2(12), mRFP1, pocilloporin, Renilla GFP, Monster GFP, paGFP, Kaede protein and kindling protein, Phycobiliproteins and Phycobiliprotein conjugates including B-Phycoerythrin, R-Phycoerythrin and Allophycocyanin. Other examples of fluorescent proteins include mHoneydew, mBanana, mOrange, dTomato, tdTomato, mTangerine, mStrawberry, mCherry, mGrape1, mRaspberry, mGrape2, mPlum (Shaner et al. (2005) *Nat. Methods* 2:905-909), and the like. Any of a variety of fluorescent and colored proteins from Anthozoan species, as described in, e.g., Matz et al. (1999) *Nature Biotechnol.* 17:969-973, is suitable for use.

[00232] In some cases, the biomolecule is an antibody. Suitable antibodies are described elsewhere herein. The antibody can be any antigen-binding antibody-based polypeptide, a wide variety of which are known in the art. In some instances, the antibody is a single chain Fv (scFv). Other antibody-based recognition domains (cAb VHH (camelid antibody variable domains) and humanized versions, IgNAR VH (shark antibody variable domains) and humanized versions, sdAb VH (single domain antibody variable domains) and "camelized" antibody variable domains are suitable for use. In some instances, T-cell receptor (TCR) based recognition domains such as single chain TCR (scTv, single chain two-domain TCR containing $V\alpha V\beta$) are also suitable for use.

[00233] An antibody can be specific for an antigen such as CD19, CD20, CD38, CD30, Her2/neu, ERBB2, CA125, MUC-1, prostate-specific membrane antigen (PSMA), CD44 surface adhesion molecule, mesothelin, carcinoembryonic antigen (CEA), epidermal growth factor receptor (EGFR), EGFRvIII, vascular endothelial growth factor receptor-2 (VEGFR2), high molecular weight-melanoma associated antigen (HMW-MAA), MAGE-A1, IL-13R-a2, GD2, and the like. In some cases, the antibody is specific for a cytokine. In some cases, the antibody is specific for a cytokine receptor. In some cases, the antibody is specific for a growth factor. In

some cases, the antibody is specific for a growth factor receptor. In some cases, the antibody is specific for a cell-surface receptor. In some cases, the antibody is an anti-CD3 antibody.

[00234] In some cases, both the target molecule and the biomolecule are antibodies. In some cases, the target molecule is a first antibody specific for a first antigen, and the biomolecule is a second antibody specific for a second antigen. The first antigen can the second antigen can be completely separate molecules. For example, the first antigen can be a first polypeptide and the second antigen can be a second polypeptide. The first antigen can be a first epitope displayed by an antigen, and the second antigen can be a second epitope displayed by the same antigen. The resulting conjugate can be a bispecific antibody.

[00235] In some cases, the biomolecule confers a property such as: i) increased serum half-life; ii) increased immunogenicity; iii) enhanced pharmacokinetic properties; iv) increased transport across the blood-brain barrier; and the like, on a target biomolecule. For example, in some cases, a biomolecule that increases serum half-life is human serum albumin. In some cases, a biomolecule that increases serum half-life is an albumin-binding domain. In some cases, a biomolecule that increases serum half-life is transthyretin. In some cases, a biomolecule that increases serum half-life is a thyroxin-binding protein. In some cases, the biomolecule is an immunoglobulin Fc polypeptide. In some cases, a biomolecule that facilitates transport across the blood-brain barrier is transferrin receptor (TR), insulin receptor (HIR), insulin-like growth factor receptor (IGFR), low-density lipoprotein receptor related proteins 1 and 2 (LPR-1 and 2), diphtheria toxin receptor, a llama single domain antibody, a protein transduction domain, TAT, penetratin, or a poly-arginine peptide.

[00236] Suitable biomolecules include small molecules such as cancer chemotherapeutic agents. Suitable cancer chemotherapeutic agents include, e.g., alkylating agents, such as nitrogen mustards (for example, chlorambucil, chlormethine, cyclophosphamide, ifosfamide, and melphalan); nitrosoureas (for example, carmustine, fotemustine, lomustine, and streptozocin); platinum compounds (for example, carboplatin, cisplatin, oxaliplatin, and BBR3464); busulfan; dacarbazine; mechlorethamine; procarbazine; temozolomide; thiotepa; uramustine; antimetabolites, such as folic acid (for example, methotrexate, pemetrexed, and raltitrexed); purine (for example, cladribine, clofarabine, fludarabine, mercaptopurine, and tioguanine); pyrimidine (for example, capecitabine); cytarabine; fluorouracil; gemcitabine; plant alkaloids, such as podophyllum (for example, etoposide, and teniposide),taxane (for example, docetaxel and paclitaxel), vinca (for example,vinblastine, vincristine,vindesine, and vinorelbine); cytotoxic/antitumor antibiotics, such as anthracycline family members (for example, daunorubicin, doxorubicin, epirubicin, idarubicin, mitoxantrone, and valrubicin), bleomycin, rifampicin, hydroxyurea, and mitomycin; topoisomerase inhibitors, such as topotecan and

irinotecan; photosensitizers, such as aminolevulinic acid, methyl aminolevulinate, porfimer sodium, and verteporfin; and other agents, such as alitretinoin, altretamine, amsacrine, anagrelide, arsenic trioxide, asparaginase, axitinib, bexarotene, bevacizumab, bortezomib, celecoxib, denileukin diftitox, erlotinib, estramustine, gefitinib, hydroxycarbamide, imatinib, lapatinib, pazopanib, pentostatin, masoprocol, mitotane, pegaspargase, tamoxifen, sorafenib, sunitinib, vemurafinib, vandetanib, and tretinoin. For example, in some cases, the target molecule is an antibody; and the biomolecule is a cancer chemotherapeutic agent.

[00237] Suitable biomolecules include cytokines, chemokines, peptide hormones, and the like. Suitable biomolecules include, e.g., interferons (e.g., IFN-γ); interleukins (e.g., IL-1α, IL-1β, IL-2, IL-4, IL-5, IL-6, IL-7, IL-9, IL-10, IL-12p40, IL-12p70, IL-13, IL-15, IL-17, and the like); IP-10, KC, MCP-1, MIP-1α, MIP-1β, M-CSF MIP-2, MIG; an alpha chemokine (e.g., a CXC chemokine; e.g., CXC-1 through CXC-17); a beta chemokine (a CC chemokine) such as RANTES or CCL20 (also known as MIP-3α); tumor necrosis factor-alpha (TNF-α); eotaxin; granulocyte colony stimulating factor (G-CSF); granulocyte-macrophage-colony stimulating factor (GM-CSF); erythropoietin; insulin; Gro-α; Groβ; Gro-γ; stromal-derived factor; platelet-derived growth factor (PDGF); vascular endothelial growth factor (VEGF); insulin-like growth factor (IGF); fibroblast growth factor (FGF); epidermal growth factor (EGF); leukemia inhibitory factor (LIF); hepatocyte growth factor (HGF); thrombopoietin; and the like.

[00238] Suitable biomolecules include nucleic acids. In some cases, the nucleic acid is a DNA molecule. In some cases, the nucleic acid is an RNA molecule. In some cases, the nucleic acid comprises both deoxyribonucleotides and ribonucleotides. In some cases, the nucleic acid is a single-stranded DNA molecule. In some cases, the nucleic acid is a double-stranded DNA molecule. In some cases, the nucleic acid is a single-stranded RNA molecule. Suitable nucleic acids include, e.g., a small interfering RNA (siRNA), a short hairpin RNA (shRNA), a microRNA (miRNA), a ribozyme, and the like. Suitable nucleic acids include nucleic acids that are or act as siRNAs or other RNA interference reagents (RNAi agents or iRNA agents), shRNA, antisense oligonucleotides, self-cleaving RNAs, ribozymes, fragment thereof and/or variants thereof (such as Peptidyl transferase 23S rRNA, RNase P, Group I and Group II introns, GIR1 branching ribozymes, Leadzyme, Hairpin ribozymes, Hammerhead ribozymes, HDV ribozymes, Mammalian CPEB3 ribozyme, VS ribozymes, glmS ribozymes, CoTC ribozyme, etc.), microRNAs, microRNA mimics, supermirs, aptamers, antimirs, antagomirs, Ul adaptors, triplex-forming oligonucleotides, RNA activators, long non-coding RNAs, short non-coding RNAs (e.g., piRNAs), immunomodulatory oligonucleotides (such as immunostimulatory oligonucleotides, immunoinhibitory oligonucleotides), GNA, LNA, ENA, PNA, TNA, HNA, TNA, XNA, HeNA, CeNA, morpholinos, G-quadruplex (RNA and DNA), antiviral

oligonucleotides, and decoy oligonucleotides. Nucleic acids can be of any length, and can include one or more of a modified ribonucleotide base, a modified deoxyribonucleotide base, a modified deoxyribose, a modified ribose, and a modified backbone linkage (e.g., a phosphorothioate linkage).

Biomolecules for conjugation to a CRISPR-Cas effector polypeptide

[00239] In some cases, a biomolecule to be conjugated to a target polypeptide is a biomolecule suitable for conjugation to a CRISPR-Cas effector polypeptide.

[00240] In some cases, a biomolecule suitable for conjugation to a CRISPR-Cas effector polypeptide is one that can modulate transcription (e.g., inhibit transcription, increase transcription) of a target DNA. For example, in some cases the biomolecule is a protein (or a domain from a protein) that inhibits transcription (e.g., a transcriptional repressor, a protein that functions via recruitment of transcription inhibitor proteins, modification of target DNA such as methylation, recruitment of a DNA modifier, modulation of histones associated with target DNA, recruitment of a histone modifier such as those that modify acetylation and/or methylation of histones, and the like). In some cases the biomolecule is a protein (or a domain from a protein) that increases transcription (e.g., a transcription activator, a protein that acts via recruitment of transcription activator proteins, modification of target DNA such as demethylation, recruitment of a DNA modifier, modulation of histones associated with target DNA, recruitment of a histone modifier such as those that modify acetylation and/or methylation of histones, and the like).

[00241] In some cases, a biomolecule suitable for conjugation to a CRISPR-Cas effector polypeptide is a polypeptide that has enzymatic activity that modifies a target nucleic acid (e.g., nuclease activity such as FokI nuclease activity, methyltransferase activity, demethylase activity, DNA repair activity, DNA damage activity, deamination activity, dismutase activity, alkylation activity, depurination activity, oxidation activity, pyrimidine dimer forming activity, integrase activity, transposase activity, recombinase activity, polymerase activity, ligase activity, helicase activity, photolyase activity or glycosylase activity).

[00242] In some cases, a biomolecule suitable for conjugation to a CRISPR-Cas effector polypeptide is a polypeptide that has enzymatic activity that modifies a polypeptide (e.g., a histone) associated with a target nucleic acid (e.g., methyltransferase activity, demethylase activity, acetyltransferase activity, deacetylase activity, kinase activity, phosphatase activity, ubiquitin ligase activity, deubiquitinating activity, adenylation activity, deadenylation activity, SUMOylating activity, deSUMOylating activity, ribosylation activity, deribosylation activity, myristoylation activity or demyristoylation activity).

[00243] Examples of proteins (or fragments thereof) that can be used in increase transcription, and that are suitable as a biomolecule for conjugation to a CRISPR-Cas effector polypeptide, include but are not limited to: transcriptional activators such as VP16, VP64, VP48, VP160, p65 subdomain (e.g., from NFkB), and activation domain of EDLL and/or TAL activation domain (e.g., for activity in plants); histone lysine methyltransferases such as SET1A, SET1B, MLL1 to 5, ASH1, SYMD2, NSD1, and the like; histone lysine demethylases such as JHDM2a/b, UTX, JMJD3, and the like; histone acetyltransferases such as GCN5, PCAF, CBP, p300, TAF1, TIP60/PLIP, MOZ/MYST3, MORF/MYST4, SRC1, ACTR, P160, CLOCK, and the like; and DNA demethylases such as Ten-Eleven Translocation (TET) dioxygenase 1 (TET1CD), TET1, DME, DML1, DML2, ROS1, and the like.

[00244] Examples of proteins (or fragments thereof) that can be used in decrease transcription, and that are suitable as a biomolecule suitable for conjugation to a CRISPR-Cas effector polypeptide, include but are not limited to: transcriptional repressors such as the Krüppel associated box (KRAB or SKD); KOX1 repression domain; the Mad mSIN3 interaction domain (SID); the ERF repressor domain (ERD), the SRDX repression domain (e.g., for repression in plants), and the like; histone lysine methyltransferases such as Pr-SET7/8, SUV4-20H1, RIZ1, and the like; histone lysine demethylases such as JMJD2A/JHDM3A, JMJD2B, JMJD2C/GASC1, JMJD2D, JARID1A/RBP2, JARID1B/PLU-1, JARID1C/SMCX, JARID1D/SMCY, and the like; histone lysine deacetylases such as HDAC1, HDAC2, HDAC3, HDAC8, HDAC4, HDAC5, HDAC7, HDAC9, SIRT1, SIRT2, HDAC11, and the like; DNA methylases such as HhaI DNA m5c-methyltransferase (M.HhaI), DNA methyltransferase 1 (DNMT1), DNA methyltransferase 3a (DNMT3a), DNA methyltransferase 3b (DNMT3b), METI, DRM3 (plants), ZMET2, CMT1, CMT2 (plants), and the like; and periphery recruitment elements such as Lamin A, Lamin B, and the like.

[00245] In some cases, a biomolecule to be conjugated to a CRISPR-Cas effector polypeptide has enzymatic activity that modifies a target nucleic acid (e.g., ssRNA, dsRNA, ssDNA, dsDNA). Examples of enzymatic activity that can be provided by the biomolecule include but are not limited to: nuclease activity such as that provided by a restriction enzyme (e.g., FokI nuclease), methyltransferase activity such as that provided by a methyltransferase (e.g., HhaI DNA m5c-methyltransferase (M.HhaI), DNA methyltransferase 1 (DNMT1), DNA methyltransferase 3a (DNMT3a), DNA methyltransferase 3b (DNMT3b), METI, DRM3 (plants), ZMET2, CMT1, CMT2 (plants), and the like); demethylase activity such as that provided by a demethylase (e.g., Ten-Eleven Translocation (TET) dioxygenase 1 (TET1CD), TET1, DME, DML1, DML2, ROS1, and the like) , DNA repair activity, DNA damage activity, deamination activity such as that provided by a deaminase (e.g., a cytosine deaminase enzyme such as rat APOBEC1),

dismutase activity, alkylation activity, depurination activity, oxidation activity, pyrimidine dimer forming activity, integrase activity such as that provided by an integrase and/or resolvase (e.g., Gin invertase such as the hyperactive mutant of the Gin invertase, GinH106Y; human immunodeficiency virus type 1 integrase (IN); Tn3 resolvase; and the like), transposase activity, recombinase activity such as that provided by a recombinase (e.g., catalytic domain of Gin recombinase), polymerase activity, ligase activity, helicase activity, photolyase activity, and glycosylase activity).

[00246] In some cases, a biomolecule to be conjugated to a CRISPR-Cas effector polypeptide has enzymatic activity that modifies a protein associated with a target nucleic acid (e.g., ssRNA, dsRNA, ssDNA, dsDNA) (e.g., a histone, an RNA binding protein, a DNA binding protein, and the like). Examples of enzymatic activity (that modifies a protein associated with a target nucleic acid) that can be provided by the biomolecule include but are not limited to: methyltransferase activity such as that provided by a histone methyltransferase (HMT) (e.g., suppressor of variegation 3-9 homolog 1 (SUV39H1, also known as KMT1A), euchromatic histone lysine methyltransferase 2 (G9A, also known as KMT1C and EHMT2), SUV39H2, ESET/SETDB1, and the like, SET1A, SET1B, MLL1 to 5, ASH1, SYMD2, NSD1, DOT1L, Pr-SET7/8, SUV4-20H1, EZH2, RIZ1), demethylase activity such as that provided by a histone demethylase (e.g., Lysine Demethylase 1A (KDM1A also known as LSD1), JHDM2a/b, JMJD2A/JHDM3A, JMJD2B, JMJD2C/GASC1, JMJD2D, JARID1A/RBP2, JARID1B/PLU-1, JARID1C/SMCX, JARID1D/SMCY, UTX, JMJD3, and the like), acetyltransferase activity such as that provided by a histone acetyl transferase (e.g., catalytic core/fragment of the human acetyltransferase p300, GCN5, PCAF, CBP, TAF1, TIP60/PLIP, MOZ/MYST3, MORF/MYST4, HBO1/MYST2, HMOF/MYST1, SRC1, ACTR, P160, CLOCK, and the like), deacetylase activity such as that provided by a histone deacetylase (e.g., HDAC1, HDAC2, HDAC3, HDAC8, HDAC4, HDAC5, HDAC7, HDAC9, SIRT1, SIRT2, HDAC11, and the like), kinase activity, phosphatase activity, ubiquitin ligase activity, deubiquitinating activity, adenylation activity, deadenylation activity, SUMOylating activity, deSUMOylating activity, ribosylation activity, deribosylation activity, myristoylation activity, and demyristoylation activity.

[00247] In some cases, a biomolecule to be conjugated to a CRISPR-Cas effector polypeptide is a catalytically active endonuclease. For example, in some cases, the target polypeptide is a CRISPR-Cas effector polypeptide that is catalytically inactive (e.g., does not exhibit endonuclease activity) and that retains target nucleic acid binding activity (when complexed with a guide RNA); and the biomolecule to be conjugated to the CRISPR-Cas effector polypeptide is a catalytically active endonuclease. For example, in some cases, the catalytically active endonuclease is a FokI polypeptide. As one non-limiting example, in some cases, a biomolecule

to be conjugated to a CRISPR-Cas effector polypeptide is a FokI nuclease comprising an amino acid sequence having at least at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the FokI amino acid sequence provided below; where the FokI nuclease has a length of from about 195 amino acids to about 200 amino acids.

[00248] FokI nuclease amino acid sequence:
QLVKSELEEKKSELRHKLKYVPHEYIELIEIARNSTQDRILEMKVMEFFMKVYGYRGKH
LGGSRKPDGAIYTVGSPIDYGVIVDTKAYSGGYNLPIGQADEMQRYVEENQTRNKHINP
NEWWKVYPSSVTEFKFLFVSGHFKGNYKAQLTRLNHITNCNGAVLSVEELLIGGEMIKA
GTLTLEEVRRKFNNGEINF (SEQ ID NO:886).

[00249] In some cases, the biomolecule to be conjugated to a CRISPR-Cas effector polypeptide is a deaminase. In some cases, the target CRISPR/Cas effector polypeptide is catalytically inactive. Suitable deaminases include a cytidine deaminase and an adenosine deaminase.

[00250] A suitable adenosine deaminase is any enzyme that is capable of deaminating adenosine in DNA. In some cases, the deaminase is a TadA deaminase.

[00251] In some cases, a suitable adenosine deaminase comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following amino acid sequence:
MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAA
GSLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTD (SEQ ID
NO:887)

[00252] In some cases, a suitable adenosine deaminase comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following amino acid sequence:
MRRAFITGVFFLSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWN
RPIGRHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFG
ARDAKTGAAGSLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQ
SSTD (SEQ ID NO:888).

[00253] In some cases, a suitable adenosine deaminase comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following *Staphylococcus aureus* TadA amino acid sequence:
MGSHMTNDIYFMTLAIEEAKKAAQLGEVPIGAIITKDDEVIARAHNLRETLQQPTAHAE
HIAIERAAKVLGSWRLEGCTLYVTLEPCVMCAGTIVMSRIPRVVYGADDPKGGCSGSL
MNLLQQSNFNHRAIVDKGVLKEACSTLLTTFFK NLRANKKSTN: (SEQ ID NO:889)

[00254] In some cases, a suitable adenosine deaminase comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following *Bacillus subtilis* TadA amino acid sequence: MTQDELYMKEAIKEAKKAEEKGEVPIGAVLVINGEIIARAHNLRETEQRSIAHAEMLVID EACKALGTWRLEGATLYVTLEPCPMCAGAVVLSRVEKVVFGAFDPKGGCSGTLMNLL QEERFNHQAEVVSGVLEEECGGMLSAFFRELRKKKKAARKNLSE (SEQ ID NO:890)

[00255] In some cases, a suitable adenosine deaminase comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following *Salmonella typhimurium* TadA: MPPAFITGVTSLSDVELDHEYWMRHALTLAKRAWDEREVPVGAVLVHNHRVIGEGWN RPIGRHDPTAHAEIMALRQGGLVLQNYRLLDTTLYVTLEPCVMCAGAMVHSRIGRVVF GARDAKTGAAGSLIDVLHHPGMNHRVEIIEGVLRDECATLLSDFFRMRRQEIKALKKAD RAEGAGPAV (SEQ ID NO:891)

[00256] In some cases, a suitable adenosine deaminase comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following *Shewanella putrefaciens* TadA amino acid sequence: MDEYWMQVAMQMAEKAEAAGEVPVGAVLVKDGQQIATGYNLSISQHDPTAHAEILCL RSAGKKLENYRLLDATLYITLEPCAMCAGAMVHSRIARVVYGARDEKTGAAGTVVNL LQHPAFNHQVEVTSGVLAEACSAQLSRFFKRRRDEKKALKLAQRAQQGIE (SEQ ID NO:892)

[00257] In some cases, a suitable adenosine deaminase comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following *Haemophilus influenzae* F3031 TadA amino acid sequence: MDAAKVRSEFDEKMMRYALELADKAEALGEIPVGAVLVDDARNIIGEGWNLSIVQSDP TAHAEIIALRNGAKNIQNYRLLNSTLYVTLEPCTMCAGAILHSRIKRLVFGASDYKTGAI GSRFHFFDDYKMNHTLEITSGVLAEECSQKLS TFFQKRREEKKIEKALLKSLSDK (SEQ ID NO:893)

[00258] In some cases, a suitable adenosine deaminase comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following *Caulobacter crescentus* TadA amino acid sequence: MRTDESEDQDHRMMRLALDAARAAAEAGETPVGAVILDPSTGEVIATAGNGPIAAHDP TAHAEIAAMRAAAAKLGNYRLTDLTLVVTLEPCAMCAGAISHARIGRVVFGADDPKGG AVVHGPKFFAQPTCHWRPEVTGGVLADESADLLRGFFRARRKAKI (SEQ ID NO:894)

[00259] In some cases, a suitable adenosine deaminase comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following *Geobacter sulfurreducens* TadA amino acid sequence: MSSLKKTPIRDDAYWMGKAIREAAKAAARDEVPIGAVIVRDGAVIGRGHNLREGSNDP SAHAEMIAIRQAARRSANWRLTGATLYVTLEPCLMCMGAIILARLERVVFGCYDPKGG AAGSLYDLSADPRLNHQVRLSPGVCQEECGTMLSDFFRDLRRRKKAKATPALFIDERKV PPEP (SEQ ID NO:895)

[00260] Cytidine deaminases suitable as biomolecules to be conjugated to a CRISPR-Cas effector polypeptide include any enzyme that is capable of deaminating cytidine in DNA.

[00261] In some cases, the cytidine deaminase is a deaminase from the apolipoprotein B mRNA-editing complex (APOBEC) family of deaminases. In some cases, the APOBEC family deaminase is selected from the group consisting of APOBEC1 deaminase, APOBEC2 deaminase, APOBEC3A deaminase, APOBEC3B deaminase, APOBEC3C deaminase, APOBEC3D deaminase, APOBEC3F deaminase, APOBEC3G deaminase, and APOBEC3H deaminase. In some cases, the cytidine deaminase is an activation induced deaminase (AID).

[00262] In some cases, a suitable cytidine deaminase comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following amino acid sequence:

[00263] MDSLLMNRRKFLYQFKNVRWAKGRRETYLCYVVKRRDSATSFSLDFGYLRNKNGCH VELLFLRYISDWDLDPGRCYRVTWFTSWSPCYDCARHVADFLRGNPNLSLRIFTARLYF CEDRKAEPEGLRRLHRAGVQIAIMTFKDYFYCWNTFVENHERTFKAWEGLHENSVRLS RQLRRILLPLYEVDDLRDAFRTLGL (SEQ ID NO:896)

[00264] In some cases, a suitable cytidine deaminase is an AID and comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following amino acid sequence: MDSLLMNRRK FLYQFKNVRW AKGRRETYLC YVVKRRDSAT SFSLDFGYLR NKNGCHVELL FLRYISDWDL DPGRCYRVTW FTSWSPCYDC ARHVADFLRG NPNLSLRIFT ARLYFCEDRK AEPEGLRRLH RAGVQIAIMT FKENHERTFK AWEGLHENSV RLSRQLRRIL LPLYEVDDLR DAFRTLGL (SEQ ID NO:897).

[00265] In some cases, a suitable cytidine deaminase is an AID and comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following amino acid sequence: MDSLLMNRRK FLYQFKNVRW AKGRRETYLC YVVKRRDSAT SFSLDFGYLR NKNGCHVELL FLRYISDWDL DPGRCYRVTW FTSWSPCYDC ARHVADFLRG NPNLSLRIFT

ARLYFCEDRK AEPEGLRRLH RAGVQIAIMT FKDYFYCWNT FVENHERTFK AWEGLHENSV RLSRQLRRIL LPLYEVDDLR DAFRTLGL (SEQ ID NO:898).

[00266] In some cases, a method of the present disclosure for conjugating a biomolecule to a CRISPR-Cas effector polypeptide is carried out in the presence of trehalose. The concentration of trehalose can be from 25 mM to about 100 mM (e.g., from 25 mM to 50 mM, from 50 mM to 100 mM). For example, in some cases, a method of the present disclosure for conjugating a biomolecule to a CRISPR-Cas effector polypeptide is carried out under the following conditions: 20 mM Tris HCl, 300 mM KCl, 50 mM Trehalose pH 7.0, 4°C 1 hr; 10 μM CRISPR-Cas effector polypeptide.

TARGET MOLECULES

[00267] Target molecules that are suitable for modification include, but are not limited to, polypeptides, polynucleotides, carbohydrates, lipids, glycolipids, glycopolypeptides, and the like. A target molecule to be modified according to a method of the present disclosure comprises, or is modified to comprise, a phenol moiety or catechol moiety.

[00268] In some cases, a target molecule is a polypeptide (a "target polypeptide").

[00269] Target polypeptides that can be modified using a method of the present disclosure include, but are not limited to, an enzyme, an antibody, a structural polypeptide, a ligand for a receptor, a receptor, and the like. Target polypeptides can include, structural proteins; receptors; enzymes; cell surface proteins; proteins integral to the function of a cell; proteins involved in catalytic activity; proteins involved in motor activity; proteins involved in helicase activity; proteins involved in metabolic processes (anabolism and catabolism); proteins involved in antioxidant activity; proteins involved in proteolysis; proteins involved in biosynthesis; proteins having kinase activity; proteins having oxidoreductase activity; proteins having transferase activity; proteins having hydrolase activity; proteins having lyase activity; proteins having isomerase activity; proteins having ligase activity; proteins having enzyme regulator activity; proteins having signal transducer activity; structural polypeptides; polypeptides having binding activity; receptor polypeptides; proteins involved in cell motility; proteins involved in membrane fusion; proteins involved in cell communication; proteins involved in regulation of biological processes; proteins involved in development; proteins involved in cell differentiation; proteins involved in response to stimulus; behavioral proteins; cell adhesion proteins; proteins involved in cell death; proteins involved in transport (including protein transporter activity, nuclear transport, ion transporter activity, channel transporter activity, and the like); proteins involved in secretion activity; proteins involved in electron transporter activity; proteins involved in pathogenesis; proteins involved in chaperone regulator activity; proteins having nucleic acid binding activity; proteins having transcription regulator activity; proteins involved in

extracellular organization; proteins involved in biogenesis; proteins involved in translation regulation; and the like.

[00270] In some cases, the target polypeptide is an antibody. The antibody can be any antigen-binding antibody-based polypeptide, a wide variety of which are known in the art. In some instances, the antibody is a single chain Fv (scFv). Other antibody-based recognition domains (cAb VHH (camelid antibody variable domains) and humanized versions, IgNAR VH (shark antibody variable domains) and humanized versions, sdAb VH (single domain antibody variable domains) and "camelized" antibody variable domains are suitable for use. In some instances, T-cell receptor (TCR) based recognition domains such as single chain TCR (scTv, single chain two-domain TCR containing VαVβ) are also suitable for use.

[00271] An antibody can be specific for an antigen such as CD19, CD20, CD38, CD30, Her2/neu, ERBB2, CA125, MUC-1, prostate-specific membrane antigen (PSMA), CD44 surface adhesion molecule, mesothelin, carcinoembryonic antigen (CEA), epidermal growth factor receptor (EGFR), EGFRvIII, vascular endothelial growth factor receptor-2 (VEGFR2), high molecular weight-melanoma associated antigen (HMW-MAA), MAGE-A1, IL-13R-a2, GD2, and the like. In some cases, the antibody is specific for a cytokine. In some cases, the antibody is specific for a cytokine receptor. In some cases, the antibody is specific for a growth factor. In some cases, the antibody is specific for a growth factor receptor. In some cases, the antibody is specific for a cell-surface receptor. In some cases, the antibody is an anti-CD3 antibody.

[00272] In some cases, the antibody is selected from: 806, 9E10, 3F8, 81C6, 8H9, Abagovomab, Abatacept, Abciximab, Abituzumab, Abrilumab, Actoxumab, Adalimumab, Adecatumumab, Aducanumab, Afelimomab, Afutuzumab, Alacizumab pegol, ALD518, Alefacept, Alemtuzumab, Alirocumab, Altumomab pentetate, Amatuximab, AMG 102, Anatumomab mafenatox, Anetumab ravtansine, Anifrolumab, Anrukinzumab, Apolizumab, Arcitumomab, Ascrinvacumab, Aselizumab, Atacicept, Atezolizumab, Atinumab, Atlizumab/tocilizumab, Atorolimumab, AVE1642, Bapineuzumab, Basiliximab, Bavituximab, Bectumomab, Begelomab, Belimumab, Benralizumab, Bertilimumab, Besilesomab, Bevacizumab, Bezlotoxumab, Biciromab, Bimagrumab, Bimekizumab, Bivatuzumab mertansine, Blinatumomab, Blosozumab, BMS-936559, Bococizumab, Brentuximab vedotin, Briakinumab, Brodalumab, Brolucizumab, Brontictuzumab, Canakinumab, Cantuzumab mertansine, Cantuzumab ravtansine, Caplacizumab, Capromab pendetide, Carlumab, Catumaxomab, cBR96-doxorubicin immunoconjugate, CC49, CDP791, Cedelizumab, Certolizumab pegol, Cetuximab, cG250, Ch.14.18, Citatuzumab bogatox, Cixutumumab, Clazakizumab, Clenoliximab, Clivatuzumab tetraxetan, Codrituzumab, Coltuximab ravtansine, Conatumumab, Concizumab, CP 751871, CR6261, Crenezumab, CS-1008, Dacetuzumab, Daclizumab, Dalotuzumab,

Dapirolizumab pegol, Daratumumab, Dectrekumab, Demcizumab, Denintuzumab mafodotin, Denosumab, Derlotuximab biotin, Detumomab, Dinutuximab, Diridavumab, Dorlimomab aritox, Drozitumab, Duligotumab, Dupilumab, Durvalumab, Dusigitumab, Ecromeximab, Eculizumab, Edobacomab, Edrecolomab, Efalizumab, Efungumab, Eldelumab, Elgemtumab, Elotuzumab, Elsilimomab, Emactuzumab, Emibetuzumab, Enavatuzumab, Enfortumab vedotin, Enlimomab pegol, Enoblituzumab, Enokizumab, Enoticumab, Ensituximab, Epitumomab cituxetan, Epratuzumab, Erlizumab, Ertumaxomab, Etanercept, Etaracizumab, Etrolizumab, Evinacumab, Evolocumab, Exbivirumab, F19, Fanolesomab, Faralimomab, Farletuzumab, Fasinumab, FBTA05, Felvizumab, Fezakinumab, Ficlatuzumab, Figitumumab, Firivumab, Flanvotumab, Fletikumab, Fontolizumab, Foralumab, Foravirumab, Fresolimumab, Fulranumab, Futuximab, Galiximab, Ganitumab, Gantenerumab, Gavilimomab, Gemtuzumab ozogamicin, Gevokizumab, Girentuximab, Glembatumumab vedotin, Golimumab, Gomiliximab, Guselkumab, HGS-ETR2, hu3S193, huA33, Ibalizumab, Ibritumomab tiuxetan, Icrucumab, Idarucizumab, IGN101, IgN311, Igovomab, IIIA4, IM-2C6, IMAB362, Imalumab, IMC-A12, Imciromab, Imgatuzumab, Inclacumab, Indatuximab ravtansine, Indusatumab vedotin, Infliximab, Inolimomab, Inotuzumab ozogamicin, Intetumumab, Ipilimumab, Iratumumab, Isatuximab, Itolizumab, Ixekizumab, J591, KB004, Keliximab, KW-2871, Labetuzumab, Lambrolizumab, Lampalizumab, Lebrikizumab, Lemalesomab, Lenzilumab, Lerdelimumab, Lexatumumab, Libivirumab, Lifastuzumab vedotin, Ligelizumab, Lilotomab satetraxetan, Lintuzumab, Lirilumab, Lodelcizumab, Lokivetmab, Lorvotuzumab mertansine, Lucatumumab, Lulizumab pegol, Lumiliximab, Lumretuzumab, Mapatumumab, Margetuximab, Maslimomab, Matuzumab, Mavrilimumab, MEDI4736, Mepolizumab, Metelimumab, METMAB, Milatuzumab, Minretumomab, Mirvetuximab soravtansine, Mitumomab, MK-0646, MK-3475, MM-121, Mogamulizumab, MORAb-003, Morolimumab, Motavizumab, MOv18, Moxetumomab pasudotox, MPDL33280A, Muromonab-CD3, Nacolomab tafenatox, Namilumab, Naptumomab estafenatox, Narnatumab, Natalizumab, Nebacumab, Necitumumab, Nemolizumab, Nerelimomab, Nesvacumab, Nimotuzumab, Nivolumab, Nofetumomab merpentan, Obiltoxaximab, Obinutuzumab, Ocaratuzumab, Ocrelizumab, Odulimomab, Ofatumumab, Olaratumab, Olokizumab, Omalizumab, Onartuzumab, Ontuxizumab, Opicinumab, Oportuzumab monatox, Oregovomab, Orticumab, Otelixizumab, Otlertuzumab, Oxelumab, Ozanezumab, Ozoralizumab, Pagibaximab, Palivizumab, Panitumumab, Pankomab, Panobacumab, Parsatuzumab, Pascolizumab, Pasotuxizumab, Pateclizumab, Patritumab, Pembrolizumab, Pemtumomab, Perakizumab, Pertuzumab, Pexelizumab, Pidilizumab, Pinatuzumab vedotin, Pintumomab, Placulumab, Polatuzumab vedotin, Ponezumab, Priliximab, Pritoxaximab, Pritumumab, PRO 140, Quilizumab, R1507, Racotumomab, Radretumab, Rafivirumab, Ralpancizumab, Ramucirumab,

Ranibizumab, Raxibacumab, Refanezumab, Regavirumab, Reslizumab, Rilotumumab, Rinucumab, Rituximab, Robatumumab, Roledumab, Romosozumab, Rontalizumab, Rovelizumab, Ruplizumab, Sacituzumab govitecan, Samalizumab, Sarilumab, Satumomab pendetide, SCH 900105, Secukinumab, Seribantumab, Setoxaximab, Sevirumab, SGN-CD19A, SGN-CD33A, Sibrotuzumab, Sifalimumab, Siltuximab, Simtuzumab, Siplizumab, Sirukumab, Sofituzumab vedotin, Solanezumab, Solitomab, Sonepcizumab, Sontuzumab, Stamulumab, Sulesomab, Suvizumab, Tabalumab, Tacatuzumab tetraxetan, Tadocizumab, Talizumab, Tanezumab, Taplitumomab paptox, Tarextumab, Tefibazumab, Telimomab aritox, Tenatumomab, Teneliximab, Teplizumab, Teprotumumab, Tesidolumab, Tetulomab, TGN1412, Ticilimumab/tremelimumab, Tigatuzumab, Tildrakizumab, TNX-650, Tocilizumab, Toralizumab, Tosatoxumab, Tositumomab, Tovetumab, Tralokinumab, Trastuzumab, TRBS07, Tregalizumab, Tremelimumab, Trevogrumab, Tucotuzumab celmoleukin, Tuvirumab, Ublituximab, Ulocuplumab, Urelumab, Urtoxazumab, Ustekinumab, Vandortuzumab vedotin, Vantictumab, Vanucizumab, Vapaliximab, Varlilumab, Vatelizumab, Vedolizumab, Veltuzumab, Vepalimomab, Vesencumab, Visilizumab, Volociximab, Vorsetuzumab mafodotin, Votumumab, Zalutumumab, Zanolimumab, Zatuximab, Ziralimumab and Zolimomab aritox.

[00273] In some cases, the target polypeptide is a CRISPR-Cas effector polypeptide. A suitable CRISPR-Cas effector polypeptide is a class 2 CRISPR/Cas endonuclease such as a type II, type V, or type VI CRISPR-Cas effector polypeptide. In some cases, a suitable RNA-guided endonuclease is a class 2 CRISPR/Cas endonuclease. In some cases, a suitable RNA-guided endonuclease is a class 2 type II CRISPR/Cas endonuclease (e.g., a Cas9 protein). In some cases, a CRISPR-Cas effector polypeptide is a class 2 type V CRISPR-Cas effector polypeptide (e.g., a Cpf1 protein, a C2c1 protein, or a C2c3 protein). In some cases, a suitable CRISPR-Cas effector polypeptide is a class 2 type VI CRISPR-Cas effector polypeptide (e.g., a C2c2 protein; also referred to as a "Cas13a" protein). Also suitable is a CasX protein. Also suitable is a CasY protein.

[00274] In some cases, the CRISPR/Cas effector polypeptide is a Type II CRISPR/Cas effector polypeptide. In some cases, the CRISPR/Cas effector polypeptide is a Cas9 polypeptide. The Cas9 protein is guided to a target site (e.g., stabilized at a target site) within a target nucleic acid sequence (e.g., a chromosomal sequence or an extrachromosomal sequence, e.g., an episomal sequence, a minicircle sequence, a mitochondrial sequence, a chloroplast sequence, etc.) by virtue of its association with the protein-binding segment of the Cas9 guide RNA. In some cases, a Cas9 polypeptide comprises an amino acid sequence having at least 50%, at least 60%, at least 70%, at least 80%, at least 90%, at least 95%, at least 98%, at least 99%, or more than 99%, amino acid sequence identity to the *Streptococcus pyogenes* Cas9 set forth in SEQ ID NO:753.

In some cases, a Cas9 polypeptide comprises the amino acid sequence set forth in any one of SEQ ID NOs:5-816. In some cases, a Cas9 polypeptide comprises an amino acid sequence having at least 50%, at least 60%, at least 70%, at least 80%, at least 90%, at least 95%, at least 98%, at least 99%, or more than 99%, amino acid sequence identity to the amino acid sequence set forth in any one of SEQ ID NOs:5-816.

[00275] In some cases, the Cas9 polypeptide is a *Staphylococcus aureus* Cas9 (saCas9) polypeptide. In some cases, the saCas9 polypeptide comprises an amino acid sequence having at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the saCas9 amino acid sequence set forth in SEQ ID NO:249.

[00276] In some cases, the Cas9 polypeptide is a *Campylobacter jejuni* Cas9 (CjCas9) polypeptide. CjCas9 recognizes the 5′-NNNVRYM-3′ as the protospacer-adjacent motif (PAM). The amino acid sequence of CjCas9 is set forth in SEQ ID NO:55. In some cases, a suitable Cas9 polypeptide comprises an amino acid sequence having at least 50%, at least 60%, at least 70%, at least 80%, at least 90%, at least 95%, at least 98%, at least 99%, or more than 99%, amino acid sequence identity to the CjCas9 amino acid sequence set forth in SEQ ID NO:55.

[00277] In some cases, a suitable Cas9 polypeptide is a high-fidelity (HF) Cas9 polypeptide. Kleinstiver et al. (2016) *Nature* 529:490. For example, amino acids N497, R661, Q695, and Q926 of a *Streptococcus pyogenes* Cas9 amino acid sequence (e.g., SEQ ID NO:5) are substituted, e.g., with alanine. For example, an HF Cas9 polypeptide can comprise an amino acid sequence having at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to a *Streptococcus pyogenes* Cas9 (e.g., SEQ ID NO:5), where amino acids N497, R661, Q695, and Q926 are substituted, e.g., with alanine. In some cases, a suitable Cas9 polypeptide exhibits altered PAM specificity. See, e.g., Kleinstiver et al. (2015) *Nature* 523:481.

[00278] In some cases, a suitable Cas9 polypeptide comprises an amino acid sequence having at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following Cas9-HF1 sequence:

DKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEA
TRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGN
IVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDV
DKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLI
ALSLGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAIL
LSDILRVNTEITKAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAG
YIDGGASQEEFYKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAI
LRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVV
DKGASAQSFIERMTAFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFL

SGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKI
IKDKDFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGW
GALSRKLINGIRDKQSGKTILDFLKSDGFANRNFMALIHDDSLTFKEDIQKAQVSGQGDS
LHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSR
ERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYD
VDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQR
KFDNLTKAERGGLSELDKAGFIKRQLVETRAITKHVAQILDSRMNTKYDENDKLIREVK
VITLKSKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDY
KVYDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIV
WDKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKY
GGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEV
KKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSP
EDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENII
HLFTLTNLGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGD
(SEQ ID NO:899).

[00279] In some cases, a suitable CRISPR/Cas effector polypeptide is a type V CRISPR/Cas effector polypeptide. In some cases, a type V CRISPR/Cas effector polypeptide is a Cpf1 protein. In some cases, a Cpf1 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the Cpf1 amino acid sequence set forth in any one of SEQ ID NOs:818-822.

[00280] In some cases, a suitable CRISPR/Cas effector polypeptide is a CasX or a CasY polypeptide. CasX and CasY polypeptides are described in Burstein et al. (2017) *Nature* 542:237.

[00281] In some cases, a suitable CRISPR/Cas effector polypeptide is a fusion protein comprising a CRISPR/Cas effector polypeptide that is fused to a heterologous polypeptide (also referred to as a "fusion partner"). In some cases, a CRISPR/Cas effector polypeptide is fused to an amino acid sequence (a fusion partner) that provides for subcellular localization, i.e., the fusion partner is a subcellular localization sequence (e.g., one or more nuclear localization signals (NLSs) for targeting to the nucleus, two or more NLSs, three or more NLSs, etc.).

[00282] A nucleic acid that binds to a class 2 CRISPR/Cas effector polypeptide (e.g., a Cas9 protein; a type V or type VI CRISPR/Cas protein; a Cpf1 protein; etc.) and targets the complex to a specific location within a target nucleic acid is referred to herein as a "guide RNA" or "CRISPR/Cas guide nucleic acid" or "CRISPR/Cas guide RNA." A guide RNA provides target

specificity to the complex (the RNP complex) by including a targeting segment, which includes a guide sequence (also referred to herein as a targeting sequence), which is a nucleotide sequence that is complementary to a sequence of a target nucleic acid.

[00283] In some cases, a guide RNA includes two separate nucleic acid molecules: an "activator" and a "targeter" and is referred to herein as a "dual guide RNA", a "double-molecule guide RNA", a "two-molecule guide RNA", or a "dgRNA." In some cases, the guide RNA is one molecule (e.g., for some class 2 CRISPR/Cas proteins, the corresponding guide RNA is a single molecule; and in some cases, an activator and targeter are covalently linked to one another, e.g., via intervening nucleotides), and the guide RNA is referred to as a "single guide RNA", a "single-molecule guide RNA," a "one-molecule guide RNA", or simply "sgRNA."

Class 2 CRISPR/Cas effector polypeptides

[00284] In class 2 CRISPR systems, the functions of the effector complex (e.g., the cleavage of target DNA) are carried out by a single endonuclease (e.g., see Zetsche et al., Cell. 2015 Oct 22;163(3):759-71; Makarova et al., Nat Rev Microbiol. 2015 Nov;13(11):722-36; Shmakov et al., Mol Cell. 2015 Nov 5;60(3):385-97); and Shmakov et al. (2017) *Nature Reviews Microbiology* 15:169. As such, the term "class 2 CRISPR/Cas protein" is used herein to encompass the CRISPR/Cas effector polypeptide (e.g., the target nucleic acid cleaving protein) from class 2 CRISPR systems. Thus, the term "class 2 CRISPR/Cas effector polypeptide" as used herein encompasses type II CRISPR/Cas effector polypeptides (e.g., Cas9); type V-A CRISPR/Cas effector polypeptides (e.g., Cpf1 (also referred to a "Cas12a")); type V-B CRISPR/Cas effector polypeptides (e.g., C2c1 (also referred to as "Cas12b")); type V-C CRISPR/Cas effector polypeptides (e.g., C2c3 (also referred to as "Cas12c")); type V-U1 CRISPR/Cas effector polypeptides (e.g., C2c4); type V-U2 CRISPR/Cas effector polypeptides (e.g., C2c8); type V-U5 CRISPR/Cas effector polypeptides (e.g., C2c5); type V-U4 CRISPR/Cas proteins (e.g., C2c9); type V-U3 CRISPR/Cas effector polypeptides (e.g., C2c10); type VI-A CRISPR/Cas effector polypeptides (e.g., C2c2 (also known as "Cas13a")); type VI-B CRISPR/Cas effector polypeptides (e.g., Cas13b (also known as C2c4)); and type VI-C CRISPR/Cas effector polypeptides (e.g., Cas13c (also known as C2c7)). To date, class 2 CRISPR/Cas effector polypeptides encompass type II, type V, and type VI CRISPR/Cas effector polypeptides, but the term is also meant to encompass any class 2 CRISPR/Cas effector polypeptide suitable for binding to a corresponding guide RNA and forming an RNP complex.

Type II CRISPR/Cas endonucleases (e.g., Cas 9)

[00285] In natural Type II CRISPR/Cas systems, Cas9 functions as an RNA-guided endonuclease that uses a dual-guide RNA having a crRNA and *trans*-activating crRNA (tracrRNA) for target recognition and cleavage by a mechanism involving two nuclease active sites in Cas9 that

together generate double-stranded DNA breaks (DSBs), or can individually generate single-stranded DNA breaks (SSBs). The Type II CRISPR endonuclease Cas9 and engineered dual- (dgRNA) or single guide RNA (sgRNA) form a ribonucleoprotein (RNP) complex that can be targeted to a desired DNA sequence. Guided by a dual-RNA complex or a chimeric single-guide RNA, Cas9 generates site-specific DSBs or SSBs within double-stranded DNA (dsDNA) target nucleic acids, which are repaired either by non-homologous end joining (NHEJ) or homology-directed recombination (HDR).

[00286] A type II CRISPR/Cas effector polypeptide is a type of class 2 CRISPR/Cas endonuclease. In some cases, the type II CRISPR/Cas endonuclease is a Cas9 protein. A Cas9 protein forms a complex with a Cas9 guide RNA. The guide RNA provides target specificity to a Cas9-guide RNA complex by having a nucleotide sequence (a guide sequence) that is complementary to a sequence (the target site) of a target nucleic acid (as described elsewhere herein). The Cas9 protein of the complex provides the site-specific activity. In other words, the Cas9 protein is guided to a target site (e.g., stabilized at a target site) within a target nucleic acid sequence (e.g. a chromosomal sequence or an extrachromosomal sequence, e.g., an episomal sequence, a minicircle sequence, a mitochondrial sequence, a chloroplast sequence, etc.) by virtue of its association with the protein-binding segment of the Cas9 guide RNA.

[00287] A Cas9 protein can bind and/or modify (e.g., cleave, nick, methylate, demethylate, etc.) a target nucleic acid and/or a polypeptide associated with target nucleic acid (e.g., methylation or acetylation of a histone tail)(e.g., when the Cas9 protein includes a fusion partner with an activity). In some cases, the Cas9 protein is a naturally-occurring protein (e.g., naturally occurs in bacterial and/or archaeal cells). In other cases, the Cas9 protein is not a naturally-occurring polypeptide (e.g., the Cas9 protein is a variant Cas9 protein, a chimeric protein, and the like).

[00288] Examples of suitable Cas9 proteins include, but are not limited to, those set forth in SEQ ID NOs: 5-816. Naturally occurring Cas9 proteins bind a Cas9 guide RNA, are thereby directed to a specific sequence within a target nucleic acid (a target site), and cleave the target nucleic acid (e.g., cleave dsDNA to generate a double strand break, cleave ssDNA, cleave ssRNA, etc.). A chimeric Cas9 protein is a fusion protein comprising a Cas9 polypeptide that is fused to a heterologous protein (referred to as a fusion partner), where the heterologous protein provides an activity (e.g., one that is not provided by the Cas9 protein). The fusion partner can provide an activity, e.g., enzymatic activity (e.g., nuclease activity, activity for DNA and/or RNA methylation, activity for DNA and/or RNA cleavage, activity for histone acetylation, activity for histone methylation, activity for RNA modification, activity for RNA-binding, activity for RNA splicing etc.). In some cases, a portion of the Cas9 protein (e.g., the RuvC domain and/or the HNH domain) exhibits reduced nuclease activity relative to the corresponding portion of a wild

type Cas9 protein (e.g., in some cases the Cas9 protein is a nickase). In some cases, the Cas9 protein is enzymatically inactive, or has reduced enzymatic activity relative to a wild-type Cas9 protein (e.g., relative to *Streptococcus pyogenes* Cas9).

[00289] In some cases, a fusion protein comprises: a) a catalytically inactive Cas9 protein (or other catalytically inactive CRISPR effector polypeptide); and b) a catalytically active endonuclease. For example, in some cases, the catalytically active endonuclease is a FokI polypeptide. As one non-limiting example, in some cases, a fusion protein comprises: a) a catalytically inactive Cas9 protein (or other catalytically inactive CRISPR effector polypeptide); and b) is a FokI nuclease comprising an amino acid sequence having at least at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the FokI amino acid sequence provided below; where the FokI nuclease has a length of from about 195 amino acids to about 200 amino acids.

[00290] FokI nuclease amino acid sequence:
QLVKSELEEKKSELRHKLKYVPHEYIELIEIARNSTQDRILEMKVMEFFMKVYGYRGKH
LGGSRKPDGAIYTVGSPIDYGVIVDTKAYSGGYNLPIGQADEMQRYVEENQTRNKHINP
NEWWKVYPSSVTEFKFLFVSGHFKGNYKAQLTRLNHITNCNGAVLSVEELLIGGEMIKA
GTLTLEEVRRKFNNGEINF (SEQ ID NO:900).

[00291] Assays to determine whether given protein interacts with a Cas9 guide RNA can be any convenient binding assay that tests for binding between a protein and a nucleic acid. Suitable binding assays (e.g., gel shift assays) will be known to one of ordinary skill in the art (e.g., assays that include adding a Cas9 guide RNA and a protein to a target nucleic acid).

[00292] Assays to determine whether a protein has an activity (e.g., to determine if the protein has nuclease activity that cleaves a target nucleic acid and/or some heterologous activity) can be any convenient assay (e.g., any convenient nucleic acid cleavage assay that tests for nucleic acid cleavage). Suitable assays (e.g., cleavage assays) will be known to one of ordinary skill in the art and can include adding a Cas9 guide RNA and a protein to a target nucleic acid.

[00293] In some cases, a suitable Cas9 protein comprises an amino acid sequence having 60% or more, 70% or more, 75% or more, 80% or more, 85% or more, 90% or more, 95% or more, 99% or more or 100% amino acid sequence identity to amino acids 7-166 or 731-1003 of the Cas9 amino acid sequence set forth in SEQ ID NO: 5, or to the corresponding portions in any of the amino acid sequences set forth as SEQ ID NOs: 6-816.

[00294] Examples of various Cas9 proteins (and Cas9 domain structure) and Cas9 guide RNAs (as well as information regarding requirements related to protospacer adjacent motif (PAM) sequences present in targeted nucleic acids) can be found in the art, for example, see Jinek et al., Science.

2012 Aug 17;337(6096):816-21; Chylinski et al., RNA Biol. 2013 May;10(5):726-37; Ma et al., Biomed Res Int. 2013;2013:270805; Hou et al., Proc Natl Acad Sci U S A. 2013 Sep 24;110(39):15644-9; Jinek et al., Elife. 2013;2:e00471; Pattanayak et al., Nat Biotechnol. 2013 Sep;31(9):839-43; Qi et al., Cell. 2013 Feb 28;152(5):1173-83; Wang et al., Cell. 2013 May 9;153(4):910-8; Auer et al., Genome Res. 2013 Oct 31; Chen et al., Nucleic Acids Res. 2013 Nov 1;41(20):e19; Cheng et al., Cell Res. 2013 Oct;23(10):1163-71; Cho et al., Genetics. 2013 Nov;195(3):1177-80; DiCarlo et al., Nucleic Acids Res. 2013 Apr;41(7):4336-43; Dickinson et al., Nat Methods. 2013 Oct;10(10):1028-34; Ebina et al., Sci Rep. 2013;3:2510; Fujii et al., Nucleic Acids Res. 2013 Nov 1;41(20):e187; Hu et al., Cell Res. 2013 Nov;23(11):1322-5; Jiang et al., Nucleic Acids Res. 2013 Nov 1;41(20):e188; Larson et al., Nat Protoc. 2013 Nov;8(11):2180-96; Mali et al., Nat Methods. 2013 Oct;10(10):957-63; Nakayama et al., Genesis. 2013 Dec;51(12):835-43; Ran et al., Nat Protoc. 2013 Nov;8(11):2281-308; Ran et al., Cell. 2013 Sep 12;154(6):1380-9; Upadhyay et al., G3 (Bethesda). 2013 Dec 9;3(12):2233-8; Walsh et al., Proc Natl Acad Sci U S A. 2013 Sep 24;110(39):15514-5; Xie et al., Mol Plant. 2013 Oct 9; Yang et al., Cell. 2013 Sep 12;154(6):1370-9; Briner et al., Mol Cell. 2014 Oct 23;56(2):333-9; Shmakov et al., Nat Rev Microbiol. 2017 Mar;15(3):169-182; and U.S. patents and patent applications: 8,906,616; 8,895,308; 8,889,418; 8,889,356; 8,871,445; 8,865,406; 8,795,965; 8,771,945; 8,697,359; 20140068797; 20140170753; 20140179006; 20140179770; 20140186843; 20140186919; 20140186958; 20140189896; 20140227787; 20140234972; 20140242664; 20140242699; 20140242700; 20140242702; 20140248702; 20140256046; 20140273037; 20140273226; 20140273230; 20140273231; 20140273232; 20140273233; 20140273234; 20140273235; 20140287938; 20140295556; 20140295557; 20140298547; 20140304853; 20140309487; 20140310828; 20140310830; 20140315985; 20140335063; 20140335620; 20140342456; 20140342457; 20140342458; 20140349400; 20140349405; 20140356867; 20140356956; 20140356958; 20140356959; 20140357523; 20140357530; 20140364333; and 20140377868; each of which is hereby incorporated by reference in its entirety.

Variant Cas9 proteins – nickases and dCas9

[00295] In some cases, a Cas9 protein is a variant Cas9 protein. A variant Cas9 protein has an amino acid sequence that is different by at least one amino acid (e.g., has a deletion, insertion, substitution, fusion) when compared to the amino acid sequence of a corresponding wild type Cas9 protein. In some instances, the variant Cas9 protein has an amino acid change (e.g., deletion, insertion, or substitution) that reduces the nuclease activity of the Cas9 protein. For example, in some instances, the variant Cas9 protein has 50% or less, 40% or less, 30% or less, 20% or less, 10% or less, 5% or less, or 1% or less of the nuclease activity of the corresponding

wild-type Cas9 protein. In some cases, the variant Cas9 protein has no substantial nuclease activity. When a Cas9 protein is a variant Cas9 protein that has no substantial nuclease activity, it can be referred to as a nuclease defective Cas9 protein or "dCas9" for "dead" Cas9. A protein (e.g., a class 2 CRISPR/Cas protein, e.g., a Cas9 protein) that cleaves one strand but not the other of a double stranded target nucleic acid is referred to herein as a "nickase" (e.g., a "nickase Cas9").

[00296] In some cases, a variant Cas9 protein can cleave the complementary strand (sometimes referred to in the art as the target strand) of a target nucleic acid but has reduced ability to cleave the non-complementary strand (sometimes referred to in the art as the non-target strand) of a target nucleic acid. For example, the variant Cas9 protein can have a mutation (amino acid substitution) that reduces the function of the RuvC domain. Thus, the Cas9 protein can be a nickase that cleaves the complementary strand, but does not cleave the non-complementary strand. As a non-limiting example, in some embodiments, a variant Cas9 protein has a mutation at an amino acid position corresponding to residue D10 (e.g., D10A, aspartate to alanine) of SEQ ID NO: 5 (or the corresponding position of any of the proteins set forth in SEQ ID NOs: 6-261 and 264-816) and can therefore cleave the complementary strand of a double stranded target nucleic acid but has reduced ability to cleave the non-complementary strand of a double stranded target nucleic acid (thus resulting in a single strand break (SSB) instead of a double strand break (DSB) when the variant Cas9 protein cleaves a double stranded target nucleic acid) (see, for example, Jinek et al., Science. 2012 Aug 17;337(6096):816-21). See, e.g., SEQ ID NO: 262.

[00297] In some cases, a variant Cas9 protein can cleave the non-complementary strand of a target nucleic acid but has reduced ability to cleave the complementary strand of the target nucleic acid. For example, the variant Cas9 protein can have a mutation (amino acid substitution) that reduces the function of the HNH domain. Thus, the Cas9 protein can be a nickase that cleaves the non-complementary strand, but does not cleave the complementary strand. As a non-limiting example, in some embodiments, the variant Cas9 protein has a mutation at an amino acid position corresponding to residue H840 (e.g., an H840A mutation, histidine to alanine) of SEQ ID NO: 5 (or the corresponding position of any of the proteins set forth as SEQ ID NOs: 6-261 and 264-816) and can therefore cleave the non-complementary strand of the target nucleic acid but has reduced ability to cleave (e.g., does not cleave) the complementary strand of the target nucleic acid. Such a Cas9 protein has a reduced ability to cleave a target nucleic acid (e.g., a single stranded target nucleic acid) but retains the ability to bind a target nucleic acid (e.g., a single stranded target nucleic acid). See, e.g., SEQ ID NO: 263.

[00298] In some cases, a variant Cas9 protein has a reduced ability to cleave both the complementary and the non-complementary strands of a double stranded target nucleic acid. As a non-limiting

example, in some cases, the variant Cas9 protein harbors mutations at amino acid positions corresponding to residues D10 and H840 (e.g., D10A and H840A) of SEQ ID NO: 5 (or the corresponding residues of any of the proteins set forth as SEQ ID NOs: 6-261 and 264-816) such that the polypeptide has a reduced ability to cleave (e.g., does not cleave) both the complementary and the non-complementary strands of a target nucleic acid. Such a Cas9 protein has a reduced ability to cleave a target nucleic acid (e.g., a single stranded or double stranded target nucleic acid) but retains the ability to bind a target nucleic acid. A Cas9 protein that cannot cleave target nucleic acid (e.g., due to one or more mutations, e.g., in the catalytic domains of the RuvC and HNH domains) is referred to as a "dead" Cas9 or simply "dCas9." See, e.g., SEQ ID NO: 264.

Type V and Type VI CRISPR/Cas Endonucleases

[00299] In some cases, a suitable CRISPR/Cas effector polypeptide is a type V or type VI CRISPR/Cas endonuclease (i.e., the CRISPR/Cas effector polypeptide is a type V or type VI CRISPR/Cas endonuclease) (e.g., Cpf1, C2c1, C2c2, C2c3). Type V and type VI CRISPR/Cas endonucleases are a type of class 2 CRISPR/Cas endonuclease. Examples of type V CRISPR/Cas endonucleases include but are not limited to: Cpf1, C2c1, and C2c3. An example of a type VI CRISPR/Cas effector polypeptide is C2c2. In some cases, a suitable CRISPR/Cas effector polypeptide is a type V CRISPR/Cas endonuclease (e.g., Cpf1, C2c1, C2c3). In some cases, a Type V CRISPR/Cas effector polypeptide is a Cpf1 protein. In some cases, a suitable CRISPR/Cas effector polypeptide is a type VI CRISPR/Cas endonuclease (e.g., Cas13a).

[00300] Like type II CRISPR/Cas endonucleases, type V and VI CRISPR/Cas endonucleases form a complex with a corresponding guide RNA. The guide RNA provides target specificity to an endonuclease-guide RNA RNP complex by having a nucleotide sequence (a guide sequence) that is complementary to a sequence (the target site) of a target nucleic acid (as described elsewhere herein). The endonuclease of the complex provides the site-specific activity. In other words, the endonuclease is guided to a target site (e.g., stabilized at a target site) within a target nucleic acid sequence (e.g. a chromosomal sequence or an extrachromosomal sequence, e.g., an episomal sequence, a minicircle sequence, a mitochondrial sequence, a chloroplast sequence, etc.) by virtue of its association with the protein-binding segment of the guide RNA.

[00301] Examples and guidance related to type V and type VI CRISPR/Cas proteins (e.g., Cpf1, C2c1, C2c2, and C2c3 guide RNAs) can be found in the art, for example, see Zetsche et al., Cell. 2015 Oct 22;163(3):759-71; Makarova et al., Nat Rev Microbiol. 2015 Nov;13(11):722-36; Shmakov et al., Mol Cell. 2015 Nov 5;60(3):385-97; and Shmakov et al. (2017) *Nature Reviews Microbiology* 15:169.

[00302] In some cases, the Type V or type VI CRISPR/Cas endonuclease (e.g., Cpf1, C2c1, C2c2, C2c3) is enzymatically active, e.g., the Type V or type VI CRISPR/Cas polypeptide, when bound to a guide RNA, cleaves a target nucleic acid. In some cases, the Type V or type VI CRISPR/Cas endonuclease (e.g., Cpf1, C2c1, C2c2, C2c3) exhibits reduced enzymatic activity relative to a corresponding wild-type a Type V or type VI CRISPR/Cas endonuclease (e.g., Cpf1, C2c1, C2c2, C2c3), and retains DNA binding activity.

[00303] In some cases, a type V CRISPR/Cas endonuclease is a Cpf1 protein. In some cases, a Cpf1 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the Cpf1 amino acid sequence set forth in any of SEQ ID NOs: 818-822. In some cases, a Cpf1 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to a contiguous stretch of from 100 amino acids to 200 amino acids (aa), from 200 aa to 400 aa, from 400 aa to 600 aa, from 600 aa to 800 aa, from 800 aa to 1000 aa, from 1000 aa to 1100 aa, from 1100 aa to 1200 aa, or from 1200 aa to 1300 aa, of the Cpf1 amino acid sequence set forth in any of SEQ ID NOs:818-822.

[00304] In some cases, a Cpf1 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the RuvCI domain of the Cpf1 amino acid sequence set forth in any of SEQ ID NOs: 818-822. In some cases, a Cpf1 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the RuvCII domain of the Cpf1 amino acid sequence set forth in any of SEQ ID NOs: 818-822. In some cases, a Cpf1 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the RuvCIII domain of the Cpf1 amino acid sequence set forth in any of SEQ ID NOs: 818-822. In some cases, a Cpf1 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino

acid sequence identity to the RuvCI, RuvCII, and RuvCIII domains of the Cpf1 amino acid sequence set forth in any of SEQ ID NOs: 818-822.

[00305] In some cases, the Cpf1 protein exhibits reduced enzymatic activity relative to a wild-type Cpf1 protein (e.g., relative to a Cpf1 protein comprising the amino acid sequence set forth in any of SEQ ID NOs: 818-822), and retains DNA binding activity. In some cases, a Cpf1 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the Cpf1 amino acid sequence set forth in any of SEQ ID NOs: 818-822; and comprises an amino acid substitution (e.g., a D→A substitution) at an amino acid residue corresponding to amino acid 917 of the Cpf1 amino acid sequence set forth in SEQ ID NO: 818. In some cases, a Cpf1 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the Cpf1 amino acid sequence set forth in any of SEQ ID NOs: 818-822; and comprises an amino acid substitution (e.g., an E→A substitution) at an amino acid residue corresponding to amino acid 1006 of the Cpf1 amino acid sequence set forth in SEQ ID NO: 818. In some cases, a Cpf1 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the Cpf1 amino acid sequence set forth in any of SEQ ID NOs: 818-822; and comprises an amino acid substitution (e.g., a D→A substitution) at an amino acid residue corresponding to amino acid 1255 of the Cpf1 amino acid sequence set forth in SEQ ID NO: 818.

[00306] In some cases, a suitable Cpf1 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the Cpf1 amino acid sequence set forth in any of SEQ ID NOs: 818-822.

[00307] In some cases, a type V CRISPR/Cas endonuclease is a C2c1 protein (examples include those set forth as SEQ ID NOs: 823-830). In some cases, a C2c1 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the C2c1 amino acid sequence set forth in any of SEQ ID NOs: 823-830. In some cases, a C2c1 protein comprises an

amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to a contiguous stretch of from 100 amino acids to 200 amino acids (aa), from 200 aa to 400 aa, from 400 aa to 600 aa, from 600 aa to 800 aa, from 800 aa to 1000 aa, from 1000 aa to 1100 aa, from 1100 aa to 1200 aa, or from 1200 aa to 1300 aa, of the C2c1 amino acid sequence set forth in any of SEQ ID NOs: 823-830.

[00308] In some cases, a C2c1 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the RuvCI domain of the C2c1 amino acid sequences set forth in any of SEQ ID NOs: 823-830). In some cases, a C2c1 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the RuvCII domain of the C2c1 amino acid sequence set forth in any of SEQ ID NOs: 823-830. In some cases, a C2c1 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the RuvCIII domain of the C2c1 amino acid sequence set forth in any of SEQ ID NOs: 823-830. In some cases, a C2c1 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the RuvCI, RuvCII, and RuvCIII domains of the C2c1 amino acid sequence set forth in any of SEQ ID NOs: 823-830.

[00309] In some cases, a type V CRISPR/Cas endonuclease is a C2c3 protein (examples include those set forth as SEQ ID NOs: 831-834). In some cases, a C2c3 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the C2c3 amino acid sequence set forth in any of SEQ ID NOs: 831-834. In some cases, a C2c3 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to a contiguous stretch of from 100 amino acids to 200 amino acids (aa), from 200 aa to 400 aa, from 400 aa to

600 aa, from 600 aa to 800 aa, from 800 aa to 1000 aa, from 1000 aa to 1100 aa, from 1100 aa to 1200 aa, or from 1200 aa to 1300 aa, of the C2c3 amino acid sequence set forth in any of SEQ ID NOs: 831-834.

[00310] In some cases, a C2c3 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the RuvCI domain of the C2c3 amino acid sequence set forth in any of SEQ ID NOs: 831-834. In some cases, a C2c3 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the RuvCII domain of the C2c3 amino acid sequence set forth in any of SEQ ID NOs: 831-834. In some cases, a C2c3 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the RuvCIII domain of the C2c3 amino acid sequence set forth in any of SEQ ID NOs: 831-834. In some cases, a C2c3 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the RuvCI, RuvCII, and RuvCIII domains of the C2c3 amino acid sequence set forth in any of SEQ ID NOs: 831-834.

[00311] In some cases, the C2c3 protein exhibits reduced enzymatic activity relative to a wild-type C2c3 protein (e.g., relative to a C2c3 protein comprising the amino acid sequence set forth in any of SEQ ID NOs: 831-834), and retains DNA binding activity. In some cases, a suitable C2c3 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the C2c3 amino acid sequence set forth in any of SEQ ID NOs: 831-834.

[00312] In some cases, a type VI CRISPR/Cas endonuclease is a C2c2 protein (examples include those set forth as SEQ ID NOs: 835-846). In some cases, a C2c2 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the C2c2 amino acid sequence set forth in any of SEQ ID NOs: 835-846. In some cases, a C2c2 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%,

at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to a contiguous stretch of from 100 amino acids to 200 amino acids (aa), from 200 aa to 400 aa, from 400 aa to 600 aa, from 600 aa to 800 aa, from 800 aa to 1000 aa, from 1000 aa to 1100 aa, from 1100 aa to 1200 aa, or from 1200 aa to 1300 aa, of the C2c2 amino acid sequence set forth in any of SEQ ID NOs: 835-846.

[00313] In some cases, a C2c2 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the RuvCI domain of the C2c2 amino acid sequence set forth in any of SEQ ID NOs: 835-846. In some cases, a C2c2 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the RuvCII domain of the C2c2 amino acid sequence set forth in any of SEQ ID NOs: 835-846. In some cases, a C2c2 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the RuvCIII domain of the C2c2 amino acid sequence set forth in any of SEQ ID NOs: 835-846. In some cases, a C2c2 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the RuvCI, RuvCII, and RuvCIII domains of the C2c2 amino acid sequence set forth in any of SEQ ID NOs: 835-846.

[00314] In some cases, the C2c2 protein exhibits reduced enzymatic activity relative to a wild-type C2c2 protein (e.g., relative to a C2c2 protein comprising the amino acid sequence set forth in any of SEQ ID NOs: 835-846), and retains DNA binding activity. In some cases, a suitable C2c2 protein comprises an amino acid sequence having at least 30%, at least 35%, at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 90%, or 100%, amino acid sequence identity to the C2c2 amino acid sequence set forth in any of SEQ ID NOs: 835-846.

[00315] Examples and guidance related to type V or type VI CRISPR/Cas endonucleases (including domain structure) and guide RNAs (as well as information regarding requirements related to protospacer adjacent motif (PAM) sequences present in targeted nucleic acids) can be found in the art, for example, see Zetsche et al., Cell. 2015 Oct 22;163(3):759-71; Makarova et al., Nat

Rev Microbiol. 2015 Nov;13(11):722-36; Shmakov et al., Mol Cell. 2015 Nov 5;60(3):385-97; and Shmakov et al., Nat Rev Microbiol. 2017 Mar;15(3):169-182; and U.S. patents and patent applications: 9,580,701; 20170073695, 20170058272, 20160362668, 20160362667, 20160298078, 20160289637, 20160215300, 20160208243, and 20160208241, each of which is hereby incorporated by reference in its entirety.

CasX and CasY proteins

[00316] Suitable CRISPR/Cas effector polypeptides include CasX and CasY polypeptides. See, e.g., Burstein et al. (2017) *Nature* 542:237. Suitable CasX polypeptides include those described in WO 2018/064371. Suitable CasY polypeptides include those described in WO 2018/064352.

CRISPR/Cas effector fusion polypeptides

[00317] In some cases, a CRISPR/Cas effector polypeptide is a CRISPR/Cas effector fusion polypeptide comprising: i) a CRISPR/Cas effector polypeptide; and ii) a heterologous fusion partner.

[00318] In some cases, the fusion partner can modulate transcription (e.g., inhibit transcription, increase transcription) of a target DNA. For example, in some cases the fusion partner is a protein (or a domain from a protein) that inhibits transcription (e.g., a transcriptional repressor, a protein that functions via recruitment of transcription inhibitor proteins, modification of target DNA such as methylation, recruitment of a DNA modifier, modulation of histones associated with target DNA, recruitment of a histone modifier such as those that modify acetylation and/or methylation of histones, and the like). In some cases the fusion partner is a protein (or a domain from a protein) that increases transcription (e.g., a transcription activator, a protein that acts via recruitment of transcription activator proteins, modification of target DNA such as demethylation, recruitment of a DNA modifier, modulation of histones associated with target DNA, recruitment of a histone modifier such as those that modify acetylation and/or methylation of histones, and the like).

[00319] In some cases, a CRISPR/Cas effector fusion polypeptide includes a heterologous polypeptide that has enzymatic activity that modifies a target nucleic acid (e.g., nuclease activity such as FokI nuclease activity, methyltransferase activity, demethylase activity, DNA repair activity, DNA damage activity, deamination activity, dismutase activity, alkylation activity, depurination activity, oxidation activity, pyrimidine dimer forming activity, integrase activity, transposase activity, recombinase activity, polymerase activity, ligase activity, helicase activity, photolyase activity or glycosylase activity).

[00320] In some cases, a CRISPR/Cas effector fusion polypeptide includes a heterologous polypeptide that has enzymatic activity that modifies a polypeptide (e.g., a histone) associated with a target

nucleic acid (e.g., methyltransferase activity, demethylase activity, acetyltransferase activity, deacetylase activity, kinase activity, phosphatase activity, ubiquitin ligase activity, deubiquitinating activity, adenylation activity, deadenylation activity, SUMOylating activity, deSUMOylating activity, ribosylation activity, deribosylation activity, myristoylation activity or demyristoylation activity).

[00321] Examples of proteins (or fragments thereof) that can be used in increase transcription, and that are suitable as heterologous fusion partners, include but are not limited to: transcriptional activators such as VP16, VP64, VP48, VP160, p65 subdomain (e.g., from NFkB), and activation domain of EDLL and/or TAL activation domain (e.g., for activity in plants); histone lysine methyltransferases such as SET1A, SET1B, MLL1 to 5, ASH1, SYMD2, NSD1, and the like; histone lysine demethylases such as JHDM2a/b, UTX, JMJD3, and the like; histone acetyltransferases such as GCN5, PCAF, CBP, p300, TAF1, TIP60/PLIP, MOZ/MYST3, MORF/MYST4, SRC1, ACTR, P160, CLOCK, and the like; and DNA demethylases such as Ten-Eleven Translocation (TET) dioxygenase 1 (TET1CD), TET1, DME, DML1, DML2, ROS1, and the like.

[00322] Examples of proteins (or fragments thereof) that can be used in decrease transcription, and that are suitable as heterologous fusion partners, include but are not limited to: transcriptional repressors such as the Krüppel associated box (KRAB or SKD); KOX1 repression domain; the Mad mSIN3 interaction domain (SID); the ERF repressor domain (ERD), the SRDX repression domain (e.g., for repression in plants), and the like; histone lysine methyltransferases such as Pr-SET7/8, SUV4-20H1, RIZ1, and the like; histone lysine demethylases such as JMJD2A/JHDM3A, JMJD2B, JMJD2C/GASC1, JMJD2D, JARID1A/RBP2, JARID1B/PLU-1, JARID1C/SMCX, JARID1D/SMCY, and the like; histone lysine deacetylases such as HDAC1, HDAC2, HDAC3, HDAC8, HDAC4, HDAC5, HDAC7, HDAC9, SIRT1, SIRT2, HDAC11, and the like; DNA methylases such as HhaI DNA m5c-methyltransferase (M.HhaI), DNA methyltransferase 1 (DNMT1), DNA methyltransferase 3a (DNMT3a), DNA methyltransferase 3b (DNMT3b), METI, DRM3 (plants), ZMET2, CMT1, CMT2 (plants), and the like; and periphery recruitment elements such as Lamin A, Lamin B, and the like.

[00323] In some cases, the fusion partner has enzymatic activity that modifies a target nucleic acid (e.g., ssRNA, dsRNA, ssDNA, dsDNA). Examples of enzymatic activity that can be provided by the fusion partner include but are not limited to: nuclease activity such as that provided by a restriction enzyme (e.g., FokI nuclease), methyltransferase activity such as that provided by a methyltransferase (e.g., HhaI DNA m5c-methyltransferase (M.HhaI), DNA methyltransferase 1 (DNMT1), DNA methyltransferase 3a (DNMT3a), DNA methyltransferase 3b (DNMT3b), METI, DRM3 (plants), ZMET2, CMT1, CMT2 (plants), and the like); demethylase activity such

as that provided by a demethylase (e.g., Ten-Eleven Translocation (TET) dioxygenase 1 (TET1CD), TET1, DME, DML1, DML2, ROS1, and the like) , DNA repair activity, DNA damage activity, deamination activity such as that provided by a deaminase (e.g., a cytosine deaminase enzyme such as rat APOBEC1), dismutase activity, alkylation activity, depurination activity, oxidation activity, pyrimidine dimer forming activity, integrase activity such as that provided by an integrase and/or resolvase (e.g., Gin invertase such as the hyperactive mutant of the Gin invertase, GinH106Y; human immunodeficiency virus type 1 integrase (IN); Tn3 resolvase; and the like), transposase activity, recombinase activity such as that provided by a recombinase (e.g., catalytic domain of Gin recombinase), polymerase activity, ligase activity, helicase activity, photolyase activity, and glycosylase activity).

[00324] In some cases, the fusion partner has enzymatic activity that modifies a protein associated with a target nucleic acid (e.g., ssRNA, dsRNA, ssDNA, dsDNA) (e.g., a histone, an RNA binding protein, a DNA binding protein, and the like). Examples of enzymatic activity (that modifies a protein associated with a target nucleic acid) that can be provided by the fusion partner include but are not limited to: methyltransferase activity such as that provided by a histone methyltransferase (HMT) (e.g., suppressor of variegation 3-9 homolog 1 (SUV39H1, also known as KMT1A), euchromatic histone lysine methyltransferase 2 (G9A, also known as KMT1C and EHMT2), SUV39H2, ESET/SETDB1, and the like, SET1A, SET1B, MLL1 to 5, ASH1, SYMD2, NSD1, DOT1L, Pr-SET7/8, SUV4-20H1, EZH2, RIZ1), demethylase activity such as that provided by a histone demethylase (e.g., Lysine Demethylase 1A (KDM1A also known as LSD1), JHDM2a/b, JMJD2A/JHDM3A, JMJD2B, JMJD2C/GASC1, JMJD2D, JARID1A/RBP2, JARID1B/PLU-1, JARID1C/SMCX, JARID1D/SMCY, UTX, JMJD3, and the like), acetyltransferase activity such as that provided by a histone acetyl transferase (e.g., catalytic core/fragment of the human acetyltransferase p300, GCN5, PCAF, CBP, TAF1, TIP60/PLIP, MOZ/MYST3, MORF/MYST4, HBO1/MYST2, HMOF/MYST1, SRC1, ACTR, P160, CLOCK, and the like), deacetylase activity such as that provided by a histone deacetylase (e.g., HDAC1, HDAC2, HDAC3, HDAC8, HDAC4, HDAC5, HDAC7, HDAC9, SIRT1, SIRT2, HDAC11, and the like), kinase activity, phosphatase activity, ubiquitin ligase activity, deubiquitinating activity, adenylation activity, deadenylation activity, SUMOylating activity, deSUMOylating activity, ribosylation activity, deribosylation activity, myristoylation activity, and demyristoylation activity.

[00325] In some cases, a fusion protein comprises: a) a catalytically inactive CRISPR/Cas effector polypeptide (e.g., a catalytically inactive Cas9 polypeptide); and b) a catalytically active endonuclease. For example, in some cases, the catalytically active endonuclease is a FokI polypeptide. As one non-limiting example, in some cases, a fusion protein comprises: a) a

catalytically inactive Cas9 protein (or other catalytically inactive CRISPR effector polypeptide); and b) is a FokI nuclease comprising an amino acid sequence having at least at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the FokI amino acid sequence provided below; where the FokI nuclease has a length of from about 195 amino acids to about 200 amino acids.

[00326] FokI nuclease amino acid sequence:
QLVKSELEEKKSELRHKLKYVPHEYIELIEIARNSTQDRILEMKVMEFFMKVYGYRGKH
LGGSRKPDGAIYTVGSPIDYGVIVDTKAYSGGYNLPIGQADEMQRYVEENQTRNKHINP
NEWWKVYPSSVTEFKFLFVSGHFKGNYKAQLTRLNHITNCNGAVLSVEELLIGGEMIKA
GTLTLEEVRRKFNNGEINF (SEQ ID NO:901).

[00327] In some cases, the fusion partner is a deaminase. Thus, in some cases, a CRISPR/Cas effector polypeptide fusion polypeptide comprises: a) a CRISPR/Cas effector polypeptide; and b) a deaminase. In some cases, the CRISPR/Cas effector polypeptide is catalytically inactive. Suitable deaminases include a cytidine deaminase and an adenosine deaminase.

[00328] A suitable adenosine deaminase is any enzyme that is capable of deaminating adenosine in DNA. In some cases, the deaminase is a TadA deaminase.

[00329] In some cases, a suitable adenosine deaminase comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following amino acid sequence:
MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAA
GSLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTD (SEQ ID NO:902)

[00330] In some cases, a suitable adenosine deaminase comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following amino acid sequence:
MRRAFITGVFFLSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWN
RPIGRHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFG
ARDAKTGAAGSLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQ
SSTD (SEQ ID NO:903).

[00331] In some cases, a suitable adenosine deaminase comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following *Staphylococcus aureus* TadA amino acid sequence:
MGSHMTNDIYFMTLAIEEAKKAAQLGEVPIGAIITKDDEVIARAHNLRETLQQPTAHAE

HIAIERAAKVLGSWRLEGCTLYVTLEPCVMCAGTIVMSRIPRVVYGADDPKGGCSGSL MNLLQQSNFNHRAIVDKGVLKEACSTLLTTFFK NLRANKKSTN: (SEQ ID NO:904)

[00332] In some cases, a suitable adenosine deaminase comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following *Bacillus subtilis* TadA amino acid sequence: MTQDELYMKEAIKEAKKAEEKGEVPIGAVLVINGEIIARAHNLRETEQRSIAHAEMLVID EACKALGTWRLEGATLYVTLEPCPMCAGAVVLSRVEKVVFGAFDPKGGCSGTLMNLL QEERFNHQAEVVSGVLEEECGGMLSAFFRELRKKKKAARKNLSE (SEQ ID NO:905)

[00333] In some cases, a suitable adenosine deaminase comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following *Salmonella typhimurium* TadA: MPPAFITGVTSLSDVELDHEYWMRHALTLAKRAWDEREVPVGAVLVHNHRVIGEGWN RPIGRHDPTAHAEIMALRQGGLVLQNYRLLDTTLYVTLEPCVMCAGAMVHSRIGRVVF GARDAKTGAAGSLIDVLHHPGMNHRVEIIEGVLRDECATLLSDFFRMRRQEIKALKKAD RAEGAGPAV (SEQ ID NO:906)

[00334] In some cases, a suitable adenosine deaminase comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following *Shewanella putrefaciens* TadA amino acid sequence: MDEYWMQVAMQMAEKAEAAGEVPVGAVLVKDGQQIATGYNLSISQHDPTAHAEILCL RSAGKKLENYRLLDATLYITLEPCAMCAGAMVHSRIARVVYGARDEKTGAAGTVVNL LQHPAFNHQVEVTSGVLAEACSAQLSRFFKRRRDEKKALKLAQRAQQGIE (SEQ ID NO:907)

[00335] In some cases, a suitable adenosine deaminase comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following *Haemophilus influenzae* F3031 TadA amino acid sequence: MDAAKVRSEFDEKMMRYALELADKAEALGEIPVGAVLVDDARNIIGEGWNLSIVQSDP TAHAEIIALRNGAKNIQNYRLLNSTLYVTLEPCTMCAGAILHSRIKRLVFGASDYKTGAI GSRFHFFDDYKMNHTLEITSGVLAEECSQKLS TFFQKRREEKKIEKALLKSLSDK (SEQ ID NO:908)

[00336] In some cases, a suitable adenosine deaminase comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following *Caulobacter crescentus* TadA amino acid sequence: MRTDESEDQDHRMMRLALDAARAAAEAGETPVGAVILDPSTGEVIATAGNGPIAAHDP

TAHAEIAAMRAAAAKLGNYRLTDLTLVVTLEPCAMCAGAISHARIGRVVFGADDPKGG AVVHGPKFFAQPTCHWRPEVTGGVLADESADLLRGFFRARRKAKI (SEQ ID NO:909)

[00337] In some cases, a suitable adenosine deaminase comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following *Geobacter sulfurreducens* TadA amino acid sequence: MSSLKKTPIRDDAYWMGKAIREAAKAAARDEVPIGAVIVRDGAVIGRGHNLREGSNDP SAHAEMIAIRQAARRSANWRLTGATLYVTLEPCLMCMGAIILARLERVVFGCYDPKGG AAGSLYDLSADPRLNHQVRLSPGVCQEECGTMLSDFFRDLRRRKKAKATPALFIDERKV PPEP (SEQ ID NO:910)

[00338] Cytidine deaminases suitable for inclusion in a CRISPR/Cas effector polypeptide fusion polypeptide include any enzyme that is capable of deaminating cytidine in DNA.

[00339] In some cases, the cytidine deaminase is a deaminase from the apolipoprotein B mRNA-editing complex (APOBEC) family of deaminases. In some cases, the APOBEC family deaminase is selected from the group consisting of APOBEC1 deaminase, APOBEC2 deaminase, APOBEC3A deaminase, APOBEC3B deaminase, APOBEC3C deaminase, APOBEC3D deaminase, APOBEC3F deaminase, APOBEC3G deaminase, and APOBEC3H deaminase. In some cases, the cytidine deaminase is an activation induced deaminase (AID).

[00340] In some cases, a suitable cytidine deaminase comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following amino acid sequence:

[00341] MDSLLMNRRKFLYQFKNVRWAKGRRETYLCYVVKRRDSATSFSLDFGYLRNKNGCH VELLFLRYISDWDLDPGRCYRVTWFTSWSPCYDCARHVADFLRGNPNLSLRIFTARLYF CEDRKAEPEGLRRLHRAGVQIAIMTFKDYFYCWNTFVENHERTFKAWEGLHENSVRLS RQLRRILLPLYEVDDLRDAFRTLGL (SEQ ID NO:911)

[00342] In some cases, a suitable cytidine deaminase is an AID and comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following amino acid sequence: MDSLLMNRRK FLYQFKNVRW AKGRRETYLC YVVKRRDSAT SFSLDFGYLR NKNGCHVELL FLRYISDWDL DPGRCYRVTW FTSWSPCYDC ARHVADFLRG NPNLSLRIFT ARLYFCEDRK AEPEGLRRLH RAGVQIAIMT FKENHERTFK AWEGLHENSV RLSRQLRRIL LPLYEVDDLR DAFRTLGL (SEQ ID NO:912).

[00343] In some cases, a suitable cytidine deaminase is an AID and comprises an amino acid sequence having at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the following amino acid sequence: MDSLLMNRRK

FLYQFKNVRW AKGRRETYLC YVVKRRDSAT SFSLDFGYLR NKNGCHVELL FLRYISDWDL DPGRCYRVTW FTSWSPCYDC ARHVADFLRG NPNLSLRIFT ARLYFCEDRK AEPEGLRRLH RAGVQIAIMT FKDYFYCWNT FVENHERTFK AWEGLHENSV RLSRQLRRIL LPLYEVDDLR DAFRTLGL (SEQ ID NO:913).

[00344] In some cases, a CRISPR/Cas effector polypeptide fusion polypeptide comprises a CRISPR/Cas effector polypeptide that exhibits nickase activity. Suitable nickases are described elsewhere herein.

[00345] In some cases, a fusion CRISPR/Cas effector polypeptide comprises one or more localization signal peptides. Suitable localization signals ("subcellular localization signals") include, e.g., a nuclear localization signal (NLS) for targeting to the nucleus; a sequence to keep the fusion protein out of the nucleus, e.g., a nuclear export sequence (NES); a sequence to keep the fusion protein retained in the cytoplasm; a mitochondrial localization signal for targeting to the mitochondria; a chloroplast localization signal for targeting to a chloroplast; an endoplasmic reticulum (ER) retention signal; and ER export signal; and the like. In some cases, a fusion polypeptide does not include an NLS so that the protein is not targeted to the nucleus (which can be advantageous, e.g., when the target nucleic acid is an RNA that is present in the cytosol).

[00346] In some cases, a fusion polypeptide includes (is fused to) a nuclear localization signal (NLS) (e.g., in some cases 2 or more, 3 or more, 4 or more, or 5 or more NLSs). Thus, in some cases, a fusion polypeptide includes one or more NLSs (e.g., 2 or more, 3 or more, 4 or more, or 5 or more NLSs). In some cases, one or more NLSs (2 or more, 3 or more, 4 or more, or 5 or more NLSs) are positioned at or near (e.g., within 50 amino acids of) the N-terminus and/or the C-terminus. In some cases, one or more NLSs (2 or more, 3 or more, 4 or more, or 5 or more NLSs) are positioned at or near (e.g., within 50 amino acids of) the N-terminus. In some cases, one or more NLSs (2 or more, 3 or more, 4 or more, or 5 or more NLSs) are positioned at or near (e.g., within 50 amino acids of) the C-terminus. In some cases, one or more NLSs (3 or more, 4 or more, or 5 or more NLSs) are positioned at or near (e.g., within 50 amino acids of) both the N-terminus and the C-terminus. In some cases, an NLS is positioned at the N-terminus and an NLS is positioned at the C-terminus.

[00347] In some cases, a fusion polypeptide includes (is fused to) between 1 and 10 NLSs (e.g., 1-9, 1-8, 1-7, 1-6, 1-5, 2-10, 2-9, 2-8, 2-7, 2-6, or 2-5 NLSs). In some cases, a fusion polypeptide includes (is fused to) between 2 and 5 NLSs (e.g., 2-4, or 2-3 NLSs).

[00348] Non-limiting examples of NLSs include an NLS sequence derived from: the NLS of the SV40 virus large T-antigen, having the amino acid sequence PKKKRKV (SEQ ID NO:914); the NLS from nucleoplasmin (e.g., the nucleoplasmin bipartite NLS with the sequence

KRPAATKKAGQAKKKK (SEQ ID NO:915)); the c-myc NLS having the amino acid sequence PAAKRVKLD (SEQ ID NO:916) or RQRRNELKRSP (SEQ ID NO:917); the hRNPA1 M9 NLS having the sequence NQSSNFGPMKGGNFGGRSSGPYGGGGQYFAKPRNQGGY (SEQ ID NO:918); the sequence RMRIZFKNKGKDTAELRRRRVEVSVELRKAKKDEQILKRRNV (SEQ ID NO:919) of the IBB domain from importin-alpha; the sequences VSRKRPRP (SEQ ID NO:920) and PPKKARED (SEQ ID NO:921) of the myoma T protein; the sequence PQPKKKPL (SEQ ID NO:922) of human p53; the sequence SALIKKKKKMAP (SEQ ID NO:923) of mouse c-abl IV; the sequences DRLRR (SEQ ID NO:924) and PKQKKRK (SEQ ID NO:925) of the influenza virus NS1; the sequence RKLKKKIKKL (SEQ ID NO:926) of the Hepatitis virus delta antigen; the sequence REKKKFLKRR (SEQ ID NO:927) of the mouse Mx1 protein; the sequence KRKGDEVDGVDEVAKKKSKK (SEQ ID NO:928) of the human poly(ADP-ribose) polymerase; and the sequence RKCLQAGMNLEARKTKK (SEQ ID NO:929) of the steroid hormone receptors (human) glucocorticoid. In some cases, an NLS comprises the amino acid sequence MDSLLMNRRKFLYQFKNVRWAKGRRETYLC (SEQ ID NO:930). In general, NLS (or multiple NLSs) are of sufficient strength to drive accumulation of the fusion polypeptide in a detectable amount in the nucleus of a eukaryotic cell. Detection of accumulation in the nucleus may be performed by any suitable technique. For example, a detectable marker may be fused to the fusion polypeptide such that location within a cell may be visualized. Cell nuclei may also be isolated from cells, the contents of which may then be analyzed by any suitable process for detecting protein, such as immunohistochemistry, Western blot, or enzyme activity assay. Accumulation in the nucleus may also be determined indirectly.

[00349] In some cases, a CRISPR/Cas effector polypeptide fusion polypeptide includes a "Protein Transduction Domain" or PTD (also known as a CPP – cell penetrating peptide), which refers to a polypeptide, polynucleotide, carbohydrate, or organic or inorganic compound that facilitates traversing a lipid bilayer, micelle, cell membrane, organelle membrane, or vesicle membrane. A PTD attached to another molecule, which can range from a small polar molecule to a large macromolecule and/or a nanoparticle, facilitates the molecule traversing a membrane, for example going from extracellular space to intracellular space, or cytosol to within an organelle. In some embodiments, a PTD is covalently linked to the amino terminus of a polypeptide. In some embodiments, a PTD is covalently linked to the carboxyl terminus of a polypeptide. In some cases, the PTD is inserted internally in the fusion polypeptide (i.e., is not at the N- or C-terminus of the fusion polypeptide) at a suitable insertion site. In some cases, a subject fusion polypeptide includes (is conjugated to, is fused to) one or more PTDs (e.g., two or more, three or more, four or more PTDs). In some cases, a PTD includes a nuclear localization signal (NLS) (e.g., in some cases 2 or more, 3 or more, 4 or more, or 5 or more NLSs). Thus, in

some cases, a fusion polypeptide includes one or more NLSs (e.g., 2 or more, 3 or more, 4 or more, or 5 or more NLSs). In some embodiments, a PTD is covalently linked to a nucleic acid (e.g., a guide nucleic acid, a polynucleotide encoding a guide nucleic acid, a polynucleotide encoding a fusion polypeptide, a donor polynucleotide, etc.). Examples of PTDs include but are not limited to a minimal undecapeptide protein transduction domain (corresponding to residues 47-57 of HIV-1 TAT comprising YGRKKRRQRRR; SEQ ID NO:931); a polyarginine sequence comprising a number of arginines sufficient to direct entry into a cell (e.g., 3, 4, 5, 6, 7, 8, 9, 10, or 10-50 arginines); a VP22 domain (Zender et al. (2002) *Cancer Gene Ther.* 9(6):489-96); an Drosophila Antennapedia protein transduction domain (Noguchi et al. (2003) *Diabetes* 52(7):1732-1737); a truncated human calcitonin peptide (Trehin et al. (2004) *Pharm. Research* 21:1248-1256); polylysine (Wender et al. (2000) *Proc. Natl. Acad. Sci. USA* 97:13003-13008); RRQRRTSKLMKR (SEQ ID NO:932); Transportan GWTLNSAGYLLGKINLKALAALAKKIL (SEQ ID NO:933); KALAWEAKLAKALAKALAKHLAKALAKALKCEA (SEQ ID NO:934); and RQIKIWFQNRRMKWKK (SEQ ID NO:935). Exemplary PTDs include but are not limited to, YGRKKRRQRRR (SEQ ID NO:936), RKKRRQRRR (SEQ ID NO:937); an arginine homopolymer of from 3 arginine residues to 50 arginine residues; Exemplary PTD domain amino acid sequences include, but are not limited to, any of the following: YGRKKRRQRRR (SEQ ID NO:938); RKKRRQRR (SEQ ID NO:939); YARAAARQARA (SEQ ID NO:940); THRLPRRRRRR (SEQ ID NO:941); and GGRRARRRRRR (SEQ ID NO:942). In some embodiments, the PTD is an activatable CPP (ACPP) (Aguilera et al. (2009) *Integr Biol (Camb)* June; 1(5-6): 371-381). ACPPs comprise a polycationic CPP (e.g., Arg9 or "R9") connected via a cleavable linker to a matching polyanion (e.g., Glu9 or "E9"), which reduces the net charge to nearly zero and thereby inhibits adhesion and uptake into cells. Upon cleavage of the linker, the polyanion is released, locally unmasking the polyarginine and its inherent adhesiveness, thus "activating" the ACPP to traverse the membrane.

Guide RNA

[00350] Where a target polypeptide is a CRISPR/Cas effector polypeptide, in some cases, the CRISPR/Cas effector polypeptide is complexed with a CRISPR/Cas effector polypeptide guide RNA (also referred to as a "CRISPR-Cas guide RNA").

[00351] A nucleic acid molecule that binds to a CRISPR/Cas effector polypeptide protein and targets the complex to a specific location within a target nucleic acid is referred to herein as a "CRISPR/Cas effector polypeptide guide RNA" or simply a "guide RNA."

[00352] A guide RNA (can be said to include two segments, a first segment (referred to herein as a "targeting segment"); and a second segment (referred to herein as a "protein-binding segment").

By "segment" it is meant a segment/section/region of a molecule, e.g., a contiguous stretch of nucleotides in a nucleic acid molecule. A segment can also mean a region/section of a complex such that a segment may comprise regions of more than one molecule. The "targeting segment" is also referred to herein as a "variable region" of a guide RNA. The "protein-binding segment" is also referred to herein as a "constant region" of a guide RNA. In some cases, the guide RNA is a Cas9 guide RNA.

[00353] The first segment (targeting segment) of a guide RNA includes a nucleotide sequence (a guide sequence) that is complementary to (and therefore hybridizes with) a specific sequence (a target site) within a target nucleic acid (e.g., a target ssRNA, a target ssDNA, the complementary strand of a double stranded target DNA, etc.). The protein-binding segment (or "protein-binding sequence") interacts with (binds to) a CRISPR/Cas effector polypeptide. The protein-binding segment of a guide RNA includes two complementary stretches of nucleotides that hybridize to one another to form a double stranded RNA duplex (dsRNA duplex). Site-specific binding and/or cleavage of a target nucleic acid (e.g., genomic DNA) can occur at locations (e.g., target sequence of a target locus) determined by base-pairing complementarity between the guide RNA (the guide sequence of the guide RNA) and the target nucleic acid.

[00354] A guide RNA and a CRISPR/Cas effector polypeptide form a complex (e.g., bind via non-covalent interactions). The guide RNA provides target specificity to the complex by including a targeting segment, which includes a guide sequence (a nucleotide sequence that is complementary to a sequence of a target nucleic acid). The CRISPR/Cas effector polypeptide of the complex provides the site-specific activity (e.g., cleavage activity or an activity provided by the CRISPR/Cas effector polypeptide when the CRISPR/Cas effector polypeptide is a CRISPR/Cas effector polypeptide fusion polypeptide, i.e., has a fusion partner). In other words, the CRISPR/Cas effector polypeptide is guided to a target nucleic acid sequence (e.g. a target sequence in a chromosomal nucleic acid, e.g., a chromosome; a target sequence in an extrachromosomal nucleic acid, e.g. an episomal nucleic acid, a minicircle, an ssRNA, an ssDNA, etc.; a target sequence in a mitochondrial nucleic acid; a target sequence in a chloroplast nucleic acid; a target sequence in a plasmid; a target sequence in a viral nucleic acid; etc.) by virtue of its association with the guide RNA.

[00355] The "guide sequence" also referred to as the "targeting sequence" of a guide RNA can be modified so that the guide RNA can target a CRISPR/Cas effector polypeptide to any desired sequence of any desired target nucleic acid, with the exception that the protospacer adjacent motif (PAM) sequence can be taken into account. Thus, for example, a guide RNA can have a targeting segment with a sequence (a guide sequence) that has complementarity with (e.g., can hybridize to) a sequence in a nucleic acid in a eukaryotic cell, e.g., a viral nucleic acid, a

eukaryotic nucleic acid (e.g., a eukaryotic chromosome, chromosomal sequence, a eukaryotic RNA, etc.), and the like.

[00356] In some embodiments, a guide RNA includes two separate nucleic acid molecules: an "activator" and a "targeter" and is referred to herein as a "dual guide RNA", a "double-molecule guide RNA", or a "two-molecule guide RNA" a "dual guide RNA", or a "dgRNA." In some embodiments, the activator and targeter are covalently linked to one another (e.g., via intervening nucleotides) and the guide RNA is referred to as a "single guide RNA", a "Cas9 single guide RNA", a "single-molecule Cas9 guide RNA," or a "one-molecule Cas9 guide RNA", or simply "sgRNA."

[00357] A guide RNA comprises a crRNA-like ("CRISPR RNA" / "targeter" / "crRNA" / "crRNA repeat") molecule and a corresponding tracrRNA-like ("trans-acting CRISPR RNA" / "activator" / "tracrRNA") molecule. A crRNA-like molecule (targeter) comprises both the targeting segment (single stranded) of the guide RNA and a stretch ("duplex-forming segment") of nucleotides that forms one half of the dsRNA duplex of the protein-binding segment of the guide RNA. A corresponding tracrRNA-like molecule (activator / tracrRNA) comprises a stretch of nucleotides (duplex-forming segment) that forms the other half of the dsRNA duplex of the protein-binding segment of the guide nucleic acid. In other words, a stretch of nucleotides of a crRNA-like molecule are complementary to and hybridize with a stretch of nucleotides of a tracrRNA-like molecule to form the dsRNA duplex of the protein-binding domain of the guide RNA. As such, each targeter molecule can be said to have a corresponding activator molecule (which has a region that hybridizes with the targeter). The targeter molecule additionally provides the targeting segment. Thus, a targeter and an activator molecule (as a corresponding pair) hybridize to form a guide RNA. The exact sequence of a given crRNA or tracrRNA molecule is characteristic of the species in which the RNA molecules are found. A dual guide RNA can include any corresponding activator and targeter pair.

[00358] The term "activator" or "activator RNA" is used herein to mean a tracrRNA-like molecule (tracrRNA : "trans-acting CRISPR RNA") of a dual guide RNA (and therefore of a single guide RNA when the "activator" and the "targeter" are linked together by, e.g., intervening nucleotides). Thus, for example, a guide RNA (dgRNA or sgRNA) comprises an activator sequence (e.g., a tracrRNA sequence). A tracr molecule (a tracrRNA) is a naturally existing molecule that hybridizes with a CRISPR RNA molecule (a crRNA) to form a dual guide RNA. The term "activator" is used herein to encompass naturally existing tracrRNAs, but also to encompass tracrRNAs with modifications (e.g., truncations, sequence variations, base modifications, backbone modifications, linkage modifications, etc.) where the activator retains at least one function of a tracrRNA (e.g., contributes to the dsRNA duplex to which Cas9 protein

binds). In some cases, the activator provides one or more stem loops that can interact with Cas9 protein. An activator can be referred to as having a tracr sequence (tracrRNA sequence) and in some cases is a tracrRNA, but the term "activator" is not limited to naturally existing tracrRNAs.

[00359] The term "targeter" or "targeter RNA" is used herein to refer to a crRNA-like molecule (crRNA: "CRISPR RNA") of a dual guide RNA (and therefore of a single guide RNA when the "activator" and the "targeter" are linked together, e.g., by intervening nucleotides). Thus, for example, a guide RNA (dgRNA or sgRNA) comprises a targeting segment (which includes nucleotides that hybridize with (are complementary to) a target nucleic acid, and a duplex-forming segment (e.g., a duplex forming segment of a crRNA, which can also be referred to as a crRNA repeat). Because the sequence of a targeting segment (the segment that hybridizes with a target sequence of a target nucleic acid) of a targeter is modified by a user to hybridize with a desired target nucleic acid, the sequence of a targeter will often be a non-naturally occurring sequence. However, the duplex-forming segment of a targeter (described in more detail below), which hybridizes with the duplex-forming segment of an activator, can include a naturally existing sequence (e.g., can include the sequence of a duplex-forming segment of a naturally existing crRNA, which can also be referred to as a crRNA repeat). Thus, the term targeter is used herein to distinguish from naturally occurring crRNAs, despite the fact that part of a targeter (e.g., the duplex-forming segment) often includes a naturally occurring sequence from a crRNA. However, the term "targeter" encompasses naturally occurring crRNAs.

[00360] A guide RNA can also be said to include 3 parts: (i) a targeting sequence (a nucleotide sequence that hybridizes with a sequence of the target nucleic acid); (ii) an activator sequence (as described above)(in some cases, referred to as a tracr sequence); and (iii) a sequence that hybridizes to at least a portion of the activator sequence to form a double stranded duplex. A targeter has (i) and (iii); while an activator has (ii).

[00361] A guide RNA (e.g. a dual guide RNA or a single guide RNA) can be comprised of any corresponding activator and targeter pair. In some cases, the duplex forming segments can be swapped between the activator and the targeter. In other words, in some cases, the targeter includes a sequence of nucleotides from a duplex forming segment of a tracrRNA (which sequence would normally be part of an activator) while the activator includes a sequence of nucleotides from a duplex forming segment of a crRNA (which sequence would normally be part of a targeter).

[00362] As noted above, a targeter comprises both the targeting segment (single stranded) of the guide RNA and a stretch ("duplex-forming segment") of nucleotides that forms one half of the dsRNA duplex of the protein-binding segment of the guide RNA. A corresponding tracrRNA-like molecule (activator) comprises a stretch of nucleotides (a duplex-forming segment) that forms

the other half of the dsRNA duplex of the protein-binding segment of the guide RNA. In other words, a stretch of nucleotides of the targeter is complementary to and hybridizes with a stretch of nucleotides of the activator to form the dsRNA duplex of the protein-binding segment of a guide RNA. As such, each targeter can be said to have a corresponding activator (which has a region that hybridizes with the targeter). The targeter molecule additionally provides the targeting segment. Thus, a targeter and an activator (as a corresponding pair) hybridize to form a guide RNA. The particular sequence of a given naturally existing crRNA or tracrRNA molecule is characteristic of the species in which the RNA molecules are found. Examples of suitable activator and targeter are well known in the art.

Nucleic acid modifications

[00363] In some cases, a CRISPR-Cas guide RNA has one or more modifications, e.g., a base modification, a backbone modification, a sugar modification, etc., to provide the nucleic acid with a new or enhanced feature (e.g., improved stability).

[00364] Suitable nucleic acid modifications include, but are not limited to: 2'O-methyl modified nucleotides, 2' fluoro modified nucleotides, locked nucleic acid (LNA) modified nucleotides, peptide nucleic acid (PNA) modified nucleotides, nucleotides with phosphorothioate linkages, and a 5' cap (e.g., a 7-methylguanylate cap (m7G)).

[00365] Suitable modified nucleic acid backbones containing a phosphorus atom therein include, for example, phosphorothioates, chiral phosphorothioates, phosphorodithioates, phosphotriesters, aminoalkylphosphotriesters, methyl and other alkyl phosphonates including 3'-alkylene phosphonates, 5'-alkylene phosphonates and chiral phosphonates, phosphinates, phosphoramidates including 3'-amino phosphoramidate and aminoalkylphosphoramidates, phosphorodiamidates, thionophosphoramidates, thionoalkylphosphonates, thionoalkylphosphotriesters, selenophosphates and boranophosphates having normal 3'-5' linkages, 2'-5' linked analogs of these, and those having inverted polarity wherein one or more internucleotide linkages is a 3' to 3', 5' to 5' or 2' to 2' linkage. Suitable oligonucleotides having inverted polarity comprise a single 3' to 3' linkage at the 3'-most internucleotide linkage i.e. a single inverted nucleoside residue which may be a basic (the nucleobase is missing or has a hydroxyl group in place thereof). Various salts (such as, for example, potassium or sodium), mixed salts and free acid forms are also included.

[00366] In some cases, a CRISPR-Cas guide RNA has one or more nucleotides that are linked by a phosphorothioate bond (i.e., the subject nucleic acid has one or more phosphorothioate linkages). The phosphorothioate (PS) bond (i.e., a phosphorothioate linkage) substitutes a sulfur atom for a non-bridging oxygen in the phosphate backbone of a nucleic acid (e.g., an oligo). This modification renders the internucleotide linkage resistant to nuclease degradation.

Phosphorothioate bonds can be introduced between the last 3-5 nucleotides at the 5'- or 3'-end of the oligo to inhibit exonuclease degradation. Including phosphorothioate bonds within the oligo (e.g., throughout the entire oligo) can help reduce attack by endonucleases as well.

[00367] Also suitable are CRISPR-Cas guide RNAs having morpholino backbone structures as described in, e.g., U.S. Pat. No. 5,034,506. For example, in some embodiments, a CRISPR-Cas guide RNA comprises a 6-membered morpholino ring in place of a ribose ring. In some of these embodiments, a phosphorodiamidate or other non-phosphodiester internucleoside linkage replaces a phosphodiester linkage.

[00368] A CRISPR-Cas guide RNA can also include one or more substituted sugar moieties. Suitable polynucleotides comprise a sugar substituent group selected from: OH; F; O-, S-, or N-alkyl; O-, S-, or N-alkenyl; O-, S- or N-alkynyl; or O-alkyl-O-alkyl, wherein the alkyl, alkenyl and alkynyl may be substituted or unsubstituted C_1 to C_{10} alkyl or C_2 to C_{10} alkenyl and alkynyl. Particularly suitable are $O((CH_2)_nO)_mCH_3$, $O(CH_2)_nOCH_3$, $O(CH_2)_nNH_2$, $O(CH_2)_nCH_3$, $O(CH_2)_nONH_2$, and $O(CH_2)_nON((CH_2)_nCH_3)_2$, where n and m are from 1 to about 10. Other suitable polynucleotides comprise a sugar substituent group selected from: C_1 to C_{10} lower alkyl, substituted lower alkyl, alkenyl, alkynyl, alkaryl, aralkyl, O-alkaryl or O-aralkyl, SH, SCH_3, OCN, Cl, Br, CN, CF_3, OCF_3, $SOCH_3$, SO_2CH_3, ONO_2, NO_2, N_3, NH_2, heterocycloalkyl, heterocycloalkaryl, aminoalkylamino, polyalkylamino, substituted silyl, an RNA cleaving group, a reporter group, an intercalator, a group for improving the pharmacokinetic properties of an oligonucleotide, or a group for improving the pharmacodynamic properties of an oligonucleotide, and other substituents having similar properties. A suitable modification includes 2'-methoxyethoxy (2'-O-CH_2 CH_2OCH_3, also known as 2'-O-(2-methoxyethyl) or 2'-MOE) (Martin et al., Helv. Chim. Acta, 1995, 78, 486-504) i.e., an alkoxyalkoxy group. A further suitable modification includes 2'-dimethylaminooxyethoxy, i.e., a $O(CH_2)_2ON(CH_3)_2$ group, also known as 2'-DMAOE, as described in examples herein below, and 2'-dimethylaminoethoxyethoxy (also known in the art as 2'-O-dimethyl-amino-ethoxy-ethyl or 2'-DMAEOE), i.e., 2'-O-CH_2-O-CH_2-$N(CH_3)_2$.

METHODS OF COUPLING TWO PROTEINS VIA A COUPLING PROTEIN

[00369] The present disclosure provides methods for chemoselective coupling of a first polypeptide and a second polypeptide via a coupling polypeptide. The product of the chemoselective coupling can comprise, in order from N-terminus to C-terminus: i) the first polypeptide; ii) the coupling polypeptide; and iii) the second polypeptide. The method takes advantage of the substrate preferences of tyrosinase polypeptides, as described above.

[00370] For example, in some cases, the present disclosure provides a method for chemoselective coupling of a first polypeptide and a second polypeptide to a coupling polypeptide, the method

comprising: a) contacting the first polypeptide with the coupling polypeptide, to generate a first polypeptide-coupling polypeptide conjugate, where the first polypeptide comprises a thiol moiety (e.g., a Cys, where the Cys can be at any solvent-accessible position within the first polypeptide), where the coupling polypeptide comprises an N-terminal reactive moiety that forms a covalent bond with the thiol moiety present in the first polypeptide, where the coupling polypeptide comprising the N-terminal reactive moiety is generated by reaction of a polypeptide ("coupling precursor polypeptide") comprising an N-terminal phenol or catechol moiety and a C-terminal phenol or catechol moiety with a first enzyme capable of oxidizing the N-terminal phenol or catechol moiety, but not the C-terminal phenol or catechol moiety, to generate the N-terminal reactive moiety; and where the coupling polypeptide comprises two or more positively charged or neutral amino acids within ten amino acids of the N-terminal phenol or catechol moiety and two or more negatively charged amino acids within ten amino acids of the C-terminal phenol or catechol moiety; and b) contacting the second polypeptide with the first polypeptide-coupling polypeptide conjugate, where the second polypeptide comprises a thiol moiety (e.g. a Cys, where the Cys can be at any solvent-accessible position within the second polypeptide), where the first polypeptide-coupling polypeptide conjugate comprises a C-terminal reactive moiety that forms a covalent bond with the thiol moiety present in the second polypeptide, where the first polypeptide-coupling polypeptide conjugate comprising the C-terminal reactive moiety is generated by reaction of the first polypeptide-coupling polypeptide conjugate with a second enzyme capable of oxidizing the C-terminal phenol or catechol moiety to generate a C-terminal reactive moiety; and where said contacting generates a first polypeptide-coupling polypeptide-second polypeptide conjugate. In some cases, the first enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to the abTYR amino acid sequence depicted in FIG. 8 or FIG. 9; and the second enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to any one of the amino acid sequences depicted in any one of FIG. 10A-10Z and 10AA-10VV.

[00371] As another example, in some cases, the present disclosure provides a method for chemoselective coupling of a first polypeptide and a second polypeptide to a coupling polypeptide, the method comprising: a) contacting the first polypeptide with the coupling polypeptide, to generate a first polypeptide-coupling polypeptide conjugate, where the first polypeptide comprises a thiol moiety, where the coupling polypeptide comprises an N-terminal reactive moiety that forms a covalent bond with the thiol moiety present in the first polypeptide, where the coupling polypeptide comprising the N-terminal reactive moiety is generated by reaction of a polypeptide comprising an N-terminal phenol or catechol moiety and a C-terminal

phenol or catechol moiety with a first enzyme capable of oxidizing the N-terminal phenol or catechol moiety, but not the C-terminal phenol or catechol moiety, to generate the N-terminal reactive moiety; where the coupling polypeptide comprises two or more negatively charged amino acids within ten amino acids of the N-terminal phenol or catechol moiety and two or more positively charged or neutral amino acids within ten amino acids of the C-terminal phenol or catechol moiety; and b) contacting the second polypeptide with the first polypeptide-coupling polypeptide conjugate, where the second polypeptide comprises a thiol moiety, where the first polypeptide-coupling polypeptide conjugate comprises a C-terminal reactive moiety that forms a covalent bond with the thiol moiety present in the second polypeptide, where the first polypeptide-coupling polypeptide conjugate comprising the C-terminal reactive moiety is generated by reaction of the first polypeptide-coupling polypeptide conjugate with a second enzyme capable of oxidizing the C-terminal phenol or catechol moiety to generate a C-terminal reactive moiety; and where said contacting generates a first polypeptide-coupling polypeptide-second polypeptide conjugate. In some cases, the first enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to any one of the amino acid sequences depicted in any one of FIG. 10A-10Z and 10AA-10VV; and b) the second enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to the abTYR amino acid sequence depicted in FIG. 8 or FIG. 9.

[00372] The coupling polypeptide can have a length of from 10 amino acids to 100 amino acids, or more than 100 amino acids. In some cases, the coupling polypeptide has a length of from 10 amino acids to 25 amino acids. In some cases, the coupling polypeptide has a length of from 25 amino acids to 50 amino acids. In some cases, the coupling polypeptide has a length of from 50 amino acids to 100 amino acids. In some cases, the coupling polypeptide has a length of more than 100 amino acids; e.g., in some cases, the coupling polypeptide has a length of from 100 amino acids to 200 amino acids, from 200 amino acids to 500 amino acids, or more than 500 amino acids (e.g., 500 to 1000, 1000 to 2000, or more than 2000, amino acids). In some cases, the N-terminal phenol moiety and the C-terminal phenol moiety are both tyrosines, and the enzymes that generate the reactive moieties are tyrosinases.

[00373] As noted above, in some cases, the coupling polypeptide comprises: a) two or more negatively charged amino acids within ten amino acids of the N-terminal phenol or catechol moiety; or b) two or more negatively charged amino acids within ten amino acids of the C-terminal phenol or catechol moiety. In such cases, the coupling polypeptide can comprise: a) 2, 3, 4, 5, 6, 7, 8, 9, or 10 negatively charged amino acids within ten amino acids of the N-terminal phenol or catechol moiety; or b) 2, 3, 4, 5, 6, 7, 8, 9, or 10 negatively charged amino acids within

ten amino acids of the C-terminal phenol or catechol moiety. As one non-limiting example, the coupling polypeptide comprises the amino acid sequence: YEEEE$(X)_n$RRRRY (SEQ ID NO: 961), where X is any amino acid, and where n is an integer from 0 to 40 (e.g., where n is an integer from 0 to 5, from 5 to 10, from 10 to 15, from 15 to 20, from 20 to 25, from 25 to 30, from 30 to 35, or from 35 to 40). As another non-limiting example, the coupling polypeptide comprises the amino acid sequence: YDDDD$(X)_n$KKKKY (SEQ ID NO: 962), where X is any amino acid, and where n is an integer from 0 to 40 (e.g., where n is an integer from 0 to 5, from 5 to 10, from 10 to 15, from 15 to 20, from 20 to 25, from 25 to 30, from 30 to 35, or from 35 to 40).

[00374] As noted above, in some cases, the coupling polypeptide comprises: a) two or more positively charged amino acids within ten amino acids of the N-terminal phenol or catechol moiety; or b) two or more positively charged amino acids within ten amino acids of the C-terminal phenol or catechol moiety. In such cases, the coupling polypeptide can comprise: a) 2, 3, 4, 5, 6, 7, 8, 9, or 10 positively charged amino acids within ten amino acids of the N-terminal phenol or catechol moiety; or b) 2, 3, 4, 5, 6, 7, 8, 9, or 10 positively charged amino acids within ten amino acids of the C-terminal phenol or catechol moiety. As one non-limiting example, the coupling polypeptide comprises the amino acid sequence: YKKKK$(X)_n$DDDDY (SEQ ID NO: 963), where X is any amino acid, and where n is an integer from 0 to 40 (e.g., where n is an integer from 0 to 5, from 5 to 10, from 10 to 15, from 15 to 20, from 20 to 25, from 25 to 30, from 30 to 35, or from 35 to 40). As another non-limiting example, the coupling polypeptide comprises the amino acid sequence: YRRRR$(X)_n$EEEEY (SEQ ID NO: 964), where X is any amino acid, and where n is an integer from 0 to 40 (e.g., where n is an integer from 0 to 5, from 5 to 10, from 10 to 15, from 15 to 20, from 20 to 25, from 25 to 30, from 30 to 35, or from 35 to 40).

[00375] The present disclosure provides a coupling polypeptide, as described above. The present disclosure provides a composition comprising a coupling polypeptide of the present disclosure. The present disclosure provides a composition comprising: a) a coupling polypeptide of the present disclosure; and b) a buffer.

[00376] Suitable first and second polypeptides include any of the above-mentioned polypeptides. For example, in some cases, the first and/or the second polypeptide is an antibody (e.g., a single-chain antibody). As another example, in some cases, the first and/or the second polypeptide is a CRISPR/Cas effector polypeptide. As an example, in some cases, the first polypeptide is a CRISPR/Cas effector polypeptide; and the second polypeptide is an Ig Fc polypeptide. As another example, in some cases, the first polypeptide is a CRISPR/Cas effector polypeptide; and

the second polypeptide is a nanobody. As another example, in some cases, the first polypeptide is a CRISPR/Cas effector polypeptide; and the second polypeptide is a scFv polypeptide.

METHODS OF COUPLING TWO OR MORE POLYPEPTIDES

[00377] The present disclosure provides a method of coupling two or more polypeptides to one another in a sequential manner. The method takes advantage of the substrate preferences of tyrosinase polypeptides, as described above. The method can be carried out on an insoluble substrate, i.e., an immobilized surface, such as a bead. Methods of the present disclosure for coupling two or more polypeptides to one another in a sequential manner are depicted schematically in FIG. 39A-39G.

[00378] Thus, the present disclosure provides method of covalently linking a first polypeptide to a second polypeptide, the method comprising: a) contacting the first polypeptide with an immobilized reactive moiety, where the immobilized reactive moiety is generated by reaction of an immobilized phenol moiety or catechol moiety with a first enzyme, wherein the first enzyme is capable of oxidizing the immobilized phenol moiety or catechol moiety, thereby generating the immobilized reactive moiety, where the first polypeptide comprises: i) a thiol moiety; and ii) a phenol moiety or a catechol moiety, wherein the first polypeptide comprises two or more negatively charged amino acids within ten amino acids of the phenol moiety or the catechol moiety, and where the immobilized reactive moiety forms a covalent bond with the thiol moiety present in the first polypeptide, thereby generating an immobilized first polypeptide; b) contacting the immobilized first polypeptide with second enzyme, where the second enzyme is capable of oxidizing the phenol moiety or the catechol moiety present in the first polypeptide to generate an immobilized first polypeptide comprising a reactive moiety; and c) contacting the immobilized first polypeptide comprising a reactive moiety with a second polypeptide, where the second polypeptide comprises: i) a thiol moiety; and ii) a phenol moiety or a catechol moiety, where the second polypeptide comprises two or more neutral or positively charged within ten amino acids of the phenol moiety or the catechol moiety, where the reactive moiety present in the immobilized first polypeptide forms a covalent bond with the thiol moiety present in the second polypeptide, thereby generating an immobilized conjugate comprising the first polypeptide covalently linked to the second polypeptide. In some cases, the first enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to any one of the amino acid sequences depicted in any one of FIG. 8, FIG. 9, FIG. 10A-10Z, and 10AA-10VV. In some cases, the thiol moiety present in the first polypeptide is present in a Cys (e.g., a solvent-accessible Cys; e.g., an N-terminal Cys), and wherein the phenol moiety present in the first polypeptide is present in a Tyr residue. In some cases, the Tyr residue is present in a stretch of amino acids comprising EEEY (SEQ ID NO: 953), EEEEY

(SEQ ID NO: 955), DDDDY (SEQ ID NO: 965), or DDDDY (SEQ ID NO: 965). In some cases, the second enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to any one of the amino acid sequences depicted in any one of FIG. 10A-10Z and 10AA-10VV. In some cases, the second enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%, amino acid sequence identity to the amino acid sequence depicted in FIG. 10M, where the tyrosinase polypeptide comprises a substitution of D55 (e.g., comprises a D55K substitution).

[00379] The method can be used to link any number of polypeptides, in a sequential manner. For example, in some cases, the method further comprises c) contacting the immobilized conjugate with a third enzyme, wherein the third enzyme is capable of oxidizing the phenol moiety or the catechol moiety present in the second polypeptide to generate an immobilized conjugate comprising a reactive moiety; and d) contacting the immobilized conjugate comprising a reactive moiety with a third polypeptide, where the third polypeptide comprises: i) a thiol moiety; and ii) a phenol moiety or a catechol moiety, wherein the third polypeptide comprises two or more negatively charged within ten amino acids of the phenol moiety or the catechol moiety, and where the reactive moiety present in the immobilized conjugate forms a covalent bond with the thiol moiety present in the second polypeptide, thereby generating an immobilized conjugate comprising the third polypeptide covalently linked to the second polypeptide. In some cases, the third enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to the amino acid sequence depicted in FIG. 8 or FIG. 9.

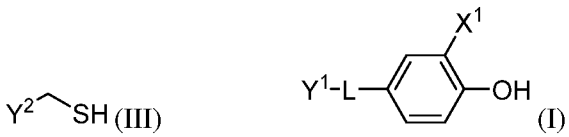
[00380] By alternating use of: a) a tyrosinase enzyme that preferentially modifies a Tyr residue that is present in a negatively charged environment (e.g., where the polypeptide comprises two or more negatively charged within ten amino acids of the Tyr residue); and b) a tyrosinase enzyme that preferentially modifies a Tyr residue that is present in a neutral or positively charged environment ((e.g., where the polypeptide comprises two or more neutral or positively charged within ten amino acids of the Tyr residue), a polypeptide substrate can be sequentially added to an immobilized conjugate comprising one, two, three, or more polypeptides. The method described above can be modified, e.g., such that the first polypeptide comprises: i) a thiol moiety; and ii) a phenol moiety or a catechol moiety, where the first polypeptide comprises two or more neutral or positively charged amino acids within ten amino acids of the phenol moiety or the catechol moiety; in such cases, the second polypeptide would then comprise: i) a thiol moiety; and ii) a phenol moiety or a catechol moiety, where the first polypeptide comprises two or more negatively charged amino acids within ten amino acids of the phenol moiety or the catechol moiety.

[00381] In some cases, the tyrosinase enzyme is inactivated or removed between any two steps of the method and before adding a further tyrosinase enzyme. For example, in some cases, between step (b) and step (c) of the method described above, the second enzyme is inactivated or removed. In some cases, the thiol moiety present in the second polypeptide is present in a Cys, and the phenol moiety present in the second polypeptide is present in a Tyr residue. In some cases, the Tyr residue is present in a stretch of amino acids comprising RRRY (SEQ ID NO: 949), RRRRY (SEQ ID NO: 951), KKKY (SEQ ID NO: 966), or KKKKY (SEQ ID NO: 967).

[00382] As depicted schematically in FIG. 39A, abTYR is used to link biotin-phenol and a first polypeptide ("Protein A") comprising a thiol group and an EEEEY (SEQ ID NO:955) sequence, to generate a biotin-first polypeptide conjugate. The biotin-first polypeptide conjugate can be contacted with streptavidin beads, to immobilize the biotin-first polypeptide conjugate. A second polypeptide ("Protein B") comprising a thiol group and an RRRRY (SEQ ID NO:951) sequence can be conjugated to the first polypeptide of the immobilized biotin-first polypeptide conjugate by action of bmTYR (D55K) (e.g., bmTYR (D55K) depicted in FIG. 10M), to generate an immobilized first polypeptide-second polypeptide conjugate. In some cases, two different polypeptides (e.g., "Protein A" and "Protein B") are alternately added to the concatemer, as depicted in FIG. 39A, FIG. 39B, and FIG. 39C. Alternatively, multiple copies of a single polypeptide are concatenated, as depicted in FIG. 39D and FIG. 39E. As yet another possibility, in some cases, each of the polypeptides that is concatenated is different from the other polypeptides, as depicted in FIG. 39F and FIG. 39G (e.g., "Protein A"; "Protein B"; and "Protein C").

COMPOSITIONS

[00383] Aspects of the disclosure further provides compositions, including pharmaceutical compositions, comprising a target molecule comprising a thiol of formula (III), and a biomolecule comprising a phenol moiety or a catechol moiety of formula (I):



[00384] where Y1 is a biomolecule, optionally comprising one or more moieties selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent; L is an optional linker; X1 is selected from hydrogen and hydroxyl; and Y2 is a second biomolecule.

[00385] In certain embodiments, there is provided a composition of a target molecule comprising a thiol of formula (III), and a pharmaceutically acceptable excipient.

[00386] In certain embodiments, there is provided a composition of a biomolecule comprising a phenol moiety or a catechol moiety of formula (I), and a pharmaceutically acceptable excipient.

[00387] In certain embodiments of the subject compositions, Y^2 is a CRISPR-Cas effector polypeptide, e.g., as described herein.

[00388] In certain embodiments of the subject compositions, formula (I) is described by any of the formulae (IA), (IAa), (IB), (IC), (ID), (IDa) and (IDb), as disclosed herein.

[00389] A subject composition generally comprises a subject target molecule comprising a thiol of formula (III); a biomolecule comprising a phenol moiety or a catechol moiety of formula (I); and at least one additional compound. Suitable additional compounds include, but are not limited to: a salt, such as a magnesium salt, a sodium salt, etc., e.g., NaCl, $MgCl_2$, KCl, $MgSO_4$, etc.; a buffering agent, e.g., a Tris buffer, N-(2-Hydroxyethyl)piperazine-N'-(2-ethanesulfonic acid) (HEPES), 2-(N-Morpholino)ethanesulfonic acid (MES), 2-(N-Morpholino)ethanesulfonic acid sodium salt (MES), 3-(N-Morpholino)propanesulfonic acid (MOPS), N-tris[Hydroxymethyl]methyl-3-aminopropanesulfonic acid (TAPS), etc.; a solubilizing agent; a detergent, e.g., a non-ionic detergent such as Tween-20, etc.; a protease inhibitor; and the like.

[00390] In some embodiments, a subject composition comprises a subject target molecule comprising a thiol of formula (III); a biomolecule comprising a phenol moiety or a catechol moiety of formula (I); and a pharmaceutically acceptable excipient. A wide variety of pharmaceutically acceptable excipients are known in the art and need not be discussed in detail herein. Pharmaceutically acceptable excipients have been amply described in a variety of publications, including, for example, A. Gennaro (2000) "Remington: The Science and Practice of Pharmacy," 20th edition, Lippincott, Williams, & Wilkins; Pharmaceutical Dosage Forms and Drug Delivery Systems (1999) H.C. Ansel et al., eds., 7th ed., Lippincott, Williams, & Wilkins; and Handbook of Pharmaceutical Excipients (2000) A.H. Kibbe et al., eds., 3rd ed. Amer. Pharmaceutical Assoc.

[00391] The pharmaceutically acceptable excipients, such as vehicles, adjuvants, carriers or diluents, are readily available to the public. Moreover, pharmaceutically acceptable auxiliary substances, such as pH adjusting and buffering agents, tonicity adjusting agents, stabilizers, wetting agents and the like, are readily available to the public.

KITS

[00392] The compounds and compositions described herein can be packaged as a kit, which may optionally include instructions for using the compounds or compositions in various exemplary applications. Non-limiting examples include kits that contain, e.g., the compounds or compositions in a powder or lyophilized form, and instructions for using, including

reconstituting, dosage information, and storage information for use in the subject methods. Kits may optionally contain containers of the compounds or compositions in a liquid form ready for use, or requiring further mixing with solutions for administration.

[00393] Aspects of the present disclosure include a kit comprising a first container comprising a composition including a subject target molecule comprising a thiol of formula (III), and a biomolecule comprising a phenol moiety of formula (I); and a second container comprising an enzyme capable of oxidizing the phenol or catechol moiety. In certain cases, the enzyme is a tyrosinase enzyme.

[00394] In certain embodiments, the subject kit includes a first container comprising a subject target molecule comprising a thiol of formula (III); a second container comprising a biomolecule comprising a phenol moiety or a catechol moiety of formula (I); and a third container comprising an enzyme capable of oxidizing the phenol or catechol moiety. In certain cases, the enzyme is a tyrosinase enzyme.

[00395] The kit can include optional components that aid in the subject methods, such as vials for reconstituting powder forms, etc. The kits may be supplied in either a container which is provided with a seal which is suitable for single or multiple puncturing with a hypodermic needle (e.g. a crimped-on septum seal closure) while maintaining sterile integrity. The kit components may be assembled in cartons, blister packs, bottles, tubes, and the like.

[00396] In addition to the above components, the subject kits may further include instructions for practicing the subject methods. These instructions may be present in the subject kits in a variety of forms, one or more of which may be present in the kit. One form in which these instructions may be present is as printed information on a suitable medium or substrate, e.g., a piece or pieces of paper on which the information is printed, in the packaging of the kit, in a package insert, etc. Another means would be a computer readable medium, e.g., CD, DVD, Blu-Ray, computer-readable memory (e.g., flash memory), etc., on which the information has been recorded or stored. Yet another means that may be present is a website address, e.g., such as a link to a website for downloading a suitable smart phone app for use in detecting the functional dye, which may be used via the Internet to access the information at a removed site. Any convenient means may be present in the kits.

UTILITY

[00397] Subject compounds, compositions, kits, and subject modification methods, are useful in a variety of applications, including research applications and diagnostic applications.

[00398] Research applications of interest include any application where the selective manipulation of a target molecules, biomolecules, cells, particles and surfaces is of interest, including the manipulation, tagging and tracking of biomolecules (e.g., proteins) in vitro.

[00399] The subject methods and compositions also find use in therapeutic applications, e.g., therapeutic applications of interest include applications where antibody-drug conjugates (ADC) find use (e.g., novel immunotherapies), delivery of proteins for gene therapy, vaccine development.

METHODS OF SCREENING TYROSINASE VARIANTS

[00400] The present disclosure provides a method of identifying a tyrosinase variant that has a preference for a particular substrate. The method can provide for identification of a tyrosinase variant that has a preference for a phenol or a catechol that is present in a particular sequence, in a negatively-charged environment, or in a positively-charged environment. The method generally involves: a) contacting a peptide with a test tyrosinase and thiol-modified biotin (biotin-thiol), wherein the peptide has a length of from about 4 amino acids to about 25 amino acids (e.g., about 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 to 20, or 20 to 25, amino acids) and where the peptide has a C-terminal Tyr residue, to generate a biotin-peptide conjugate; b) contacting the biotin-peptide conjugate with a streptavidin-conjugated bead (e.g., streptavidin conjugated to a magnetic bead), generating a streptavidin-biotin-peptide complex; and c) determine the amino acid sequence of the peptide in the streptavidin-biotin-peptide complex. In some cases, the method further comprises the step of washing the streptavidin-biotin-peptide complex to remove unbound peptides (peptides not conjugated to the biotin. In some cases, the method further comprises the step of releasing the peptide from the streptavidin-biotin-peptide complex before determining the amino acid sequence of the peptide. The peptide can be released (eluted) from streptavidin-biotin-peptide complex by incubating the streptavidin-biotin-peptide complex in a mixture comprising excess free biotin, acetonitrile, and formic acid (e.g., 80% acetonitrile, 5% formic acid, and 2 mM biotin). The amino acid sequence of the peptide present in the streptavidin-biotin-peptide complex (e.g., the eluted peptide) can be determined using any of a variety of well-known methods including, e.g., mass spectrometry (MS) (e.g., tandem MS). A library of peptides can be used to determine whether a test tyrosinase has a preference for a particular amino acid sequence, for a negatively charged environment, or for a positively charged environment.

Examples of Non-Limiting Aspects of the Disclosure

[00401] **ASPECTS A**

[00402] Aspects, including embodiments, of the present subject matter described above may be beneficial alone or in combination, with one or more other aspects or embodiments. Without limiting the foregoing description, certain non-limiting aspects of the disclosure numbered 1-39 are provided below. As will be apparent to those of skill in the art upon reading this disclosure, each of the individually numbered aspects may be used or combined with any of the preceding or following individually numbered aspects. This is intended to provide support for all such combinations of aspects and is not limited to combinations of aspects explicitly provided below:

[00403] Aspect 1. A method for chemoselective modification of a target molecule, the method comprising: contacting a target molecule comprising a thiol moiety with a biomolecule comprising a reactive moiety; wherein the biomolecule comprising the reactive moiety is generated by reaction of a biomolecule comprising a phenol moiety or a catechol moiety with an enzyme capable of oxidizing the phenol or catechol moiety; and wherein said contacting is under conditions sufficient for conjugation of the target molecule to the biomolecule, thereby producing a modified target molecule.

[00404] Aspect 2. The method of aspect 1, wherein the target molecule is a polypeptide.

[00405] Aspect 3. The method of aspect 1 or 2, wherein the enzyme is a tyrosinase enzyme.

[00406] Aspect 4. The method of any one of aspects 1 to 3, wherein the enzyme is bound to a solid support.

[00407] Aspect 5. The method of any one of aspects 1 to 4, wherein the phenol moiety is present in a tyrosine residue.

[00408] Aspect 6. The method of any one of aspects 1 to 5, wherein the thiol moiety is present in a cysteine residue.

[00409] Aspect 7. The method of aspect 6, wherein the cysteine residue is a native cysteine residue.

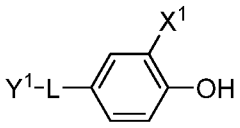
[00410] Aspect 8 The method of any one of aspects 1 to 7, wherein the biomolecule comprises one or more moieties selected from a fluorophore, an active small molecule, an affinity tag, and a metal-chelating agent.

[00411] Aspect 9. The method of any one of aspects 1 to 8, wherein the reactive moiety is an orthoquinone or a semi-quinone radical, or a combination thereof.

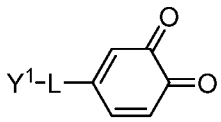
[00412] Aspect 10. The method of any one of aspects 1 to 9, wherein the biomolecule is a polypeptide.

[00413] Aspect 11. The method of aspect 10, wherein the biomolecule is a polypeptide selected from a fluorescent protein, an antibody, an enzyme, a ligand for a receptor, and a receptor.

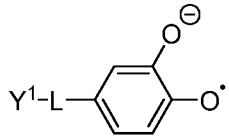
[00414] Aspect 12. The method of any one of aspects 1 to 11, wherein the biomolecule comprising a phenol moiety or a catechol moiety is of formula (I), and wherein the biomolecule comprising a reactive moiety is of formula (II) or (IIA), or a combination thereof:



(I)



(II)



(IIA)

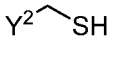
wherein:

Y^1 is a biomolecule, optionally comprising one or more moieties selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

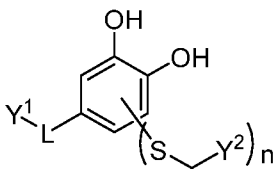
X^1 is selected from hydrogen and hydroxyl; and

L is an optional linker.

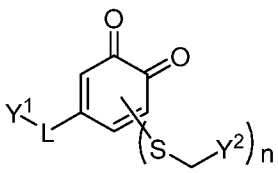
[00415] Aspect 13. The method of any one of aspects 1 to 12, wherein the target molecule comprising a thiol moiety is of formula (III), and wherein the modified target molecule is of formula (IV), or (IVA), or a combination thereof:



(III)



(IV)



(IVA)

wherein:

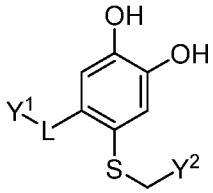
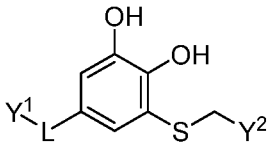
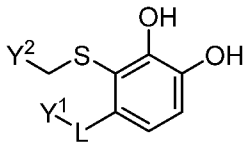
Y^1 is a biomolecule, optionally comprising one or more moieties selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

Y^2 is a second biomolecule;

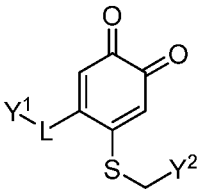
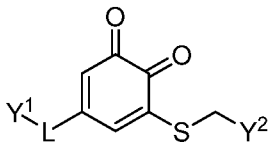
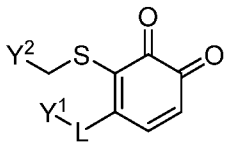
L is an optional linker; and

n is an integer from 1 to 3.

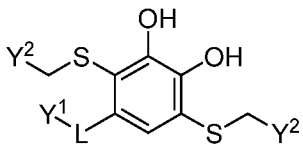
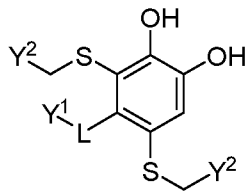
[00416] Aspect 14. The method of aspect 13, wherein the modified target molecule of formula (IV) is of any of formulae (IV1)-(IV3):


(IV1),

(IV2),

(IV3); and

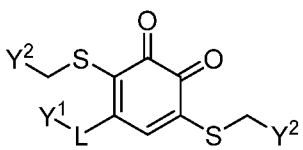
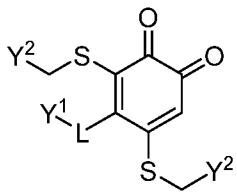
the modified target molecule of formula (IVA) is of any of formulae (IVA1)-(IVA3):


(IVA1),

(IVA2) ,

(IVA3).

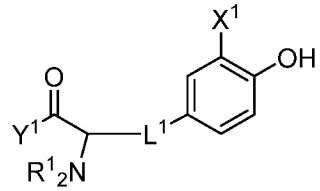
[00417] Aspect 15. The method of aspect 13, wherein the modified target molecule of formula (IV) is of any of formulae (IV5)-(IV6):


(IV4),

(IV5); and

the modified target molecule of formula (IVA) is of any of formulae (IVA4)-(IVA5):


(IVA4) ,

(IVA5).

[00418] Aspect 16. The method of any one of aspects 1-15, wherein the biomolecule comprising a phenol moiety or a catechol moiety is described by the formula (IA):


(IA)

wherein:

Y^1 is a biomolecule optionally comprising one or more groups selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

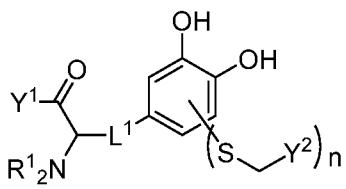
each R^1 is independently selected from hydrogen, acyl, substituted acyl, alkyl, and substituted alkyl;

X^1 is selected from hydrogen and hydroxyl; and

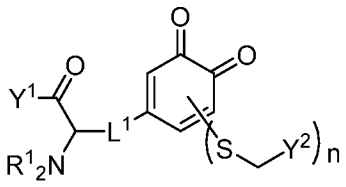
L^1 is a linker selected from a straight or branched alkyl, a straight or branched substituted alkyl, a polyethylene glycol (PEG), a substituted PEG, and one or more peptides.

[00419] Aspect 17. The method of aspect 16, wherein the fluorophore is a rhodamine dye or a xanthene dye.

[00420] Aspect 18. The method of any one of aspects 1 to 17, wherein the modified target molecule is described by the formula (IVB) or (IVC), or a combination thereof:



(IVB)



(IVC)

wherein:

Y^1 is a biomolecule optionally comprising one or more groups selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

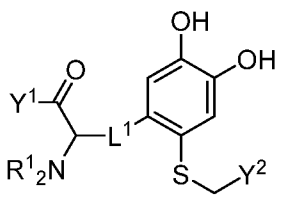
each R^1 is independently selected from hydrogen, acyl, substituted acyl, alkyl, and substituted alkyl;

Y^2 is a second biomolecule;

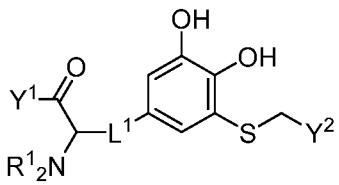
L^1 is a linker selected from a straight or branched alkyl, a straight or branched substituted alkyl, a polyethylene glycol (PEG), a substituted PEG, and one or more peptides; and

n is an integer from 1 to 3.

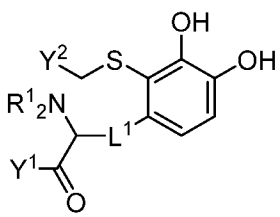
[00421] Aspect 19. The method of aspect 18, wherein the modified target molecule of formula (IVB) is of any of formulae (IVB1)-(IVZB3):



(IVB1),

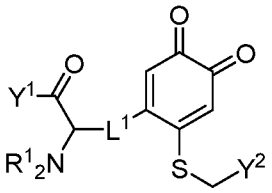


(IVB2),

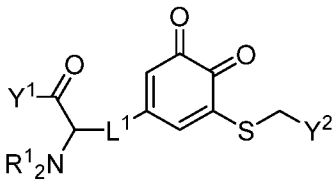


(IVB3); and

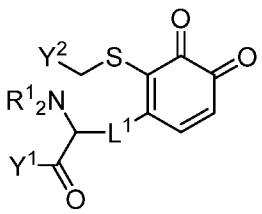
the modified target molecule of formula (IVC) is of any of formulae (IVC1)-(IVC3):



(IVC1),

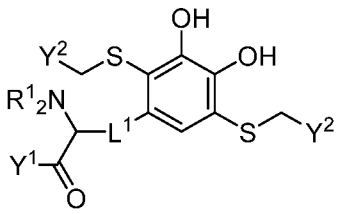


(IVC2) ,

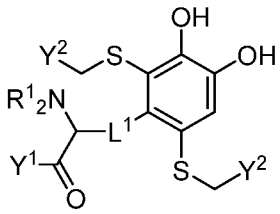


(IVC3).

[00422] Aspect 20. The method of aspect 18, wherein the modified target molecule of formula (IVB) is of any of formulae (IVB5)-(IVB6):

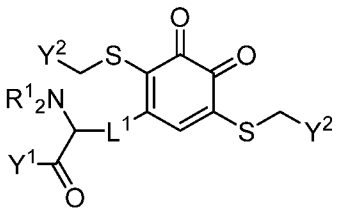


(IVB4),

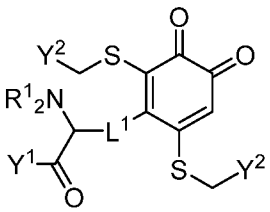


(IVB5); and

the modified target molecule of formula (IVC) is of any of formulae (IVC4)-(IVC5):



(IVC4) ,



(IVC5).

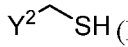
[00423] Aspect 21. The method of any one of aspects 1 to 20, wherein the method is conducted at a pH from 4 to 9.

[00424] Aspect 22. The method of aspect 21, wherein the method is conducted at neutral pH.

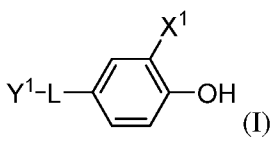
[00425] Aspect 23. The method of any one of aspects 1 to 22, wherein the target molecule comprising a thiol group is a CRISPR-Cas effector polypeptide.

[00426] Aspect 24. A composition, comprising:

a target molecule comprising a thiol of formula (III):

 (III); and

a biomolecule comprising a phenol moiety or a catechol moiety of formula (I):

 (I)

wherein:

Y^1 is a biomolecule, optionally comprising one or more moieties selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

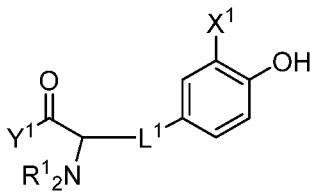
X^1 is selected from hydrogen and hydroxyl;

L is an optional linker; and

Y^2 is a second biomolecule.

[00427] Aspect 25. The composition of aspect 24, wherein Y^2 is a CRISPR-Cas effector polypeptide.

[00428] Aspect 26. The composition of aspect 24 or 25, wherein formula (I) is described by the formula (IA):



(IA)

wherein:

Y^1 is a biomolecule optionally comprising one or more groups selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

each R^1 is independently selected from hydrogen, acyl, substituted acyl, alkyl, and substituted alkyl;

X^1 is selected from hydrogen and hydroxyl; and

L^1 is a linker selected from a straight or branched alkyl, a straight or branched substituted alkyl, a polyethylene glycol (PEG), a substituted PEG, and one or more peptides.

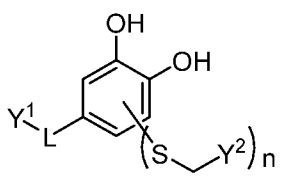
[00429] Aspect 27. A kit comprising:

a first container comprising a composition of any one of aspects 24 to 26; and

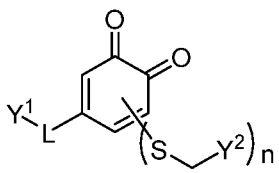
a second container comprising an enzyme capable of oxidizing the phenol or catechol moiety.

[00430] Aspect 28. The kit of claim 27, wherein the enzyme is a tyrosinase enzyme.

[00431] Aspect 29. A compound, of formula (IV) or (IVA):



(IV)



(IVA)

wherein:

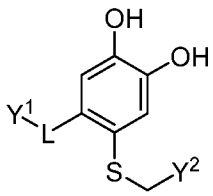
Y^1 is a biomolecule, optionally comprising one or more moieties selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

L is an optional linker;

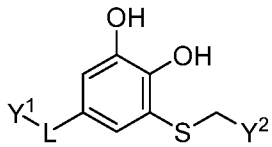
Y^2 is a second biomolecule; and

n is an integer from 1 to 3.

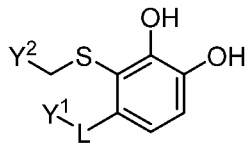
[00432] Aspect 30. The compound of aspect 29, wherein the modified target molecule of formula (IV) is of any of formulae (IV1)-(IV5):



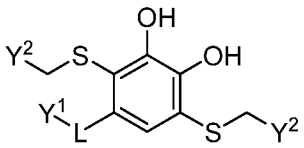
(IV1),



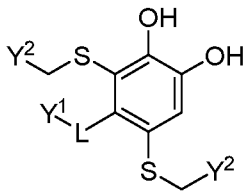
(IV2),



(IV3),

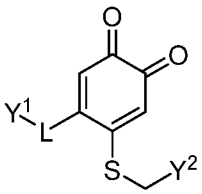


(IV4), and

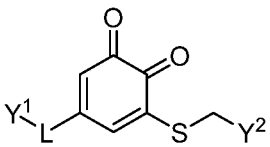


(IV5).

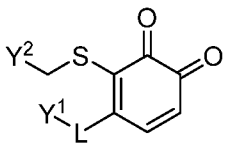
[00433] Aspect 31. The compound of aspect 29, wherein the modified target molecule of formula (IVA) is of any of formulae (IVA1)-(IVA5):



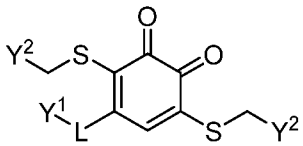
(IVA1),



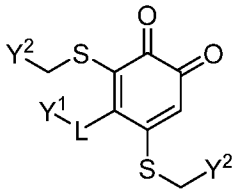
(IVA2) ,



(IVA3),



(IVA4) , and



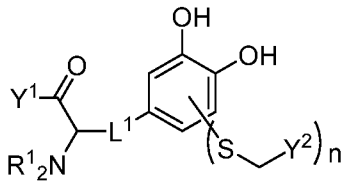
(IVA5).

[00434] Aspect 32. The compound of any one of aspects 29 to 31, wherein L is a cleavable linker.

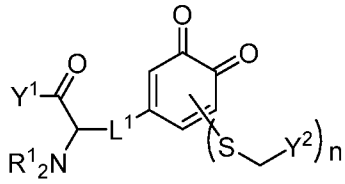
[00435] Aspect 33. The compound of any one of aspects 29 to 32, wherein Y^1 is a polypeptide.

[00436] Aspect 34. The compound of aspect 33, wherein Y^1 is selected from a fluorescent protein, an antibody, and an enzyme.

[00437] Aspect 35. The compound of any one of aspects 29 to 34, described by the formula (IVB) or (IVC):



(IVB)



(IVC)

wherein:

Y^1 is a biomolecule optionally comprising one or more groups selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

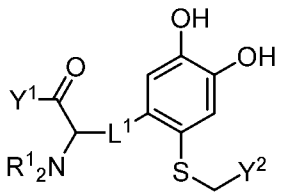
each R^1 is independently selected from hydrogen, acyl, substituted acyl, alkyl, and substituted alkyl;

Y^2 is a second biomolecule;

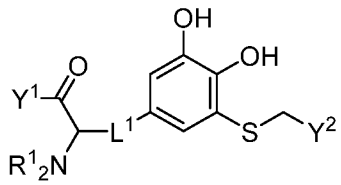
L^1 is a linker selected from a straight or branched alkyl, a straight or branched substituted alkyl, a polyethylene glycol (PEG), a substituted PEG, and one or more peptides; and

n is an integer from 1 to 3.

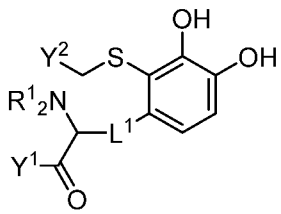
[00438] Aspect 36. The compound of aspect 35, wherein the modified target molecule of formula (IVB) is of any of formulae (IVB1)-(IVZB5):



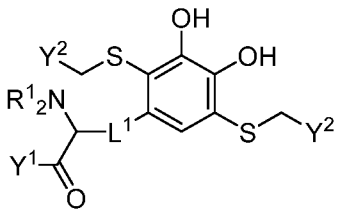
(IVB1),



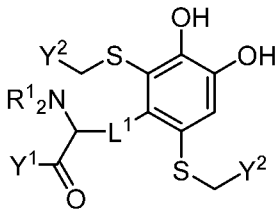
(IVB2),



(IVB3),

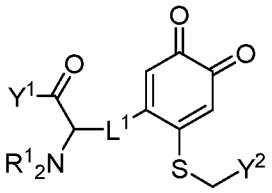


(IVB4), and

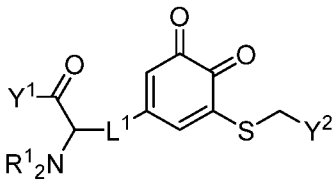


(IVB5).

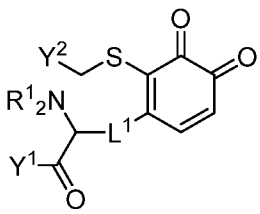
[00439] Aspect 37. The compound of aspect 35, wherein the modified target molecule of formula (IV) is of any one of formulae (IVC1)-(IVC5):



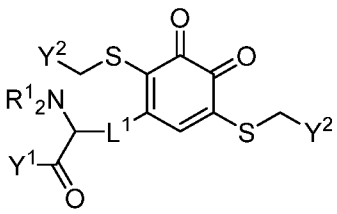
(IVC1),



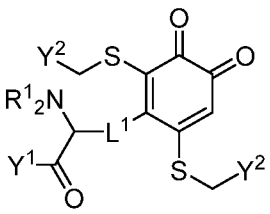
(IVC2) ,



(IVC3),

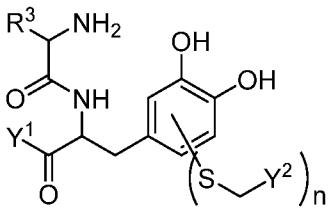


(IVC4) , and

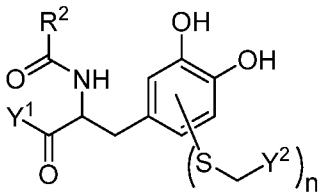


(IVC5).

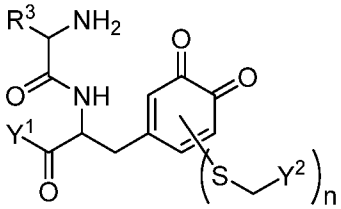
[00440] Aspect 38. The compound of any one of aspects 29 to 37, described by any of formula (IVD)-(IVG):



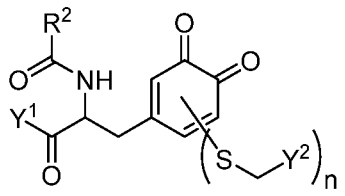
(IVD),



(IVE),



(IVF), and



(IVG),

wherein:

R^2 is selected from alkyl, and substituted alkyl;

R^3 is selected from, hydrogen, alkyl substituted alkyl, a peptide, and a polypeptide; and

n is an integer from 1 to 3.

[00441] Aspect 39. The compound of any one of aspects 29 to 38, wherein Y^2 is a CRISPR-Cas effector polypeptide.

[00442] **ASPECTS B**

[00443] Aspects, including embodiments, of the present subject matter described above may be beneficial alone or in combination, with one or more other aspects or embodiments. Without

limiting the foregoing description, certain non-limiting aspects of the disclosure numbered 1-71 are provided below. As will be apparent to those of skill in the art upon reading this disclosure, each of the individually numbered aspects may be used or combined with any of the preceding or following individually numbered aspects. This is intended to provide support for all such combinations of aspects and is not limited to combinations of aspects explicitly provided below:

[00444] Aspect 1. A method for chemoselective modification of a target molecule, the method comprising: contacting a target molecule comprising a thiol moiety with a biomolecule comprising a reactive moiety; wherein the biomolecule comprising the reactive moiety is generated by reaction of a biomolecule comprising a phenol moiety or a catechol moiety with an enzyme capable of oxidizing the phenol or catechol moiety; and wherein said contacting is under conditions sufficient for conjugation of the target molecule to the biomolecule, thereby producing a modified target molecule.

[00445] Aspect 2. The method of aspect 1, wherein the target molecule is a polypeptide or a polynucleotide.

[00446] Aspect 3. The method of aspect 1 or aspect 2, wherein the enzyme is a tyrosinase polypeptide.

[00447] Aspect 4. The method of any one of aspects 1-3, wherein the tyrosinase polypeptide is an *Agricus bisporus* tyrosinase (abTYR) polypeptide.

[00448] Aspect 5. The method of any one of aspects 1-3, wherein the tyrosinase polypeptide comprises an amino acid sequence having at least 75% amino acid sequence identity to the abTYR amino acid sequence depicted in FIG. 8 or FIG. 9.

[00449] Aspect 6. The method of aspect 4 or aspect 5, wherein the biomolecule comprising the phenol moiety or the catechol moiety is neutral or positively charged within 50 Angstroms (Å) of the phenol or catechol moiety.

[00450] Aspect 7. The method of any one of aspects 1-3, wherein the tyrosinase polypeptide is a *Bacillus megaterium* tyrosinase (bmTYR) polypeptide.

[00451] Aspect 8. The method of any one of aspects 1-3, wherein the tyrosinase polypeptide comprises an amino acid sequence having at least 75% amino acid sequence identity to any one of the amino acid sequences depicted in any one of FIG. 10A-10Z and 10AA-10VV.

[00452] Aspect 9. The method of aspect 7 or aspect 8, wherein the biomolecule comprising a phenol moiety or a catechol moiety is negatively charged within 50 Å of the phenol or catechol moiety.

[00453] Aspect 10. The method of any one of aspects 1-9, wherein the target molecule is a polynucleotide.

[00454] Aspect 11. The method of aspect 10, wherein the target molecule is a DNA molecule.

[00455] Aspect 12. The method of aspect 10, wherein the target molecule is an RNA molecule.

[00456] Aspect 13. The method of any one of aspects 10-12, wherein the biomolecule is a polypeptide.

[00457] Aspect 14. The method of any one of aspects 1 to 13, wherein the enzyme is bound to a solid support.

[00458] Aspect 15. The method of any one of aspects 1 to 14, wherein the phenol moiety is present in a tyrosine residue.

[00459] Aspect 16. The method of any one of aspects 1 to 15, wherein the thiol moiety is present in a cysteine residue.

[00460] Aspect 17. The method of aspect 16, wherein the cysteine residue is a native cysteine residue.

[00461] Aspect 18. The method of any one of aspects 1 to 17, wherein the biomolecule comprises one or more moieties selected from a fluorophore, an active small molecule, an affinity tag, and a metal-chelating agent.

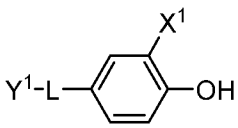
[00462] Aspect 19. The method of any one of aspects 1 to 18, wherein the reactive moiety is an orthoquinone or a semi-quinone radical, or a combination thereof.

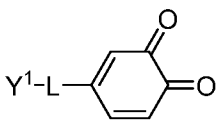
[00463] Aspect 20. The method of any one of aspects 1 to 19, wherein the biomolecule is a polypeptide.

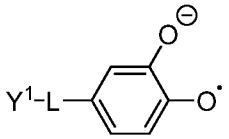
[00464] Aspect 21. The method of aspect 20, wherein the biomolecule is a polypeptide selected from a fluorescent protein, an antibody, an enzyme, a ligand for a receptor, and a receptor.

[00465] Aspect 22. The method of any one of aspects 1 to 21, wherein the biomolecule comprising a phenol moiety or a catechol moiety is of formula (I), and wherein the biomolecule comprising a reactive moiety is of formula (II) or (IIA), or a combination thereof:

[00466]







[00467] (I) (II) (IIA)

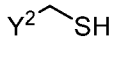
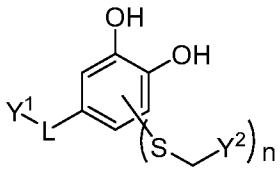
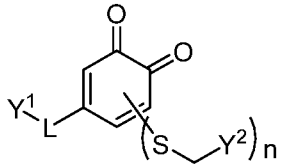
[00468] wherein:

[00469] Y^1 is a biomolecule, optionally comprising one or more moieties selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

[00470] X^1 is selected from hydrogen and hydroxyl; and

[00471] L is an optional linker.

[00472] Aspect 23. The method of any one of aspects 1 to 22, wherein the target molecule comprising a thiol moiety is of formula (III), and wherein the modified target molecule is of formula (IV), or (IVA), or a combination thereof:

[00473]   

[00474] (III) (IV) (IVA)

[00475] wherein:

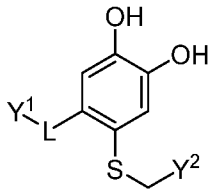
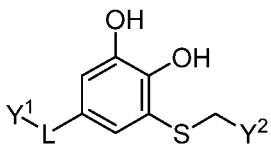
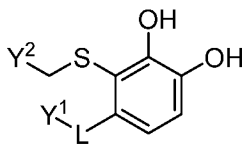
[00476] Y^1 is a biomolecule, optionally comprising one or more moieties selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

[00477] Y^2 is a second biomolecule;

[00478] L is an optional linker; and

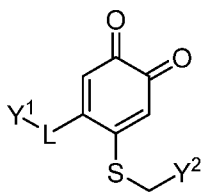
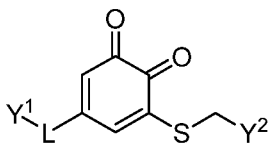
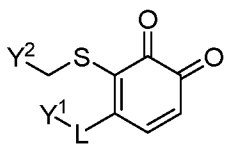
[00479] n is an integer from 1 to 3.

[00480] Aspect 24. The method of aspect 23, wherein the modified target molecule of formula (IV) is of any of formulae (IV1)-(IV3):

[00481]   

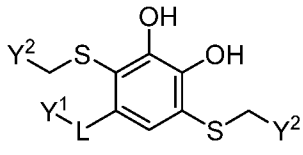
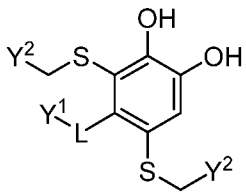
[00482] (IV1), (IV2), (IV3); and

the modified target molecule of formula (IVA) is of any of formulae (IVA1)-(IVA3):

[00483]   

[00484] (IVA1), (IVA2) , (IVA3).

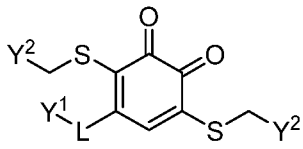
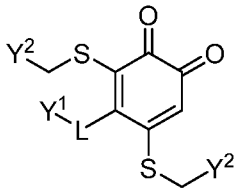
[00485] Aspect 25. The method of aspect 23, wherein the modified target molecule of formula (IV) is of any of formulae (IV5)-(IV6):

[00486]  

[00487] (IV4), (IV5); and

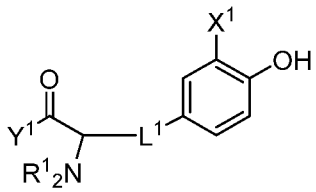
[00488] the modified target molecule of formula (IVA) is of any of formulae (IVA4)-(IVA5):

[00489]

[00490]  

[00491] (IVA4) , (IVA5).

[00492] Aspect 26. The method of any one of aspects 1 to 25, wherein the biomolecule comprising a phenol moiety or a catechol moiety is described by the formula (IA):

[00493]  (IA)

[00494] wherein:

[00495] Y^1 is a biomolecule optionally comprising one or more groups selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

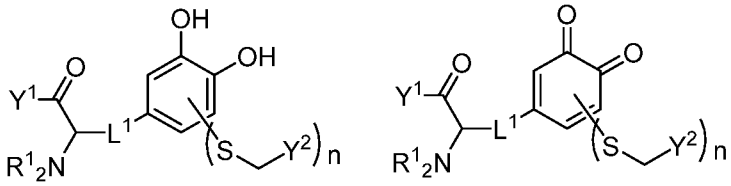
[00496] each R^1 is independently selected from hydrogen, acyl, substituted acyl, alkyl, and substituted alkyl;

[00497] X^1 is selected from hydrogen and hydroxyl; and

[00498] L^1 is a linker selected from a straight or branched alkyl, a straight or branched substituted alkyl, a polyethylene glycol (PEG), a substituted PEG, and one or more peptides.

[00499] Aspect 27. The method of aspect 26, wherein the fluorophore is a rhodamine dye or a xanthene dye.

[00500] Aspect 28. The method of any one of aspects 1 to 27, wherein the modified target molecule is described by the formula (IVB) or (IVC), or a combination thereof:

[00501] 

[00502] (IVB) (IVC)

[00503] wherein:

[00504] Y^1 is a biomolecule optionally comprising one or more groups selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

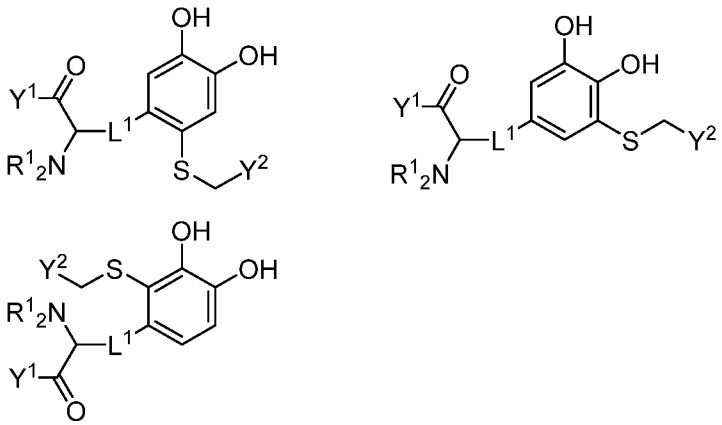
[00505] each R^1 is independently selected from hydrogen, acyl, substituted acyl, alkyl, and substituted alkyl;

[00506] Y^2 is a second biomolecule;

[00507] L^1 is a linker selected from a straight or branched alkyl, a straight or branched substituted alkyl, a polyethylene glycol (PEG), a substituted PEG, and one or more peptides; and

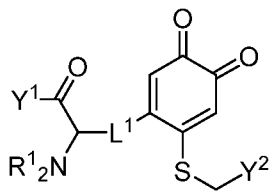
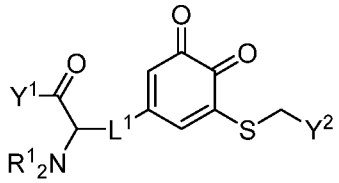
[00508] n is an integer from 1 to 3.

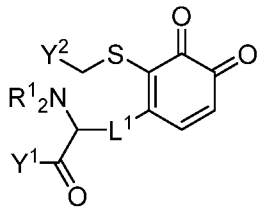
[00509] Aspect 29. The method of aspect 28, wherein the modified target molecule of formula (IVB) is of any of formulae (IVB1)-(IVZB3):

[00510] 

[00511] (IVB1), (IVB2), (IVB3); and

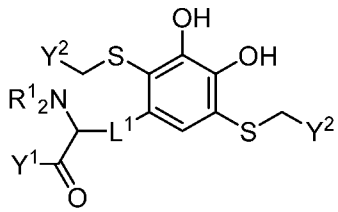
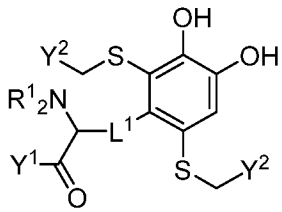
the modified target molecule of formula (IVC) is of any of formulae (IVC1)-(IVC3):

[00512]  



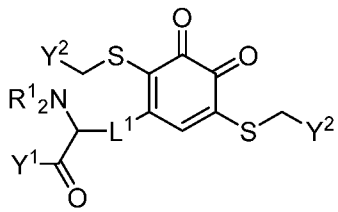
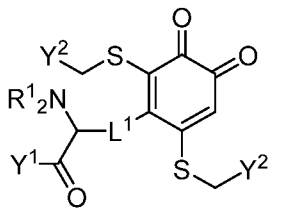
[00513] (IVC1), (IVC2) , (IVC3).

[00514] Aspect 30. The method of aspect 28, wherein the modified target molecule of formula (IVB) is of any of formulae (IVB5)-(IVB6):

[00515]  

[00516] (IVB4), (IVB5); and

[00517] the modified target molecule of formula (IVC) is of any of formulae (IVC4)-(IVC5):

[00518]  

[00519] (IVC4) , (IVC5).

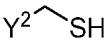
[00520] Aspect 31. The method of any one of aspects 1 to 30, wherein the method is conducted at a pH from 4 to 9.

[00521] Aspect 32. The method of aspect 31, wherein the method is conducted at neutral pH.

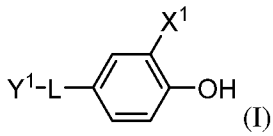
[00522] Aspect 33. The method of any one of aspects 1 to 32, wherein the target molecule comprising a thiol group is a CRISPR-Cas effector polypeptide.

[00523] Aspect 34. A composition, comprising:

[00524] a target molecule comprising a thiol of formula (III):

[00525]  (III); and

[00526] a biomolecule comprising a phenol moiety or a catechol moiety of formula (I):

[00527]  (I)

[00528] wherein:

[00529] Y^1 is a biomolecule, optionally comprising one or more moieties selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

[00530] X^1 is selected from hydrogen and hydroxyl;

[00531] L is an optional linker; and

[00532] Y^2 is a second biomolecule.

[00533] Aspect 35. The composition of aspect 34, wherein the biomolecule comprising a phenol moiety or a catechol moiety is neutral or positively charged within 50 Å of the phenol moiety or catechol moiety.

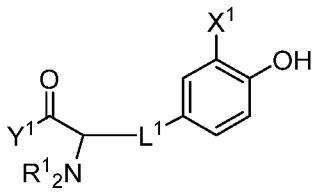
[00534] Aspect 36. The composition of aspect 34, wherein the biomolecule comprising a phenol moiety or a catechol moiety is negatively charged within 50 Å of the phenol moiety or catechol moiety.

[00535] Aspect 37. The composition of any one of aspects 34-36, wherein the Y^1 is a polypeptide and wherein Y^2 is a polypeptide.

[00536] Aspect 38. The composition of any one of aspects 34-36, wherein Y^1 is a polynucleotide and wherein Y^2 is a polypeptide.

[00537] Aspect 39. The composition of any one of aspects 34 to 38, wherein Y^2 is a CRISPR-Cas effector polypeptide.

[00538] Aspect 40. The composition of any one of aspects 34 to 39, wherein formula (I) is described by the formula (IA):

[00539]  (IA)

[00540] wherein:

[00541] Y^1 is a biomolecule optionally comprising one or more groups selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

[00542] each R^1 is independently selected from hydrogen, acyl, substituted acyl, alkyl, and substituted alkyl;

[00543] X^1 is selected from hydrogen and hydroxyl; and

[00544] L^1 is a linker selected from a straight or branched alkyl, a straight or branched substituted alkyl, a polyethylene glycol (PEG), a substituted PEG, and one or more peptides.

[00545] Aspect 41. A kit comprising:

[00546] a first container comprising a composition of any one of aspects 34 to 40; and

[00547] a second container comprising an enzyme capable of oxidizing the phenol or catechol moiety.

[00548] Aspect 42. The kit of aspect 41, wherein the enzyme is a tyrosinase polypeptide.

[00549] Aspect 43. The kit of aspect 42, wherein the tyrosinase enzyme is an *Agricus bisporus* tyrosinase enzyme (abTYR).

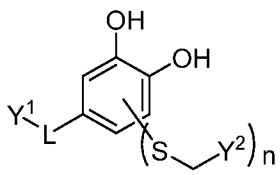
[00550] Aspect 44. The kit of aspect 42, wherein the tyrosinase polypeptide comprises an amino acid sequence having at least 75% amino acid sequence identity to the abTYR amino acid sequence depicted in FIG. 8 or FIG. 9.

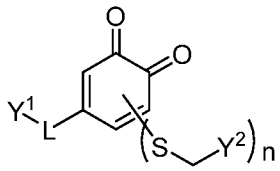
[00551] Aspect 45. The kit of aspect 42, wherein the tyrosinase enzyme is a *Bacillus megaterium* tyrosinase enzyme (bmTYR).

[00552] Aspect 46. The kit of aspect 42, wherein the tyrosinase polypeptide comprises an amino acid sequence having at least 75% amino acid sequence identity to any one of the amino acid sequences depicted in any one of FIG. 10A-10Z and 10AA-10VV.

[00553] Aspect 47. A compound, of formula (IV) or (IVA):

[00554]





[00555] (IV) (IVA)

[00556] wherein:

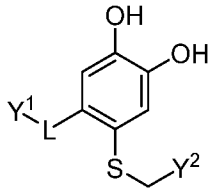
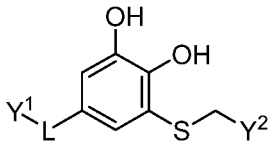
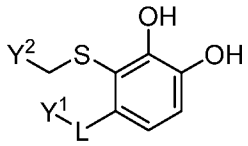
[00557] Y^1 is a biomolecule, optionally comprising one or more moieties selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

[00558] L is an optional linker;

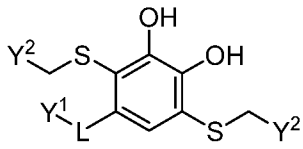
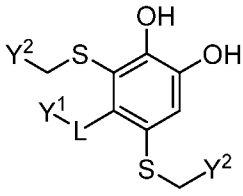
[00559] Y^2 is a second biomolecule; and

[00560] n is an integer from 1 to 3.

[00561] Aspect 48. The compound of aspect 47, wherein the modified target molecule of formula (IV) is of any of formulae (IV1)-(IV5):

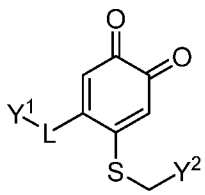
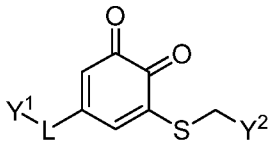
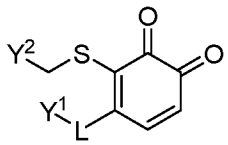
[00562]   

[00563] (IV1), (IV2), (IV3),

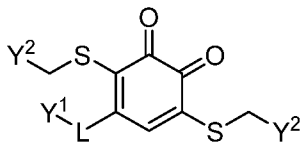
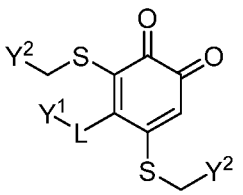
[00564]  

[00565] (IV4), and (IV5).

[00566] Aspect 49. The compound of aspect 47, wherein the modified target molecule of formula (IVA) is of any of formulae (IVA1)-(IVA5):

[00567]   

[00568] (IVA1), (IVA2) , (IVA3),

[00569]  

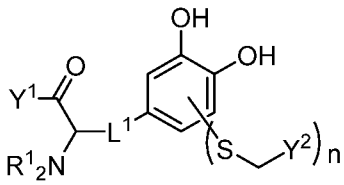
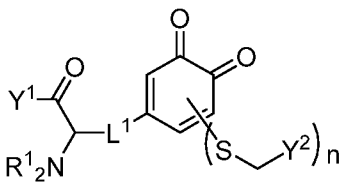
[00570] (IVA4) , and (IVA5).

[00571] Aspect 50. The compound of any one of aspects 47 to 49, wherein L is a cleavable linker.

[00572] Aspect 51. The compound of any one of aspects 47 to 50, wherein Y^1 is a polypeptide.

[00573] Aspect 52. The compound of aspect 51, wherein Y^1 is selected from a fluorescent protein, an antibody, and an enzyme.

[00574] Aspect 53. The compound of any one of aspects 47 to 52, described by the formula (IVB) or (IVC):

[00575]  

[00576] (IVB) (IVC)

[00577] wherein:

[00578] Y^1 is a biomolecule optionally comprising one or more groups selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

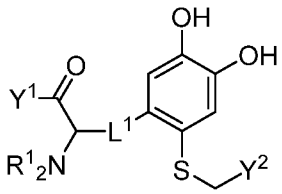
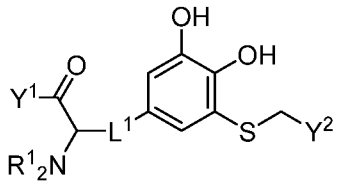
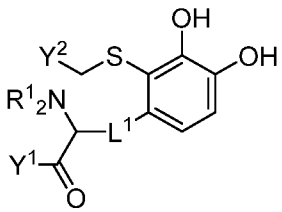
[00579] each R^1 is independently selected from hydrogen, acyl, substituted acyl, alkyl, and substituted alkyl;

[00580] Y^2 is a second biomolecule;

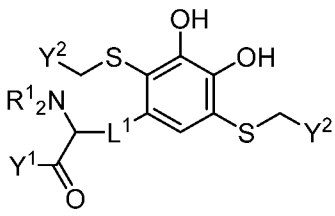
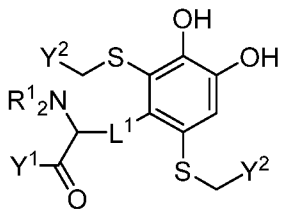
[00581] L^1 is a linker selected from a straight or branched alkyl, a straight or branched substituted alkyl, a polyethylene glycol (PEG), a substituted PEG, and one or more peptides; and

[00582] n is an integer from 1 to 3.

[00583] Aspect 54. The compound of aspect 53, wherein the modified target molecule of formula (IVB) is of any of formulae (IVB1)-(IVZB5):

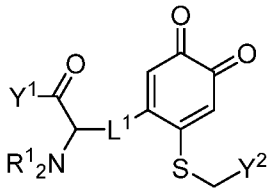
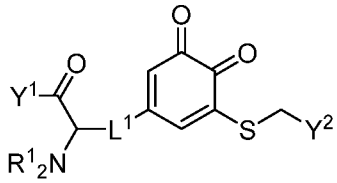
[00584]   

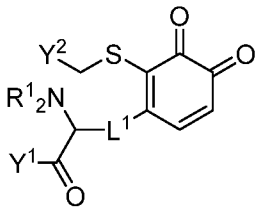
[00585] (IVB1), (IVB2), (IVB3),

[00586]  

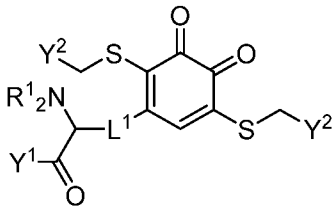
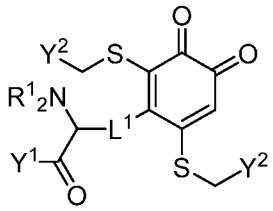
[00587] (IVB4), and (IVB5).

[00588] Aspect 55. The compound of aspect 53, wherein the modified target molecule of formula (IV) is of any one of formulae (IVC1)-(IVC5):

[00589]  

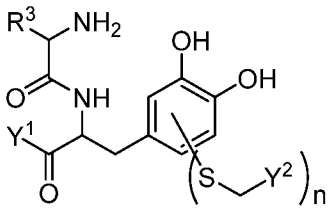
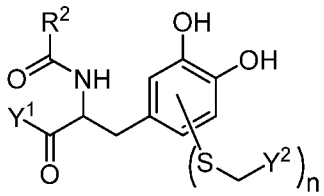


[00590] (IVC1), (IVC2) , (IVC3),

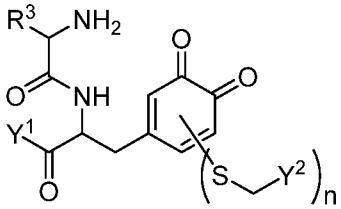
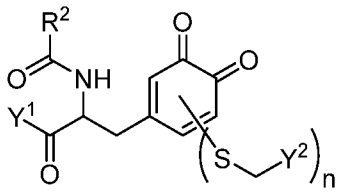
[00591]  

[00592] (IVC4) , and (IVC5).

[00593] Aspect 56. The compound of any one of aspects 47 to 55, described by any of formula (IVD)-(IVG):

[00594]  

[00595] (IVD), (IVE),

[00596]  

[00597] (IVF), and (IVG),

[00598] wherein:

[00599] R^2 is selected from alkyl, and substituted alkyl;

[00600] R^3 is selected from, hydrogen, alkyl substituted alkyl, a peptide, and a polypeptide; and

[00601] n is an integer from 1 to 3.

[00602] Aspect 57. The compound of any one of aspects 47 to 56, wherein Y^2 is a CRISPR-Cas effector polypeptide.

[00603] Aspect 58. A method for chemoselective coupling of a first polypeptide and a second polypeptide to a coupling polypeptide, the method comprising:

[00604] a) contacting the first polypeptide with the coupling polypeptide, to generate a first polypeptide-coupling polypeptide conjugate,

[00605] wherein the first polypeptide comprises a thiol moiety,

[00606] wherein the coupling polypeptide comprises an N-terminal reactive moiety that forms a covalent bond with the thiol moiety present in the first polypeptide,

[00607] wherein the coupling polypeptide comprising the N-terminal reactive moiety is generated by reaction of a polypeptide comprising an N-terminal phenol or catechol moiety and a C-terminal phenol or catechol moiety with a first enzyme capable of oxidizing the N-terminal phenol or catechol moiety, but not the C-terminal phenol or catechol moiety, to generate the N-terminal reactive moiety;

[00608] wherein the coupling polypeptide comprises two or more positively charged or neutral amino acids within ten amino acids of the N-terminal phenol or catechol moiety and two or more negatively charged amino acids within ten amino acids of the C-terminal phenol or catechol moiety; and

[00609] b) contacting the second polypeptide with the first polypeptide-coupling polypeptide conjugate,

[00610] wherein the second polypeptide comprises a thiol moiety,

[00611] wherein the first polypeptide-coupling polypeptide conjugate comprises a C-terminal reactive moiety that forms a covalent bond with the thiol moiety present in the second polypeptide,

[00612] wherein the first polypeptide-coupling polypeptide conjugate comprising the C-terminal reactive moiety is generated by reaction of the first polypeptide-coupling polypeptide conjugate with a second enzyme capable of oxidizing the C-terminal phenol or catechol moiety to generate a C-terminal reactive moiety; and

[00613] wherein said contacting generates a first polypeptide-coupling polypeptide-second polypeptide conjugate.

[00614] Aspect 59. The method of aspect 58, wherein:

[00615] a) the first enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to the abTYR amino acid sequence depicted in FIG. 8 or FIG. 9; and

[00616] b) the second enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to any one of the amino acid sequences depicted in any one of FIG. 10A-10Z and 10AA-10VV.

[00617] Aspect 60. A method for chemoselective coupling of a first polypeptide and a second polypeptide to a coupling polypeptide, the method comprising:

[00618] a) contacting the first polypeptide with the coupling polypeptide, to generate a first polypeptide-coupling polypeptide conjugate,

[00619] wherein the first polypeptide comprises a thiol moiety,

[00620] wherein the coupling polypeptide comprises an N-terminal reactive moiety that forms a covalent bond with the thiol moiety present in the first polypeptide,

[00621] wherein the coupling polypeptide comprising the N-terminal reactive moiety is generated by reaction of a polypeptide comprising an N-terminal phenol or catechol moiety and a C-terminal phenol or catechol moiety with a first enzyme capable of oxidizing the N-terminal phenol or catechol moiety, but not the C-terminal phenol or catechol moiety, to generate the N-terminal reactive moiety;

[00622] wherein the coupling polypeptide comprises two or more negatively charged amino acids within ten amino acids of the N-terminal phenol or catechol moiety and two or more positively charged or neutral amino acids within ten amino acids of the C-terminal phenol or catechol moiety; and

[00623] b) contacting the second polypeptide with the first polypeptide-coupling polypeptide conjugate,

[00624] wherein the second polypeptide comprises a thiol moiety,

[00625] wherein the first polypeptide-coupling polypeptide conjugate comprises a C-terminal reactive moiety that forms a covalent bond with the thiol moiety present in the second polypeptide,

[00626] wherein the first polypeptide-coupling polypeptide conjugate comprising the C-terminal reactive moiety is generated by reaction of the first polypeptide-coupling polypeptide conjugate with a second enzyme capable of oxidizing the C-terminal phenol or catechol moiety to generate a C-terminal reactive moiety; and

[00627] wherein said contacting generates a first polypeptide-coupling polypeptide-second polypeptide conjugate.

[00628] Aspect 61. The method of aspect 60, wherein:

[00629] a) the first enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to any one of the amino acid sequences depicted in any one of FIG. 10A-10Z and 10AA-10VV; and

[00630] b) the second enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to the abTYR amino acid sequence depicted in FIG. 8 or FIG. 9.

[00631] Aspect 62. A method of covalently linking a first polypeptide to a second polypeptide, the method comprising:

[00632] a) contacting the first polypeptide with an immobilized reactive moiety,

[00633] wherein the immobilized reactive moiety is generated by reaction of an immobilized phenol moiety or catechol moiety with a first enzyme, wherein the first enzyme is capable of oxidizing the immobilized phenol moiety or catechol moiety, thereby generating the immobilized reactive moiety,

[00634] wherein the first polypeptide comprises: i) a thiol moiety; and ii) a phenol moiety or a catechol moiety, wherein the first polypeptide comprises two or more negatively charged amino acids within ten amino acids of the phenol moiety or the catechol moiety,

[00635] wherein the immobilized reactive moiety forms a covalent bond with the thiol moiety present in the first polypeptide, thereby generating an immobilized first polypeptide;

[00636] b) contacting the immobilized first polypeptide with second enzyme, wherein the second enzyme is capable of oxidizing the phenol moiety or the catechol moiety present in the first polypeptide to generate an immobilized first polypeptide comprising a reactive moiety; and

[00637] c) contacting the immobilized first polypeptide comprising a reactive moiety with a second polypeptide,

[00638] wherein the second polypeptide comprises: i) a thiol moiety; and ii) a phenol moiety or a catechol moiety, wherein the second polypeptide comprises two or more neutral or positively charged within ten amino acids of the phenol moiety or the catechol moiety,

[00639] wherein the reactive moiety present in the immobilized first polypeptide forms a covalent bond with the thiol moiety present in the second polypeptide, thereby generating an immobilized conjugate comprising the first polypeptide covalently linked to the second polypeptide.

[00640] Aspect 63. The method of aspect 62, wherein the first enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to any one of the amino acid sequences depicted in any one of FIG. 8, FIG. 9, FIG. 10A-10Z, and 10AA-10VV.

[00641] Aspect 64. The method of aspect 62 or aspect 63, wherein the thiol moiety present in the first polypeptide is present in a Cys, and wherein the phenol moiety present in the first polypeptide is present in a Tyr residue.

[00642] Aspect 65. The method of aspect 64, wherein the Tyr residue is present in a stretch of amino acids comprising EEEY (SEQ ID NO: 953), EEEEY (SEQ ID NO: 955), DDDDY (SEQ ID NO: 965), or DDDDY (SEQ ID NO: 965).

[00643] Aspect 66. The method of any one of aspects 62-65, wherein the second enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to any one of the amino acid sequences depicted in any one of FIG. 10A-10Z and 10AA-10VV.

[00644] Aspect 67. The method of any one of aspects 62-66, further comprising:

[00645] c) contacting the immobilized conjugate with a third enzyme, wherein the third enzyme is capable of oxidizing the phenol moiety or the catechol moiety present in the second polypeptide to generate an immobilized conjugate comprising a reactive moiety; and

[00646] c) contacting the immobilized conjugate comprising a reactive moiety with a third polypeptide,

[00647] wherein the third polypeptide comprises: i) a thiol moiety; and ii) a phenol moiety or a catechol moiety, wherein the third polypeptide comprises two or more negatively charged within ten amino acids of the phenol moiety or the catechol moiety,

[00648] wherein the reactive moiety present in the immobilized conjugate forms a covalent bond with the thiol moiety present in the second polypeptide, thereby generating an immobilized conjugate comprising the third polypeptide covalently linked to the second polypeptide.

[00649] Aspect 68. The method of aspect 67, wherein the third enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to the amino acid sequence depicted in FIG. 8 or FIG. 9.

[00650] Aspect 69. The method of aspect 67 or 68, wherein, between step (b) and step (c), the second enzyme is inactivated or removed.

[00651] Aspect 70. The method of any one of aspects 67-69, wherein the thiol moiety present in the second polypeptide is present in a Cys, and wherein the phenol moiety present in the second polypeptide is present in a Tyr residue.

[00652] Aspect 71. The method of aspect 70, wherein the Tyr residue is present in a stretch of amino acids comprising RRRY (SEQ ID NO: 949), RRRRY (SEQ ID NO: 951), KKKY (SEQ ID NO: 966), or KKKKY (SEQ ID NO: 967).

EXAMPLES

[00653] The following examples are put forth so as to provide those of ordinary skill in the art with a complete disclosure and description of how to make and use the present invention, and are not intended to limit the scope of what the inventors regard as their invention nor are they intended to represent that the experiments below are all or the only experiments performed. Efforts have been made to ensure accuracy with respect to numbers used (e.g. amounts, temperature, etc.) but some experimental errors and deviations should be accounted for. Unless indicated otherwise, parts are parts by weight, molecular weight is weight average molecular weight, temperature is in degrees Celsius, and pressure is at or near atmospheric. Standard abbreviations may be used, e.g., bp, base pair(s); kb, kilobase(s); pl, picoliter(s); s or sec, second(s); min, minute(s); h or hr, hour(s); aa, amino acid(s); kb, kilobase(s); bp, base pair(s); nt, nucleotide(s); i.m., intramuscular(ly); i.p., intraperitoneal(ly); s.c., subcutaneous(ly); and the like.

[00654] Exemplary phenol and catechol containing intermediates may be synthesized using any convenient method. Methods which can be adapted for use in preparing exemplary phenol and catechol containing intermediates of this disclosure includes those methods described by Maza et al. in "Enzymatic Modification of N-Terminal Proline Residues Using Phenol Derivatives", *J. Am. Chem. Soc.* (2019), 141, 3885-3892, the disclosure of which is herein incorporated by reference in its entirety. Many general references providing commonly known chemical synthetic schemes and conditions useful for synthesizing the disclosed compounds are also available (see, e.g., Smith and March, March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, Fifth Edition, Wiley-Interscience, 2001; or Vogel, A Textbook of Practical Organic Chemistry, Including Qualitative Organic Analysis, Fourth Edition, New York: Longman, 1978). Reactions may be monitored by thin layer chromatography (TLC), LC/MS and reaction products characterized by LC/MS and ^{1}H NMR.

Example 1

[00655] Unless otherwise specified all chemicals were purchased from Sigma Aldrich. Peptides were purchased from Genescript. Peptide sequences may be found in SI.

Tyrosinase Coupling Reactions

[00656] MS2 conjugation was carried out on a cysteine mutant of the capsid which replaces the asparagine residue at position 87 with a cysteine (N87C). Coupling conditions were 20 mM pH 6.5 Phosphate, 10 uM N87C MS2, Tyrosinase purchased from Sigma-Aldrich (CAS number 9002-10-2), was diluted in 50 mM phosphate pH 6.5 was added at a 1:10 ratio to a final concentration of 0.16 μM. The coupling reagent unless otherwise noted was added to a final

concentration of 50 μM or 5x MS2 monomer concentration. Ultra Pure water (Milipore Sigma, 18 uohm resistance) was added to a final volume of 20 μL. Reactions were carried out for 30 minutes at room temperature before quenching with 2 uL 20 mM Tropolone and 20 mM TCEP, yielding a final concentration of 2mM for each.

[00657] For stability studies, loose tyrosinase was replaced with enzyme coupled to resin. Reactions were carried out as above with the addition of a filtration step through 0.2 um filters to remove excess tyrosinase as well as quenching with 1mM Tropolone and TCEP.

[00658] Cas9 coupling occurred under the following conditions: 20 mM Tris HCl, 300 mM KCl, 50 mM Trehalose pH 7.0 (Buffer A), 4°C 1 hr. 10 uM Cas9. All samples were quenched with using the quenching solution as above, then solvent exchanged into Buffer A three times using a 100,000 kDa MWCO spin concentrator. For peptide coupling, peptides were added at a 5x ratio, yielding 50 uM peptide concentration. In protein-protein coupling it was found that a 1:1 ratio of Cas9: target protein yielded near-quantitative conversion to the singly modified Cas9 after filtration, while a 1:5 ratio of Cas9: target yielded full conversion to the doubly modified product.

[00659] FIG. 1 shows the scheme of the reaction on the protein scale.

[00660] FIG. 2, panel A shows that capping the thiols via a maleimide on the protein blocks addition via tyrosinase catalyzed reaction, and that the converse, where tyrosinase is performed first, also blocks the reaction of maleimide.

[00661] FIG. 2, panel B shows a series of stability studies, demonstrating that the conjugate linkage is stable over time in a variety of buffer conditions.

[00662] FIG. 3 shows a diverse array of substrates have been used in the subject methods.

[00663] FIG. 4 shows mass spectrum data supporting the addition of a variety of peptides using the subject methods.

[00664] FIG. 5, panel A demonstrates that Cas9 can be modified using the subject methods.

[00665] FIG. 5, panel B, demonstrates that the modified Cas9 retains activity, even if the reaction is performed on the apo protein, i.e., Cas9 without its guide RNA.

[00666] FIG. 5, panel C demonstrates that Cas9 can be modified with another protein, in this case GFP with an N-terminal Tyrosine.

[00667] FIG. 5, panel D demonstrates that the GFP-Cas9 conjugate retains activity.

[00668] FIG. 6 demonstrates that Cas9 modified with a peptide that is the 2NLS sequence Ac-YGPKKKRKVGGSPKKKRKV (SEQ ID NO:943), in which case a 20x improvement in editing in neural progenitor cells.

[00669] FIG. 7 illustrates ESI-TOF data showing modification of a phenol containing protein with small molecule thiols.

Example 2

[00670] A system that takes advantage of the charge limitations of abTYR, while employing a semi-orthogonal tyrosinase from the bacteria Bacillus *megaterium* (bmTYR) (Goldfeder et al. (2013) *Biochim. Biophys. Acta - Proteins Proteomics* 1834:629; Kanteev et al. (2013) *J. Biol. Inorg. Chem.* 18:895; Kanteev et al. (2015) *Protein Sci* 24:1360; Sendovski et al. (2010) *Acta Crystallogr. Sect. F Struct. Biol. Cryst. Commun.* 66:1101; Shuster Ben-Yosef et al. (2010) *Enzyme Microb. Technol.* 47:372; Shuster et al. (2009) *J. Mol. Microbiol. Biotechnol.* 17:188) was developed.

[00671] To explore the effects of substrate charge on abTYR, a library of fifteen 5-mer peptides was obtained, and a charge screen of abTYR was conducted by comparing the yields of the coupling reaction between the peptide library and both Y182C GFP and pAF MS2. These substrates were chosen as they represent a single thiol in the case of Y182C GFP and a single aniline in the case of pAF MS2, as well as both a positive and negatively charged protein substrate. Based on the data, it appears that abTYR is sensitive to both charge and steric hinderance around the tyrosine residue, with negative charge being a much more detrimental factor than steric bulk. In both cases, a -4 charge was enough to completely inhibit tyrosinase activity on peptide (FIG. 11).

[00672] In order to explore the potential reasons behind abTYR's charge preferences, the protein's crystal structure was examined and it was noted that abTYR has a large overall negative charge around its active site, due to the abundance of glutamate and aspartate residues. It was hypothesized that these "gatekeeper" residues are what is causing the charge preferences of abTYR (FIG. 12 A).

[00673] Expressing eukaryotic enzymes in bacteria is nontrivial; in addition, abTYR is hetero-tetrameric which adds further complexity to its expression. A monomeric bacterial tyrosinase with a published crystal structure was identified. The tyrosinase from *Bacillus megaterium* (bmTYR) (Goldfeder et al. (2013) *supra*; Kanteev et al. (2013) *supra*; Kanteev et al. (2015) *supra*; Sendovski et al. (2010) *supra*; Shuster Ben-Yosef et al. (2010) *supra*; Shuster et al. (2009) *supra*) was studied. bmTYR has a positively charged active site, which confirmed by the crystal structure (FIG. 12B). bmTYR was expressed in *E. coli* and initial trials of the peptide charge screen were carried out. The data indicated that bmTYR can accept negatively charged substrates (FIG. 13, 14). Additionally, bmTYR is inhibited by tropolone similarly to abTYR. Expressing bmTYR mutants in order to increase catalytic activity can be carried out. Based on

the literature the mutations: F197A, R209H, V218G, and V218F (Kanteev et al. (2015) *supra*; Sendovski et al. (2010) *supra*; Shuster Ben Yosef et al. (2010) *supra*; Shuster Ben-Yosef (2010) *supra*) give rise to some varied and beneficial properties including better retention of copper molecules, greater selectivity for phenolic targets, and both increased and decreased sensitivity to steric bulk. Additionally, bmTYR with the mutations D55K and E141K can be used, which should give rise to a tyrosinase which acts only on negatively charged substrates. These residues, D55 and E141 are located adjacent to the active site and are highlighted in red (FIG. 12 B).

Example 3

Results

[00674] In the course of initial studies on abTYR-mediated oxidative coupling of phenol-functionalized cargo, it was asked whether the N-terminal tyrosine residue on the α-endorphin peptide (FIG. 16 a) would be sterically accessible enough to reach into the abTYR active site. This reaction with p-Aminophenylalanine (pAF) MS2 viral capsid coupling partner was tested. Clean, near-quantitative conversion to the functionalized viral capsid was observed (FIG. 16 b). Acetylation of the α-endorphin N-terminus was essential to the success of the reaction, since the free N-terminus would readily attack the proximal *o*-quinone, as it does upon the oxidation of the free L-Tyrosine amino acid during melanin biosynthesis (Ramsden et al. (2014) *Bioorganic Med. Chem.* 22:2388).

[00675] To test the reaction on a challenging protein substrate, a GGY tag was chosen to be appended to the single chain variable fragment (scFv) of the Trastuzumab antibody. Trastuzumab is an FDA approved monoclonal antibody for the treatment of $HER2^+$ breast cancer (Plosker et al. (2006) *Drugs* 66:449) and is widely used as a model construct for testing bioconjugation reactions (Chen et al. (2016) *Sci. rep.* 6:1; Zhang et al. (2015) *Nat. Chem.* 8:120; Ban et al. (2013) *Bioconjug. Chem.* 24:520; Bruins et al. (2017) *Bioconjug. Chem.* 28:1189). Trastuzumab is also commonly used in single chain variable fragment (scFv) format, which is of interest because of its improved tissue and tumor penetration relative to full length antibodies (Yokota et al. (1992) *Cancer Res.* 52:3402; Batra et al. (2002) 13:603) as well as its potential to be used for constructing bispecific antibodies(Brinkmann et al. (2017) *MAbs* 9:182). An established *E. coli* periplasmic expression protocol was chosen to produce the Trastuzumab scFv with a C-terminal -GGY tag (Rouet et al. (2012) *Nat. Protoc.* 7:364). One potential challenge presented by this substrate is that, of its 15 tyrosine residues, 8 are located on the antigen binding site with their phenol side chains oriented toward the bulk solution. Despite the potential for off target oxidation of the internal tyrosine residues, it was observed that the C-terminally -GGY tagged version of the scFv was near-quantitatively coupled to a model Aniline nucleophile (FIG. 16) while a non-tagged version is virtually untouched under the reaction conditions (FIG. 23).

[00676] The exceptionally clean conversion of this substrate led to the use of it as a model for testing several parameters of the reaction. While conducting these investigations, abTYR concentrations were measured in units of U/mL, as equal masses of different batches of abTYR were found vary somewhat in their enzymatic activity (e.g. 1 mg/mL tyrosinase stock solutions typically had activities of between 900 and 1200 U/mL, corresponding to 150 to 200 nM of enzyme in a typical 12 U/mL reaction).Varying the concentration of Aniline from 25 μM to 750 μM showed that maximum conversion was achieved at a concentration of 150 μM (FIG. 16 b) with at least 8 U/mL abTYR. However, at lower abTYR concentrations, higher concentrations of Aniline appeared to inhibit tyrosinase, as evidenced by residual un-oxidized starting material in these reactions (FIG. 24). To reduce inhibition of abTYR by the nucleophilic coupling partner, the concentration screen was repeated with o-Toluidine and 2,6-Dimethylaniline (FIG. 26, FIG. 17), which was hypothesized to not occlude the tyrosinase active site as readily. However, these nucleophiles provided lower conversion than Aniline at every concentration tested.

[00677] The fact that residual un-coupled protein was fully oxidized by TOF-LCMS in reactions with at least 8 U/mL tyrosinase suggests that the coupling partner has a limited time to intercept the *o*-quinone intermediate before it is quenched by a competing process. A late nucleophile addition experiment, in which Aniline was added to the a series of scFv-GGY OC reactions 5, 10, 20, 40, or 60 min after Tyrosinase, showed that while the starting protein is completely oxidized in every case, the amount of product formed depends upon how soon after the start of the reaction the coupling partner is added (FIG. 25).

[00678] Given the importance of the rate at which the nucleophile reacts with the *o*-quinone intermediate, what the optimal coupling partner might be between the 4-aminophenyl group and its cargo was investigated. 4-Aminophenyl-*N*-methylamide, *p*-Anisidine, and *p*-Toluidine were used as model compounds to probe the best means of attaching 4-Aminophenols to other substrates. 4-Aminophenyl-*N*-methylamide provided the cleanest reactions while *p*-Anisidine and *p*-Toluidine provided poor results. **p*-Anisidine reaction turned orange, indicating oxidation of the nucleophile and secondary modification of the protein. Finally, the coupling efficiencies of various piperazines and a racemic N-methyl pyrrolidine were assessed. These proved to be inferior nucleophiles as much higher micromolar and millimolar concentrations were required to achieve good conversions (FIG. 16 c; FIG. 27). N-methyl-pyrrolidine – a model for a proline N-terminus – provided the best conversion in this category of nucleophiles.

[00679] To demonstrate that the abTYR-mediated modification of the -GGY tagged Trastuzumab scFv did not perturb the binding activity of this construct, the fluorescent dye Oregon Green (O.G.) 488 was derivatized with an Aniline nucleophile and oxidatively coupled onto the scFv. The reaction proceeded optimally with 25 μM Aniline-O.G. 488 with 12 U/mL

abTYR to give the scFv-GGY-An-O.G. 488 construct with 85% conversion. Flow cytometry showed that this construct could recognize the HER2+ SK-BR-3 breast cancer cell line selectively over HER2- MDA-MB-468 breast cancer cells (FIG. 22 d).

[00680] The product structure of the oxidative coupling reaction between p-aminophenylalanine and *o*-methoxyphenols and *o*-aminophenols mediated by sodium periodate and potassium ferricyanide (Obermeyer et al. (2014) *Angew. Chemie – Int. Ed.* 53:1057; Elsohly et al. (2017) *J. Am. Chem. Soc.* 139:3767) has been characterized previously and the product masses observed in the tyrosinase-mediated coupling are consistent with the expected structure. Nonetheless,the coupling product by NMR was characterized to confirm the equivalence of the reactions. A small-molecule model reaction was performed between *N*-Acetyl-L-Tyrosine and *p*-Toluidine in D_2O with abTYR. The reaction required more tyrosinase and an extended reaction time to proceed in D_2O and turned dark purple. Direct NMR observation of the reaction mixture revealed a single primary product consistent with that shown in the figures.

[00681] The stability of the aniline conjugate to the Tyr-tagged scFv was monitored at 4 °C over the course of 7 days in a standard phosphate and NaCl protein storage buffer with 15% glycerol (pH 7.4) and the linkage was found to be intact (FIG. 30). Addition of 10 mM dithiothreitol (FIG. 29) or glutathione (FIG. 31) resulted in the formation of thiol adducts. In the case of glutathione, this further modification occurred quantitatively within 24 hours. FIG. 32 shows sequential treatment of the aniline-coupled scFv with Glutathione then DTT. Despite this additional modification, in both cases the aniline linkage remained intact.

[00682] The methodology was also tested on diverse protein substrates by expressing several full-length proteins with tyrosine tags at the N or C termini.

[00683] Protein-L is an IgG binding protein that recognizes variable regions of human kappa light chains. Discovered in pathogenic *Peptostreptococcus magnus*, it consists of five binding domains (Donaldson et al. (2013) *Proc. Natl. Acad. Sci. U.S.A.* 110:17456) connected in tandem by short 9-10 amino acid linkers (Kastern et al. (1992) *J. Biol. Chem.* 267:12820) (FIG. 20 a). The avidity of the combined interactions of these five domains allows the protein to achieve a K_d of 130 nM at pH 8 (Beckingham et al. (1999) *Biochem. J.* 340:193). When expressed recombinantly, cell-wall anchoring domains of the wild type protein are typically omitted, and some truncated versions have only 3 or 4 light chain binding domains. Protein-L is routinely used for the purification of scFv's (Song et al. (2015) *Protein Expr. Purif.* 116:98) and has been employed as a universal flow cytometry marker for cells expressing Chimeric Antigen Receptors (CARs) (Zheng et al. (2012) *J. Transl. Med.* 10:1) which typically utilize scFv's to recognize their targets. Because Protein-L binds to variable light chains without interfering with the antigen

recognition loops, it can be used as a "secondary" detection reagent for bound scFv's as well as IgG's.

[00684] Protein-L was expressed in *E. coli* with pendent -GGY and -GGGGSGGY (SEQ ID NO: 968) tags for abTYR-mediated modification with aniline-functionalized O.G. 488 to create a secondary scFv detection reagent. However, these constructs were resistant to oxidation by abTYR, most likely because the terminal tyrosine residue does not extend far enough away from the bulk of the protein structure to reach into the sterically occluded abTYR active site. The same problem was encountered when short, -GGY and -SSGGGGY (SEQ ID NO: 948) tags were appended to the C-terminus of Maltose Binding Protein (MBP). In order to circumvent this problem, a collection of Protein-L variants with C-terminal linkers of various types and lengths preceding the tyrosine tag was generated (FIG. 20 b, FIG. 28). In addition to the flexible $(G_4S)_{1-3}$ linkers, Protein-L was extended with an alpha-helical $(EAAAK)_2$ (SEQ ID NO: 969) repeat sequence (Arai et al. (2001) *Protein Eng.* 14:529), a non-hydrogen bonding, rigid $(AP)_3$ repeat (Chen et al. (2013) *Adv. Drug Deliv. Rev.* 65:1357), a poly asparagine (N_{20}) sequence, and the C-terminal sequence of the easily-modified Trastuzumab scFv (EIKRTGGY) (SEQ ID NO: 970). Additionally, the C-terminal 5th light chain binding domain was deleted and the native linker between the 4th and 5th light chain binding domains was extended with -GGY and -G_4SGGY (SEQ ID NO: 968) tags. Disappointingly, none of these variants could be oxidized by abTYR.

[00685] It was recognized that the steric bulk of the 120 kDa tyrosinase protein will likely make access to the active site difficult on many protein substrates. While in principle, it should be possible to generate an abTYR-oxidizable variant by continuing to extend the C-terminal linker, longer linkers increase the risk of the tag interfering with protein function, and are more difficult to install by PCR, reducing the convenience of the tyrosine tagging approach. Therefore, there was motivation to express and test the much smaller *Bacillus megaterium* Tyrosinase (bmTYR). This 35.5 kDa protein is robustly expressed in BL21 (DE3) *E. coli* with a yield of up to 200 mg/L and has a much more sterically exposed active site in comparison to abTYR. Gratifyingly, all tyrosine-tagged Protein-L variants exposed to bmTYR were quantitatively oxidized and reacted with 150 μM aniline with over 90% conversion while the non-tagged variant was untouched (FIG. 20 b, FIG. 28). Tyrosine-tagged MBP variants were successfully oxidized by bmTYR as well, though in this case, the reaction took more than 1 hour to reach high conversion.

[00686] With a solution to Protein-L modification in hand, the bmTYR mediated OC was performed with 25 μM of the Aniline-O.G. 488 nucleophile on the -AN_{20}GGY tagged Protein-L variant. The desired conjugate was obtained with 87% conversion (FIG. 22 c). This construct was then applied to HER2+ (SK-BR-3) or HER2- (MDA-MB-468) breast cancer cells which had

been pre-treated with the non-tyrosine tagged Trastuzumab scFv. Only the Protein-L construct that had been modified with Aniline-O.G. 488 under the bmTYR-mediated OC conditions was able to label HER2+ cells after exposure to the scFv (FIG. 22 d). Cells without HER2 or samples with a component omitted from the coupling and labeling workflow were untagged.

Materials and Methods

Reagents

[00687] All chemicals were ordered from Sigma Aldrich or ThermoFisher Scientific and used as received unless noted otherwise. Milli-Q H_2O was used.

[00688] *Agaricus bisporus* Tyrosinase ("Tyrosinase from Mushroom") was obtained from Sigma Aldrich as a lyophilized powder and stored at -20 °C when received. 1 mg/mL stock solutions were prepared in 50 mM phosphate buffer, in 15% glycerol in water, pH 6.5, stored at -80 °C. Aliquots were thawed on ice shortly before use and the activity of each new stock was assayed. A stability study has indicated that the activity of abTYR aliquots stored in this manner changes very little over months of storage at -80 °C.

Protein Constructs

[00689] Protein gene blocks were ordered from Integrated DNA Technologies, codon-optimized for *E. coli* expression. Bsa1 cut sites were present at either end of the gene sequence for cloning into the pET28b golden gate entry vector. This vector enabled green / white screening for colonies successfully transformed with plasmids bearing the inserted gene.

Representative Tyrosinase-mediated oxidative coupling reaction for subsequent TOF-LCMS analysis

[00690] Volumes of each stock solution were added to an Eppendorf tube with the tyrosinase enzyme added last. The resulting solution was allowed to stand at room temperature for 60 minutes before adding 5.0 µL of a 21 mM aqueous solution of tropolone. The quenched reaction was subject to four cycles of spin desalting in a 10 kDa MWCO 500 µL amicon ultra centrifugal filter, diluting with 400 µL of Milli-Q H_2O before each cycle to remove aniline, and phosphate buffer. The resulting 35-50 µL droplet was passed through a 0.22 µm cellulose acetate centrifugal filter and submitted to TOF-LCMS analysis.

Cytosolic expression of recombinant proteins – Liter Scale

[00691] A 10 mL overnight culture of BL21 (DE3) Star *E. coli* in TB medium with 50 µg/mL kanamycin was inoculated into a 2.8 L trident Erlenmeyer flask with 1 L of sterile Terrific Broth medium and kanamycin. The cultures were grown at 37 °C with 220 rpm shaking until O.D. at 600 nm reached 0.6 – 0.8. To induce expression, IPTG was added from a 1.0 M stock to a final concentration of 1.0 mM. The cultures were incubated at the temperature, time, and shaking

speed given in the table above. The culture was pelleted via centrifugation (3,200 g, 15 min, 4 °C) and the supernatant was discarded. All steps from this point were performed with cold (4 °C) buffers and on ice. Each pellet was re-suspended in 45 mL of D.I. H_2O then pelleted in 50 mL falcon tubes (3,200 g, 15 min, 4 °C). The supernatant was poured off and the pellets were either stored at -80 °C or lysed immediately.

[00692] Each cell pellet (from 0.5 L culture) was re-suspended in 25 mL of lysis buffer (PBS, 20 mM imidazole, pH 7.4 with 0.1 mM Phenylmethylsulfonyl fluoride, 0.05 U/mL benzynase, and 0.5 mg/mL chicken egg white lysozyme). The cells were incubated on ice for at least 30 minutes then lysed by 10 min of sonication (2 sec on, 3 sec off pulses at 60% amplitude). The resulting suspension was centrifuged (14,000 g, 30 min, 4 °C) and the supernatant was passed through a 0.2 μm syringe filter. The crude lysate was subject to NiNTA purification using a G.E. Healthcare HisTrap HP 5mL affinity column equilibrated with Buffer A (PBS with 20 mM imidazole, pH 7.4). The protein was eluted using a gradient of 0-100% Buffer B (PBS with 400 mM imidazole, pH 7.4) over 20 column volumes. Product containing fractions were identified using SDS-PAGE and submitted to further purification as needed. Purified protein was exchanged into protein storage buffer (PBS with 15% glycerol) via 4 rounds of spin concentration in 10 kDa MWCO, 15 mL amicon ultra centrifugal filters, diluting with storage buffer before each spin.

Cytosolic Expression of Recombinant Proteins – 10-50 mL Scale

[00693] Expression and cell pellet processing were carried out as above.

[00694] Pellets were re-suspended in 1.0 mL of lysis buffer and sonicated for 45 sec (5 sec on, 5 sec off pulses at 50% amplitude). Lysates were centrifuged for 10 min at 16,100 g. Supernatant was retained and solids were discarded. For each lysate, 10 μL of HisPur NiNTA resin (Thermo Scientific Products #88221; capacity of 60 mg His_6-protein per mL suspended resin) per mL of cell culture was equilibrated with binding buffer (PBS, 20 mM Imidazole, pH 7.4). The resin was then suspended in the cell lysate and incubated at 4 °C for 1 hour. After binding, resin aliquots were washed 2x with binding buffer, then bound proteins were released with elution buffer (PBS, 80 mM Imidazole, pH 7.4). The purity of eluted proteins was assessed with SDS-PAGE and TOF-LCMS. Proteins were exchanged into protein storage buffer (20 mM Na_2HPO_4, 150 mM NaCl, in 15% glycerol, pH 7.4) via 4 cycles of centrifugation (14,000 g, 20 min, 4 °C) in 10 kDa MWCO 500 μL amicon ultra spin desalting filters, diluting to 500 μL with protein storage buffer before each cycle.

Maltose Binding Protein (MBP)

[00695] After NiNTA purification, MBP-containing fractions were combined, concentrated to 20 mL in 10 kDa MWCO, 15 mL amicon ultra centrifugal filters then dialyzed into anion exchange Buffer A (25 mM TRIS-HCl, 20 mM NaCl, pH 7.9), then loaded onto a G.E. Healthcare HiTrap Q HP 5 mL column and eluted with a gradient of 0-100% Buffer B (25 mM TRIS-HCl, 500 mM NaCl, pH 7.9) over 20 column volumes.

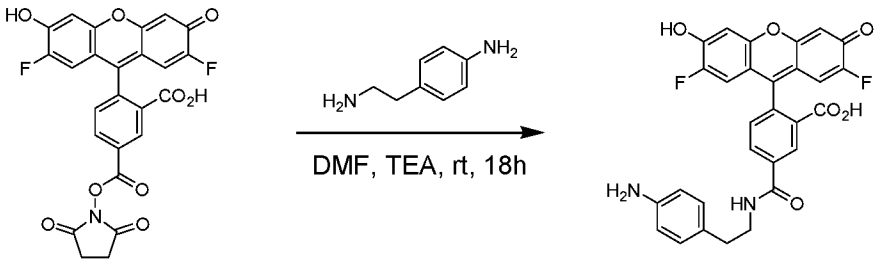
Periplasmic expression and purification of Trastuzumab scFv

[00696] The following procedure was adapted from a protocol by Rouet et al. (2012), *supra*. Two finless 4 L Erlenmeyer flasks containing 1 L of sterile Terrific Broth medium with 50 μg/mL kanamycin each, were inoculated with 10 mL overnight TB medium cultures of BL21 (DE3) Star *E. coli* cells bearing the PelB – Trastuzumab scFv – GGY or wild type C-terminus gene construct in pET28b. The cultures were grown at 37 °C with 220 rpm shaking until O.D. at 600 nm reached 0.6 – 0.8. To induce expression, IPTG was added from a 1.0 M stock to a final concentration of 0.4 mM. The cultures were then incubated at 28 °C with 200 rpm shaking. After 4 hours, each 1 L culture was divided into two centrifuge bottles and pelleted by centrifugation (3,200 g, 15 min, 4 °C) and the supernatant was discarded. All steps from this point were performed with cold (4 °C) buffers and on ice. Each pellet (from 0.5 L culture) was re-suspended in 25 mL of periplasmic extraction buffer 1 (20% w/v sucrose, 100 mM TRIS-HCl, 1.0 mM EDTA, pH 8.0) and incubated for 30 min. The cells were pelleted by centrifugation (10,000 g, 10 min, 4 °C) using a fixed-angle rotor, and the supernatant was poured off and saved as "periplasmic extract 1". The pellets were each re-suspended in 25 mL of periplasmic extraction buffer 2 (5.0 mM $MgCl_2$) and incubated on ice for 30 min. The cells were again pelleted by centrifugation (10,000 g, 10 min, 4 °C) and the supernatant was poured off and saved as "periplasmic extract 2". The periplasmic extracts were both found to contain scFv by SDS-PAGE. The extracts were combined, concentrated to 50 mL via multiple rounds of centrifugation in 10 kDa MWCO amicon ultra centrifugal filters (4000 g, 20 min, 4 °C), then passed through 0.22 μm PES syringe filters. The periplasmic extracts were transferred to 3500 Da MWCO dialysis cassettes and incubated in 4 L of PBS overnight with gentle stirring.

[00697] A 5 mL G.E. Healthcare Capto L (resin-bound Protein L) affinity column was equilibrated with Buffer A (50 mM citrate, 400 mM NaCl, pH 6.0). The dialyzed periplasmic extracts were again passed through a 0.22 μm PES syringe filter, loaded onto the Capto L column, and eluted with a gradient of 0-100% Buffer B (50 mM citrate, pH 2.5) over 22 column volumes. Fraction collection tubes were pre-filled with 1.0 mL of 1.0 M TRIS HCl buffer at pH

8.0 to neutralize elution buffer. scFv typically eluted at 100% buffer B and was pure by TOF-LCMS. 0.8 mg to 1.2 mg per liter of expression media was obtained.

Synthesis



Oregon Green 488 carboxylic acid, Succinimidyl ester, 5-isomer

X

[00698] 5.0 mg (9.8 µmole) of Oregon Green™ 488 carboxylic acid, succinimidyl ester, 5-isomer from ThermoFisher Scientific was dissolved in 200 µL of DMF. 29.1 µL of a solution of 45 µg/µL 4-(2-aminoethyl)aniline (1.34 mg, 9.8 µmol) in DMF and 52.8 µL of a solution of 60 µg/µL TEA (3.17 mg, 31.3 µmol) in DMF were added. The resulting bright red-orange solution was shielded from light, and allowed to stir at room temp for 18 hours. The reaction mixture was purified via semipreparatory HPLC using a gradient of 50-60% solvent B (ACN) in solvent A (Milli-Q H_2O) over 8 minutes. Product-containing fractions (green) were combined, partially concentrated via rotary evaporation to remove ACN, frozen at -80 °C, and lyophilized while shielded from light. 2.418 mg (46%) of an orange powder was obtained. The product was dissolved to a stock concentration of 750 µM in 20% ACN in H_2O and used in coupling reactions without further characterization.

Cell Preparation for scFv binding:

[00699] T-25 flasks with MDA-MB-468 ($Her2^-$) cells or SK-BR-3 ($Her2^+$) cells were obtained from the Berkeley Cell Culture Facility and grown to 90-100% confluency in a 37 °C incubator with 5% CO_2. In preparation for analysis, growth medium was removed and adherent cells were rinsed with D-PBS. Cells were detached by treatment with 0.25% Trypsin for 10-15 min at 37 °C. Trypsin digestions were halted by the addition of Cell Binding Buffer (DPBS supplemented with 10% Fetal Bovine Serum (FBS) and 1.0% w/v NaN_3 to prevent the internalization of cell surface markers) to a total volume of 13-15 mL. Cells were added to 15 mL falcon tubes and subject to two cycles of centrifugation (300 g, 5 min, room temp.), removing the supernatant after each cycle and diluting with 14 mL of Binding Buffer before the second cycle. Cells were re-suspended in 1.0 mL of Cell Binding Buffer, and counted with a BioRad TC20 automated cell counter. Live cell counts were > 95% as indicated by trypan blue staining. The cell

concentrations were adjusted to 2.0 x 10^6 cells/mL with additional Binding Buffer. 100 µL aliquots of the cell suspensions were transferred to Eppendorf tubes and placed on ice.

Binding of scFv-O.G. 488 Conjugate and negative controls

[00700] To each 100µL cell aliquot was added 31.3 µL of 0.048 µg/µL Trastuzumab scFv construct (either -GGY tagged or un-tagged and subject to abTYR-mediated O.C. conditions with or without O.G.-488 or abTYR) so that 1.5 µg of scFv was added to each sample. Samples were incubated on ice for 1 hour in the dark. Samples were then subject to 3 cycles of centrifugation (300 g, 3 min), re-suspending cells in 1000 µL of Cell Binding Buffer before each cycle and discarding supernatant after each cycle. After centrifugation, cell pellets were re-suspended in 1000 µL of DPBS with 0.5% paraformaldehyde and kept on ice for 1-3 hours until ready for flow cytometry analysis.

Binding of Protein-L-AN_{20}GGY-O.G. 488 conjugate to Trastuzumab scFv-treated cells

To each 100µL cell aliquot was added 2.0 µL of 1.5 µg/µL un-tagged Trastuzumab scFv. Samples were incubated on ice for 1 hour, protected from light. Samples were then subject to 2 cycles of centrifugation (300 g, 3 min), re-suspending cells in 1000 µL of Cell Binding Buffer before each cycle and discarding supernatant after each cycle. Cell pellets were re-suspended in 100 µL of Cell Binding Buffer and 60 µL of 0.045 µg/µL Protein-L-AN_{20}GGY-O.G. 488 conjugate or negative control construct was added for a total of 2.7 µg of Protein L construct per sample. Samples were incubated on ice in the dark for 1 hour. Samples were then subject to 3 cycles of centrifugation (300 g, 3 min), re-suspending cells in 1000 µL of Cell Binding Buffer before each cycle and discarding supernatant after each cycle. After centrifugation, cell pellets were re-suspended in 1000 µL of DPBS with 0.5% paraformaldehyde and kept on ice for 1-3 hours until ready for flow cytometry analysis.

Example 4

[00701] Here it is shown that the D55K mutant of bmTYR (amino acid sequence set forth in FIG. 10M) is able to efficiently couple DNA labeled with a phenol to cysteine-containing proteins. In this experiment, oligonucleotides bearing a C6-Amine linker (purchased from Integrated DNA Technologies) were modified with a phenol by incubating with a 10x molar excess of NHS-Phenol at pH 8.0 for 2 hours at RT and purified by ion exchange. The reaction conditions were as follows: i) 50 µM GFP; 157 nM abTYR (or equivalent activity of bmTYR or D55K bmTYR); ii) 250 µM DNA-phenol; iii) 10 mM phosphate, pH 6.5. The reaction was allowed to proceed for 30 minutes at room temperature (RT). GFP: 27.550 kDa; DNA: ~ 8 kDa.

[00702] The data are depicted in **FIG. 35**. The appearance of the large dark band above the GFP indicates that DNA coupling was successful using either bmTYR or D55K bmTYR, but not abTYR.

[00703] This reaction can be carried out in the opposite orientation, i.e., by combining a protein with an N-terminal or C-terminal tyrosine tag and an oligonucleotide with a thiol modification, still yielding the protein-nucleotide conjugate.

Example 5

[00704] **FIG. 36A-36C** depict coupling of nucleic acids to polypeptides using methods of the present disclosure.

[00705] As depicted in FIG. 36A, NHS phenol is coupled to an amine terminal nucleotide of a nucleic acid, to generate a phenol-containing nucleic acid (nucleic acid-phenol). As depicted in FIG. 36C, the nucleic acid-phenol is then coupled to a thiol containing protein (e.g., using a tyrosinase with a D55K substitution (e.g., a TYR polypeptide as depicted in FIG. 10M)), generating a nucleic acid-protein conjugate. As depicted in FIG. 36B, the abTYR (FIG. 8; FIG. 9) does not catalyze the reaction.

[00706] A restriction endonuclease can be included in the nucleotide sequence of the nucleic acid, providing for the ability to selectively cleave the nucleic acid from the protein of the nucleic acid-protein conjugate.

Example 6: Charge preference of TYR mutants

[00707] In these experiments 50 μM Y182C GFP was combined with 200 μM of EEEEY (SEQ ID NO: 955), RRRRY (SEQ ID NO: 951), or both with an equivalent activity to 200 nm abTYR of the relevant tyrosinase. Reactions proceeded for 30 min at RT before quenching with tropolone and analysis by ESI-TOF MS. The data are shown in **FIG. 37A-37C**.

[00708] FIG. 37A-37C show the impact of various mutations to bmTYR on its preference for charged substrates. As shown in FIG. 37C, wild type bmTYR (amino acid sequence provided in FIG. 10A) has a slight preference for the negatively charged substrate EEEEY (SEQ ID NO: 955) (product mass 28260). As shown in FIG. 37B, the R209H mutant (amino acid sequence provided in FIG. 10C) shows more activity for the cationic RRRRY (SEQ ID NO: 951) substrate (product mass 28369). As shown in FIG. 37A, the D55K mutant (amino acid sequence provided in FIG. 10M) shows virtually no activity towards the cationic RRRRY (SEQ ID NO: 951) substrate.

[00709] As shown in FIG. 38, the abTYR shows no ability to activate the negatively charged EEEEY (SEQ ID NO: 955) substrate (expected mass for the product= 28260), leaving only the starting material at mass = 27548.

Example 7: Biotin as a linker/ marker

[00710] To analyze the stability of the tyrosine-thiol bond, 200 μM Biotin-PEG_4-Phenol was combined with 50 μM Y182C GFP and 200 nM abTYR for 1 hour at RT. In a comparative reaction, 500 μM Biotin-Maleimide was separately incubated with 50 μM Y182C GFP for 2 hrs at RT before buffer exchange to remove excess maleimide. This produced Tyrosine-GFP-biotin and Maleimide-GFP-biotin, which were then incubated in human serum (from Sigma Aldrich) or buffer. After incubation, samples were combined with 25 μL streptavidin magnetic beads (from New England Biolabs) for 1 hour at RT. After 3 rounds of washing samples were eluted from the beads by incubating with a mixture of 80% acetonitrile, 5% formic acid, and 2 mM biotin for 10 min at RT. Samples were then analyzed on an Agilent 6224 ESI-TOF mass spectrometer and the relative masses were quantified.

[00711] The data are shown in **FIG. 40A-40C**. Tyrosine-GFP-biotin (BT) and Maleimide-GFP-biotin (BM) were incubated in human serum for 1 day (FIG. 40A), 2 days (FIG. 40B), or 7 days (FIG. 40C), at either room temperature (RT) or at 37°C ("37"). As shown in FIG. 40A and FIG. 40B, both Tyrosine-GFP-biotin and Maleimide-GFP-biotin were still present. However, as shown in FIG. 40C, after 7 days, Maleimide-GFP-biotin (BM) conjugates were no longer detected, while Tyrosine-GFP-biotin levels remained high, even with incubation at 37°C. These results indicate that the thiol-phenol coupling generated using tyrosinase is stable in human serum and is more stable than the maleimide coupling.

Example 8: Coupling Ig Fc proteins or a nanobody to a CRISPR/Cas effector polypeptide

[00712] An immunoglobulin (Ig) Fc and a nanobody were separately conjugated to a Cas9 protein using a method of the present disclosure. 10 μM Cas9 and 20 μM Fc domain were combined with 200 nM abTYR for 1 hour, on ice, in 20 mM Phosphate, 200 mM Trehalose, and 300 mM NaCl at pH 6.5. 10 μM Cas9 was combined with 20 μM nanobody in the trehalose buffer for 1 hour. Conjugates were analyzed on a gel, either alone or complexed with a guide RNA. The data are shown in **FIG. 41**.

[00713] Lanes 2, 3, 4, and 6 are unconjugated Ig Fc (comprising an NNNY (SEQ ID NO: 1059) sequence), unconjugated Ig Fc (comprising a GGYNNN (SEQ ID NO: 1060) sequence), nanobody, and Cas9, respectively. Lanes 8 and 9 are Cas9-Ig Fc conjugate without (Lane 8) or with (Lane 9) guide RNA. Lanes 10 and 11 are Cas9-Ig Fc conjugate without (Lane 10) or with (Lane 11) guide RNA. Lanes 12 and 13 are Nanobody-Cas9 conjugate without (Lane 12) or with (Lane 13) guide RNA.

[00714] The nanobody-Cas9 conjugate was analyzed using TOF-MS. The data are shown in **FIG. 42**.

Example 9: Modifying the surface of live mammalian cells

[00715] The methods described herein can be used for the direct labeling of live mammalian cell surfaces, e.g., using the tyrosinase and a tyrosine-tagged antigen-binding proteins. As a model substrate, GFP-binding nanobodies were attached to Jurkat cells; after attachment to the cell surface, the nanobodies retain the ability to bind antigen. The method is depicted schematically in **FIG. 43A**.

[00716] In brief, Jurkat cells were suspended in solution with 400 nM abTYR and 10 to 200 μM of a GFP binding nanobody. After the reaction, cells were rinsed with 25 μM GFP before final rinsing and analysis via flow cytometry. The data are shown in **FIG. 43B**. The increasing levels of green fluorescence based on nanobody concentration show that there was a dose-dependent binding of GFP to the nanobody-conjugated cells.

[00717] While the present invention has been described with reference to the specific embodiments thereof, it should be understood by those skilled in the art that various changes may be made and equivalents may be substituted without departing from the true spirit and scope of the invention. In addition, many modifications may be made to adapt a particular situation, material, composition of matter, process, process step or steps, to the objective, spirit and scope of the present invention. All such modifications are intended to be within the scope of the claims appended hereto.

CLAIMS

What is claimed is:

1. A method for chemoselective modification of a target molecule, the method comprising:

contacting a target molecule comprising a thiol moiety with a biomolecule comprising a reactive moiety;

wherein the biomolecule comprising the reactive moiety is generated by reaction of a biomolecule comprising a phenol moiety or a catechol moiety with an enzyme capable of oxidizing the phenol or catechol moiety; and

wherein said contacting is under conditions sufficient for conjugation of the target molecule to the biomolecule, thereby producing a modified target molecule.

2. The method of claim 1, wherein the target molecule is a polypeptide or a polynucleotide.

3. The method of claim 1 or claim 2, wherein the enzyme is a tyrosinase polypeptide.

4. The method of any one of claims 1-3, wherein the tyrosinase polypeptide is an *Agricus bisporus* tyrosinase (abTYR) polypeptide.

5. The method of any one of claims 1-3, wherein the tyrosinase polypeptide comprises an amino acid sequence having at least 75% amino acid sequence identity to the abTYR amino acid sequence depicted in FIG. 8 or FIG. 9.

6. The method of claim 4 or claim 5, wherein the biomolecule comprising the phenol moiety or the catechol moiety is neutral or positively charged within 50 Angstroms (Å) of the phenol or catechol moiety.

7. The method of any one of claims 1-3, wherein the tyrosinase polypeptide is a *Bacillus megaterium* tyrosinase (bmTYR) polypeptide.

8. The method of any one of claims 1-3, wherein the tyrosinase polypeptide comprises an amino acid sequence having at least 75% amino acid sequence identity to any one of the amino acid sequences depicted in any one of FIG. 10A-10Z and 10AA-10VV.

9. The method of claim 7 or claim 8, wherein the biomolecule comprising a phenol moiety or a catechol moiety is negatively charged within 50 Å of the phenol or catechol moiety.

10. The method of any one of claims 1-9, wherein the target molecule is a polynucleotide.

11. The method of claim 10, wherein the target molecule is a DNA molecule.

12. The method of claim 10, wherein the target molecule is an RNA molecule.

13. The method of any one of claims 10-12, wherein the biomolecule is a polypeptide.

14. The method of any one of claims 1 to 13, wherein the enzyme is bound to a solid support.

15. The method of any one of claims 1 to 14, wherein the phenol moiety is present in a tyrosine residue.

16. The method of any one of claims 1 to 15, wherein the thiol moiety is present in a cysteine residue.

17. The method of claim 16, wherein the cysteine residue is a native cysteine residue.

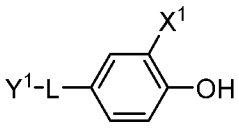
18. The method of any one of claims 1 to 17, wherein the biomolecule comprises one or more moieties selected from a fluorophore, an active small molecule, an affinity tag, and a metal-chelating agent.

19. The method of any one of claims 1 to 18, wherein the reactive moiety is an orthoquinone or a semi-quinone radical, or a combination thereof.

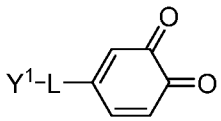
20. The method of any one of claims 1 to 19, wherein the biomolecule is a polypeptide.

21. The method of claim 20, wherein the biomolecule is a polypeptide selected from a fluorescent protein, an antibody, an enzyme, a ligand for a receptor, and a receptor.

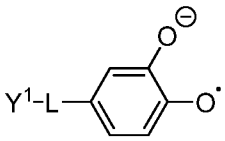
22. The method of any one of claims 1 to 21, wherein the biomolecule comprising a phenol moiety or a catechol moiety is of formula (I), and wherein the biomolecule comprising a reactive moiety is of formula (II) or (IIA), or a combination thereof:



(I)



(II)



(IIA)

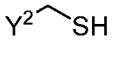
wherein:

Y^1 is a biomolecule, optionally comprising one or more moieties selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

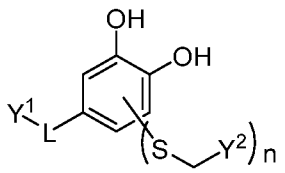
X^1 is selected from hydrogen and hydroxyl; and

L is an optional linker.

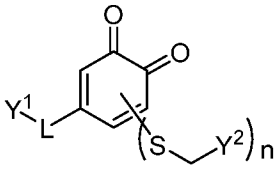
23. The method of any one of claims 1 to 22, wherein the target molecule comprising a thiol moiety is of formula (III), and wherein the modified target molecule is of formula (IV), or (IVA), or a combination thereof:



(III)



(IV)



(IVA)

wherein:

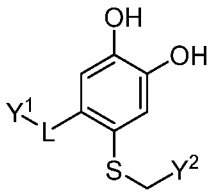
Y^1 is a biomolecule, optionally comprising one or more moieties selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

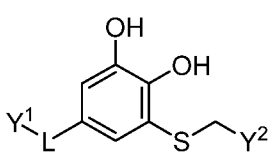
Y^2 is a second biomolecule;

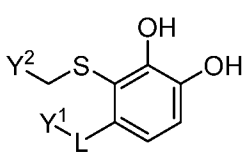
L is an optional linker; and

n is an integer from 1 to 3.

24. The method of claim 23, wherein the modified target molecule of formula (IV) is of any of formulae (IV1)-(IV3):

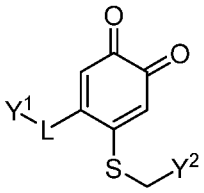


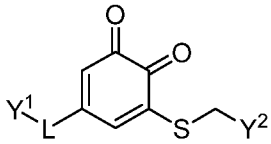


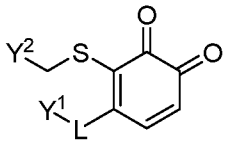


(IV1), (IV2), (IV3); and

the modified target molecule of formula (IVA) is of any of formulae (IVA1)-(IVA3):

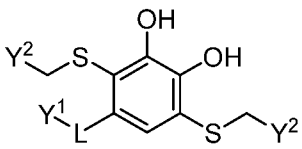


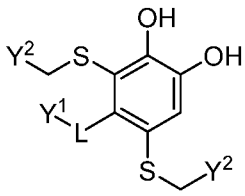




(IVA1), (IVA2) , (IVA3).

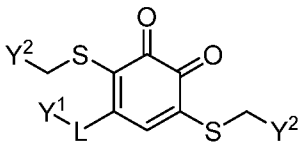
25. The method of claim 23, wherein the modified target molecule of formula (IV) is of any of formulae (IV5)-(IV6):

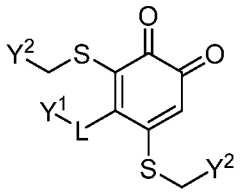




(IV4), (IV5); and

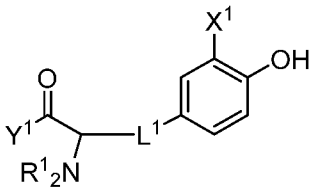
the modified target molecule of formula (IVA) is of any of formulae (IVA4)-(IVA5):





(IVA4) , (IVA5).

26. The method of any one of claims 1 to 25, wherein the biomolecule comprising a phenol moiety or a catechol moiety is described by the formula (IA):



(IA)

wherein:

Y^1 is a biomolecule optionally comprising one or more groups selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

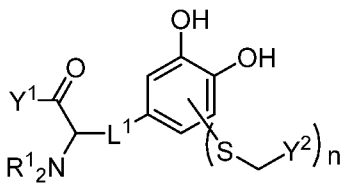
each R^1 is independently selected from hydrogen, acyl, substituted acyl, alkyl, and substituted alkyl;

X^1 is selected from hydrogen and hydroxyl; and

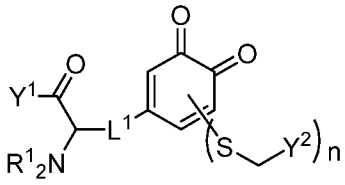
L^1 is a linker selected from a straight or branched alkyl, a straight or branched substituted alkyl, a polyethylene glycol (PEG), a substituted PEG, and one or more peptides.

27. The method of claim 26, wherein the fluorophore is a rhodamine dye or a xanthene dye.

28. The method of any one of claims 1 to 27, wherein the modified target molecule is described by the formula (IVB) or (IVC), or a combination thereof:



(IVB)



(IVC)

wherein:

Y^1 is a biomolecule optionally comprising one or more groups selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

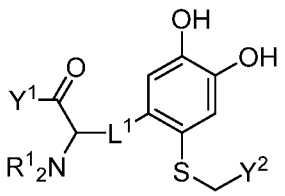
each R^1 is independently selected from hydrogen, acyl, substituted acyl, alkyl, and substituted alkyl;

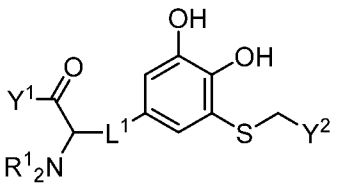
Y^2 is a second biomolecule;

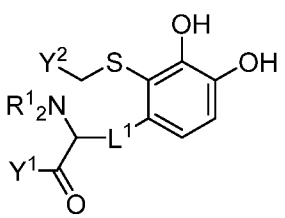
L^1 is a linker selected from a straight or branched alkyl, a straight or branched substituted alkyl, a polyethylene glycol (PEG), a substituted PEG, and one or more peptides; and

n is an integer from 1 to 3.

29. The method of claim 28, wherein the modified target molecule of formula (IVB) is of any of formulae (IVB1)-(IVZB3):

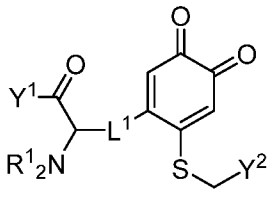


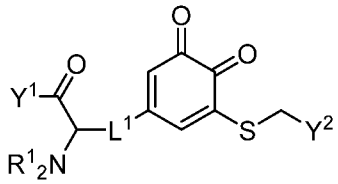


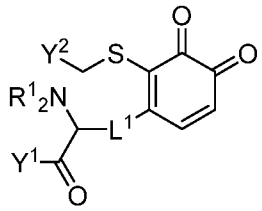


(IVB1), (IVB2), (IVB3); and

the modified target molecule of formula (IVC) is of any of formulae (IVC1)-(IVC3):

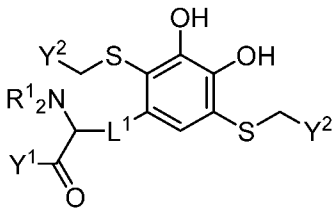


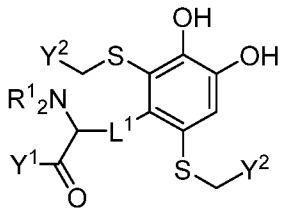




(IVC1), (IVC2) , (IVC3).

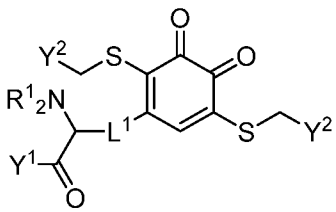
30. The method of claim 28, wherein the modified target molecule of formula (IVB) is of any of formulae (IVB5)-(IVB6):

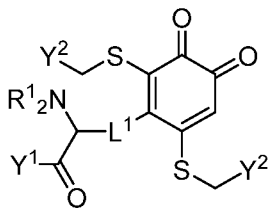




(IVB4), (IVB5); and

the modified target molecule of formula (IVC) is of any of formulae (IVC4)-(IVC5):





(IVC4) , (IVC5).

31. The method of any one of claims 1 to 30, wherein the method is conducted at a pH from 4 to 9.

32. The method of claim 31, wherein the method is conducted at neutral pH.

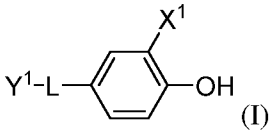
33. The method of any one of claims 1 to 32, wherein the target molecule comprising a thiol group is a CRISPR-Cas effector polypeptide.

34. A composition, comprising:

a target molecule comprising a thiol of formula (III):

 (III); and

a biomolecule comprising a phenol moiety or a catechol moiety of formula (I):

 (I)

wherein:

Y^1 is a biomolecule, optionally comprising one or more moieties selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

X^1 is selected from hydrogen and hydroxyl;

L is an optional linker; and

Y^2 is a second biomolecule.

35. The composition of claim 34, wherein the biomolecule comprising a phenol moiety or a catechol moiety is neutral or positively charged within 50 Å of the phenol moiety or catechol moiety.

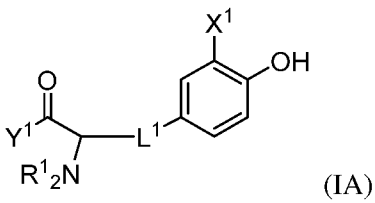
36. The composition of claim 34, wherein the biomolecule comprising a phenol moiety or a catechol moiety is negatively charged within 50 Å of the phenol moiety or catechol moiety.

37. The composition of any one of claims 34-36, wherein the Y^1 is a polypeptide and wherein Y^2 is a polypeptide.

38. The composition of any one of claims 34-36, wherein Y^1 is a polynucleotide and wherein Y^2 is a polypeptide.

39. The composition of any one of claims 34 to 38, wherein Y^2 is a CRISPR-Cas effector polypeptide.

40. The composition of any one of claims 34 to 39, wherein formula (I) is described by the formula (IA):

 (IA)

wherein:

Y^1 is a biomolecule optionally comprising one or more groups selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

each R^1 is independently selected from hydrogen, acyl, substituted acyl, alkyl, and substituted alkyl;

X^1 is selected from hydrogen and hydroxyl; and

L^1 is a linker selected from a straight or branched alkyl, a straight or branched substituted alkyl, a polyethylene glycol (PEG), a substituted PEG, and one or more peptides.

41. A kit comprising:

a first container comprising a composition of any one of claims 34 to 40; and

a second container comprising an enzyme capable of oxidizing the phenol or catechol moiety.

42. The kit of claim 41, wherein the enzyme is a tyrosinase polypeptide.

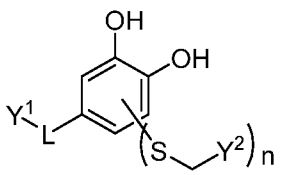
43. The kit of claim 42, wherein the tyrosinase enzyme is an *Agricus bisporus* tyrosinase enzyme (abTYR).

44. The kit of claim 42, wherein the tyrosinase polypeptide comprises an amino acid sequence having at least 75% amino acid sequence identity to the abTYR amino acid sequence depicted in FIG. 8 or FIG. 9.

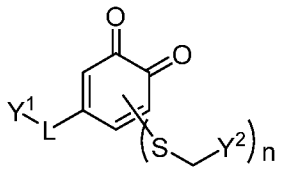
45. The kit of claim 42, wherein the tyrosinase enzyme is a *Bacillus megaterium* tyrosinase enzyme (bmTYR).

46. The kit of claim 42, wherein the tyrosinase polypeptide comprises an amino acid sequence having at least 75% amino acid sequence identity to any one of the amino acid sequences depicted in any one of FIG. 10A-10Z and 10AA-10VV.

47. A compound, of formula (IV) or (IVA):



(IV)



(IVA)

wherein:

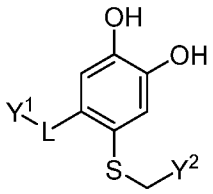
Y^1 is a biomolecule, optionally comprising one or more moieties selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

L is an optional linker;

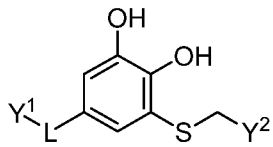
Y^2 is a second biomolecule; and

n is an integer from 1 to 3.

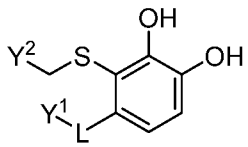
48. The compound of claim 47, wherein the modified target molecule of formula (IV) is of any of formulae (IV1)-(IV5):



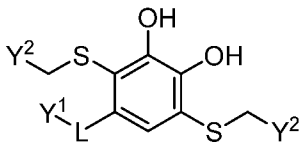
(IV1),



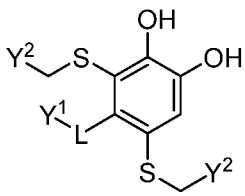
(IV2),



(IV3),

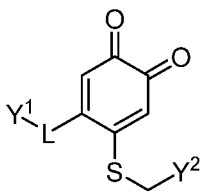


(IV4), and

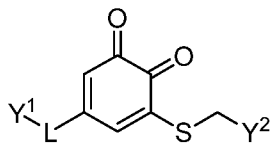


(IV5).

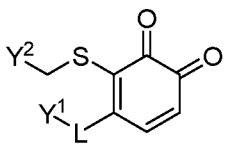
49. The compound of claim 47, wherein the modified target molecule of formula (IVA) is of any of formulae (IVA1)-(IVA5):



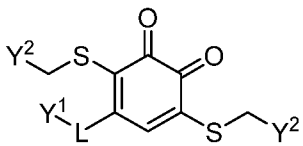
(IVA1),



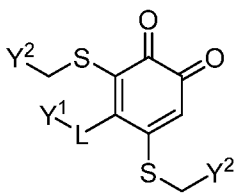
(IVA2) ,



(IVA3),



(IVA4) , and



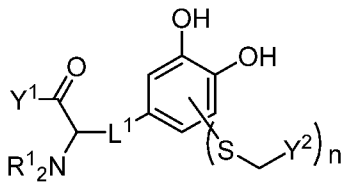
(IVA5).

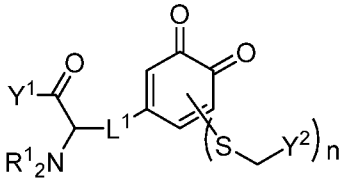
50. The compound of any one of claims 47 to 49, wherein L is a cleavable linker.

51. The compound of any one of claims 47 to 50, wherein Y^1 is a polypeptide.

52. The compound of claim 51, wherein Y^1 is selected from a fluorescent protein, an antibody, and an enzyme.

53. The compound of any one of claims 47 to 52, described by the formula (IVB) or (IVC):





(IVB) (IVC)

wherein:

Y^1 is a biomolecule optionally comprising one or more groups selected from, an active small molecule, an affinity tag, a fluorophore, and a metal-chelating agent;

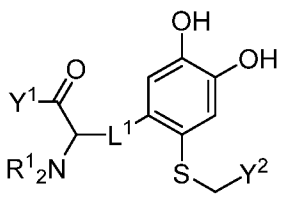
each R^1 is independently selected from hydrogen, acyl, substituted acyl, alkyl, and substituted alkyl;

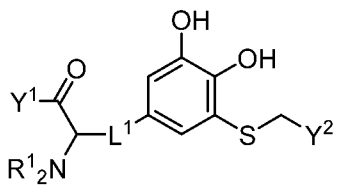
Y^2 is a second biomolecule;

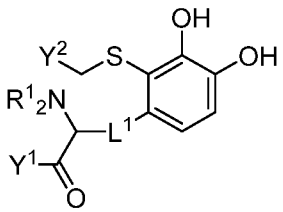
L^1 is a linker selected from a straight or branched alkyl, a straight or branched substituted alkyl, a polyethylene glycol (PEG), a substituted PEG, and one or more peptides; and

n is an integer from 1 to 3.

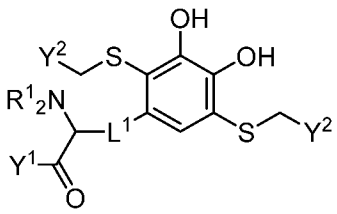
54. The compound of claim 53, wherein the modified target molecule of formula (IVB) is of any of formulae (IVB1)-(IVZB5):



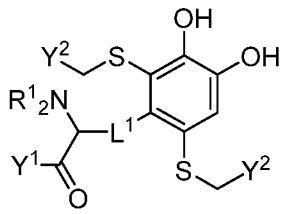




(IVB1), (IVB2), (IVB3),

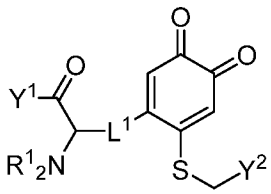


(IVB4), and

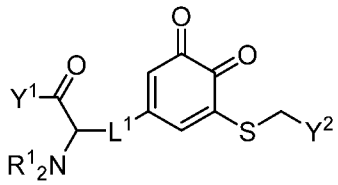


(IVB5).

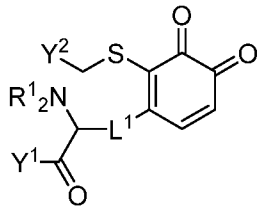
55. The compound of claim 53, wherein the modified target molecule of formula (IV) is of any one of formulae (IVC1)-(IVC5):



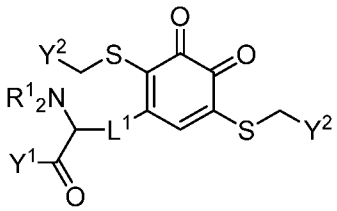
(IVC1),



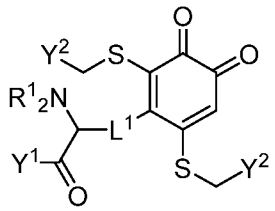
(IVC2) ,



(IVC3),

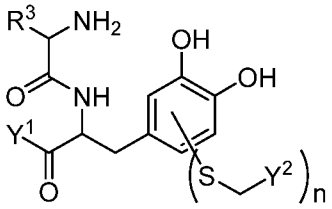


(IVC4) , and

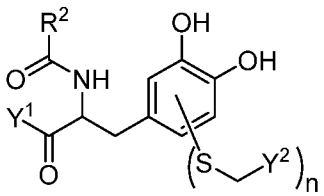


(IVC5).

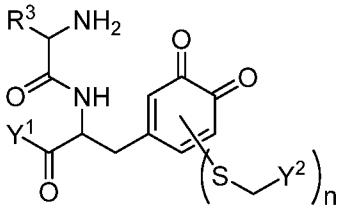
56. The compound of any one of claims 47 to 55, described by any of formula (IVD)-(IVG):



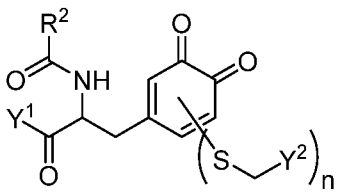
(IVD),



(IVE),



(IVF), and



(IVG),

wherein:

R^2 is selected from alkyl, and substituted alkyl;

R^3 is selected from, hydrogen, alkyl substituted alkyl, a peptide, and a polypeptide; and

n is an integer from 1 to 3.

57. The compound of any one of claims 47 to 56, wherein Y^2 is a CRISPR-Cas effector polypeptide.

58. A method for chemoselective coupling of a first polypeptide and a second polypeptide to a coupling polypeptide, the method comprising:

a) contacting the first polypeptide with the coupling polypeptide, to generate a first polypeptide-coupling polypeptide conjugate,

wherein the first polypeptide comprises a thiol moiety,

wherein the coupling polypeptide comprises an N-terminal reactive moiety that forms a covalent bond with the thiol moiety present in the first polypeptide,

wherein the coupling polypeptide comprising the N-terminal reactive moiety is generated by reaction of a polypeptide comprising an N-terminal phenol or catechol moiety and a C-terminal phenol or catechol moiety with a first enzyme capable of oxidizing the N-terminal phenol or catechol moiety, but not the C-terminal phenol or catechol moiety, to generate the N-terminal reactive moiety;

wherein the coupling polypeptide comprises two or more positively charged or neutral amino acids within ten amino acids of the N-terminal phenol or catechol moiety and two or more negatively charged amino acids within ten amino acids of the C-terminal phenol or catechol moiety; and

b) contacting the second polypeptide with the first polypeptide-coupling polypeptide conjugate,

wherein the second polypeptide comprises a thiol moiety,

wherein the first polypeptide-coupling polypeptide conjugate comprises a C-terminal reactive moiety that forms a covalent bond with the thiol moiety present in the second polypeptide,

wherein the first polypeptide-coupling polypeptide conjugate comprising the C-terminal reactive moiety is generated by reaction of the first polypeptide-coupling polypeptide conjugate with a second enzyme capable of oxidizing the C-terminal phenol or catechol moiety to generate a C-terminal reactive moiety; and

wherein said contacting generates a first polypeptide-coupling polypeptide-second polypeptide conjugate.

59. The method of claim 58, wherein:

a) the first enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to the abTYR amino acid sequence depicted in FIG. 8 or FIG. 9; and

b) the second enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to any one of the amino acid sequences depicted in any one of FIG. 10A-10Z and 10AA-10VV.

60. A method for chemoselective coupling of a first polypeptide and a second polypeptide to a coupling polypeptide, the method comprising:

a) contacting the first polypeptide with the coupling polypeptide, to generate a first polypeptide-coupling polypeptide conjugate,

wherein the first polypeptide comprises a thiol moiety,

wherein the coupling polypeptide comprises an N-terminal reactive moiety that forms a covalent bond with the thiol moiety present in the first polypeptide,

wherein the coupling polypeptide comprising the N-terminal reactive moiety is generated by reaction of a polypeptide comprising an N-terminal phenol or catechol moiety and a C-terminal phenol or catechol moiety with a first enzyme capable of oxidizing the N-terminal phenol or catechol moiety, but not the C-terminal phenol or catechol moiety, to generate the N-terminal reactive moiety;

wherein the coupling polypeptide comprises two or more negatively charged amino acids within ten amino acids of the N-terminal phenol or catechol moiety and two or more positively charged or neutral amino acids within ten amino acids of the C-terminal phenol or catechol moiety; and

b) contacting the second polypeptide with the first polypeptide-coupling polypeptide conjugate,

wherein the second polypeptide comprises a thiol moiety,

wherein the first polypeptide-coupling polypeptide conjugate comprises a C-terminal reactive moiety that forms a covalent bond with the thiol moiety present in the second polypeptide,

wherein the first polypeptide-coupling polypeptide conjugate comprising the C-terminal reactive moiety is generated by reaction of the first polypeptide-coupling polypeptide conjugate with a second enzyme capable of oxidizing the C-terminal phenol or catechol moiety to generate a C-terminal reactive moiety; and

wherein said contacting generates a first polypeptide-coupling polypeptide-second polypeptide conjugate.

61. The method of claim 60, wherein:

a) the first enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to any one of the amino acid sequences depicted in any one of FIG. 10A-10Z and 10AA-10VV; and

b) the second enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to the abTYR amino acid sequence depicted in FIG. 8 or FIG. 9.

62. A method of covalently linking a first polypeptide to a second polypeptide, the method comprising:

a) contacting the first polypeptide with an immobilized reactive moiety,

wherein the immobilized reactive moiety is generated by reaction of an immobilized phenol moiety or catechol moiety with a first enzyme, wherein the first enzyme is capable of oxidizing the immobilized phenol moiety or catechol moiety, thereby generating the immobilized reactive moiety,

wherein the first polypeptide comprises: i) a thiol moiety; and ii) a phenol moiety or a catechol moiety, wherein the first polypeptide comprises two or more negatively charged amino acids within ten amino acids of the phenol moiety or the catechol moiety,

wherein the immobilized reactive moiety forms a covalent bond with the thiol moiety present in the first polypeptide, thereby generating an immobilized first polypeptide;

b) contacting the immobilized first polypeptide with second enzyme, wherein the second enzyme is capable of oxidizing the phenol moiety or the catechol moiety present in the first polypeptide to generate an immobilized first polypeptide comprising a reactive moiety; and

c) contacting the immobilized first polypeptide comprising a reactive moiety with a second polypeptide,

wherein the second polypeptide comprises: i) a thiol moiety; and ii) a phenol moiety or a catechol moiety, wherein the second polypeptide comprises two or more neutral or positively charged within ten amino acids of the phenol moiety or the catechol moiety,

wherein the reactive moiety present in the immobilized first polypeptide forms a covalent bond with the thiol moiety present in the second polypeptide, thereby generating an immobilized conjugate comprising the first polypeptide covalently linked to the second polypeptide.

63. The method of claim 62, wherein the first enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to any one of the amino acid sequences depicted in any one of FIG. 8, FIG. 9, FIG. 10A-10Z, and 10AA-10VV.

64. The method of claim 62 or claim 63, wherein the thiol moiety present in the first polypeptide is present in a Cys, and wherein the phenol moiety present in the first polypeptide is present in a Tyr residue.

65. The method of claim 64, wherein the Tyr residue is present in a stretch of amino acids comprising EEEY (SEQ ID NO: 953), EEEEY (SEQ ID NO: 955), DDDDY (SEQ ID NO: 965), or DDDDY (SEQ ID NO: 965).

66. The method of any one of claims 62-65, wherein the second enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to any one of the amino acid sequences depicted in any one of FIG. 10A-10Z and 10AA-10VV.

67. The method of any one of claims 62-66, further comprising:

c) contacting the immobilized conjugate with a third enzyme, wherein the third enzyme is capable of oxidizing the phenol moiety or the catechol moiety present in the second polypeptide to generate an immobilized conjugate comprising a reactive moiety; and

c) contacting the immobilized conjugate comprising a reactive moiety with a third polypeptide,

wherein the third polypeptide comprises: i) a thiol moiety; and ii) a phenol moiety or a catechol moiety, wherein the third polypeptide comprises two or more negatively charged within ten amino acids of the phenol moiety or the catechol moiety,

wherein the reactive moiety present in the immobilized conjugate forms a covalent bond with the thiol moiety present in the second polypeptide, thereby generating an immobilized conjugate comprising the third polypeptide covalently linked to the second polypeptide.

68. The method of claim 67, wherein the third enzyme is a tyrosinase polypeptide comprising an amino acid sequence having at least 75% amino acid sequence identity to the amino acid sequence depicted in FIG. 8 or FIG. 9.

69. The method of claim 67 or 68, wherein, between step (b) and step (c), the second enzyme is inactivated or removed.

70. The method of any one of claims 67-69, wherein the thiol moiety present in the second polypeptide is present in a Cys, and wherein the phenol moiety present in the second polypeptide is present in a Tyr residue.

71. The method of claim 70, wherein the Tyr residue is present in a stretch of amino acids comprising RRRY (SEQ ID NO: 949), RRRRY (SEQ ID NO: 951), KKKY (SEQ ID NO: 966), or KKKKY (SEQ ID NO: 967).

FIG. 1A

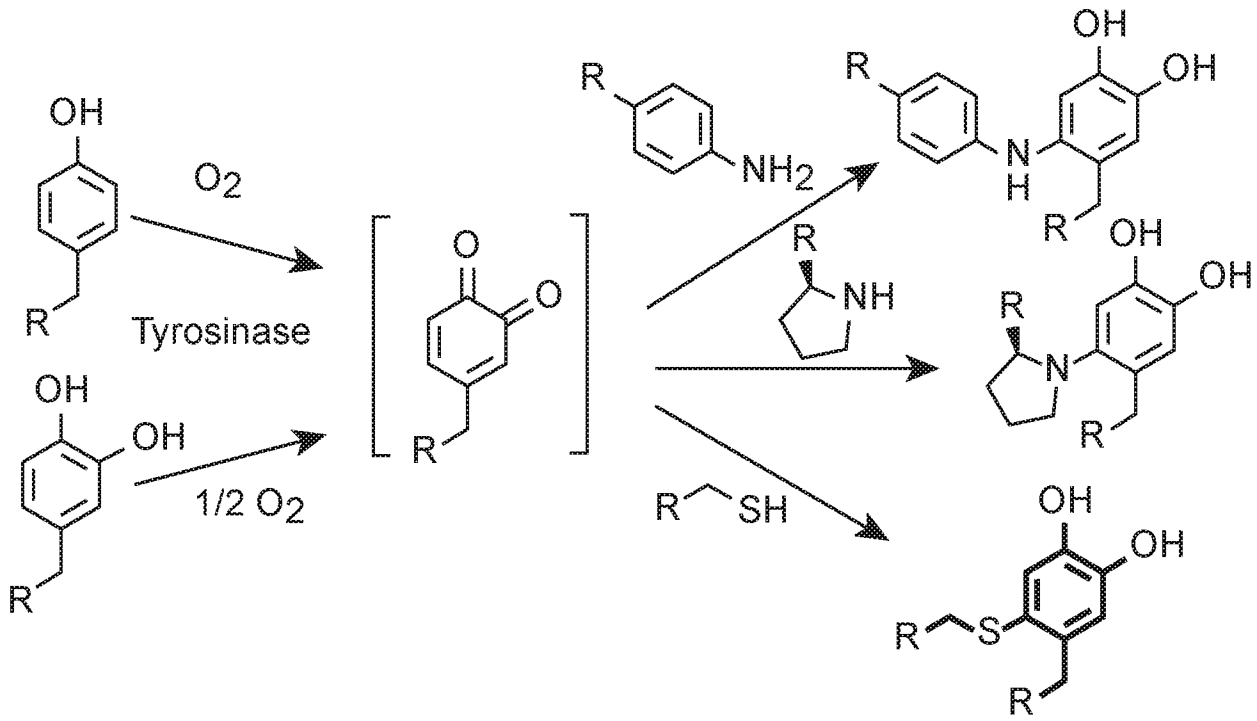

OH
O2
R
Tyrosinase
OH
OH
1/2 O2
R
O
O
R
R
NH2
R
NH
R
SH
R
OH
OH
N
H
R
R
OH
OH
N
R
R
OH
OH
R
S
R

FIG.1B

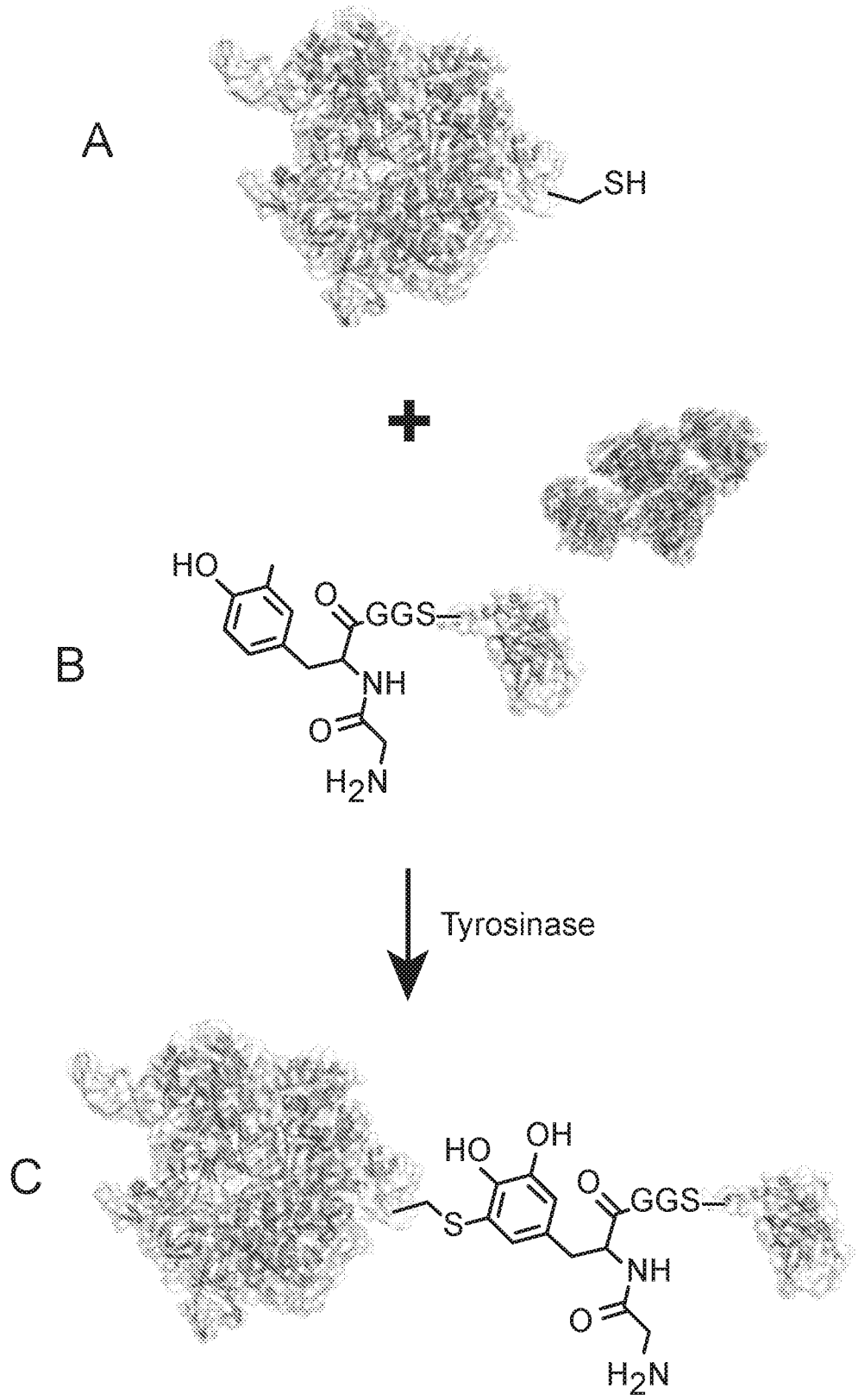


FIG. 2

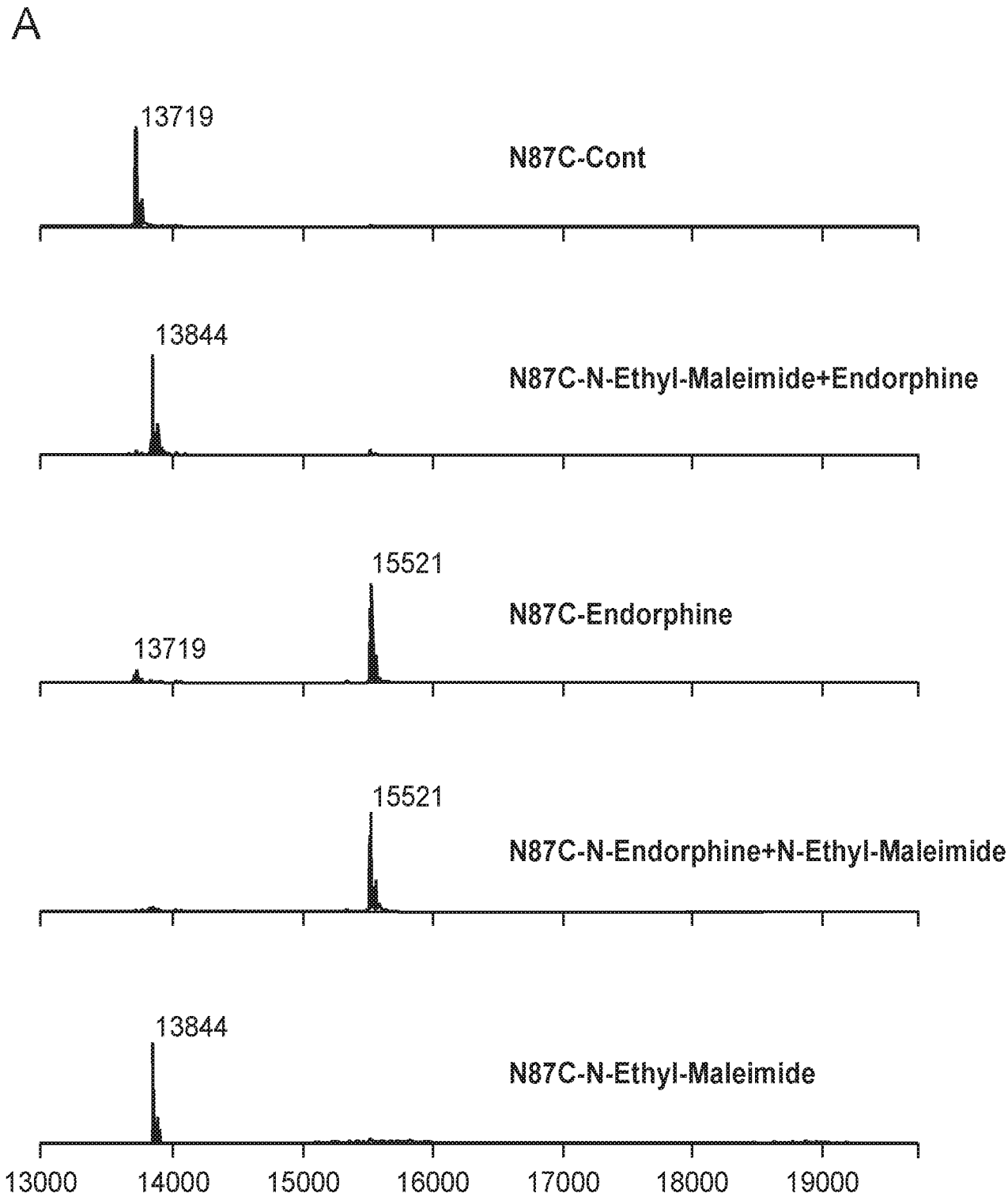
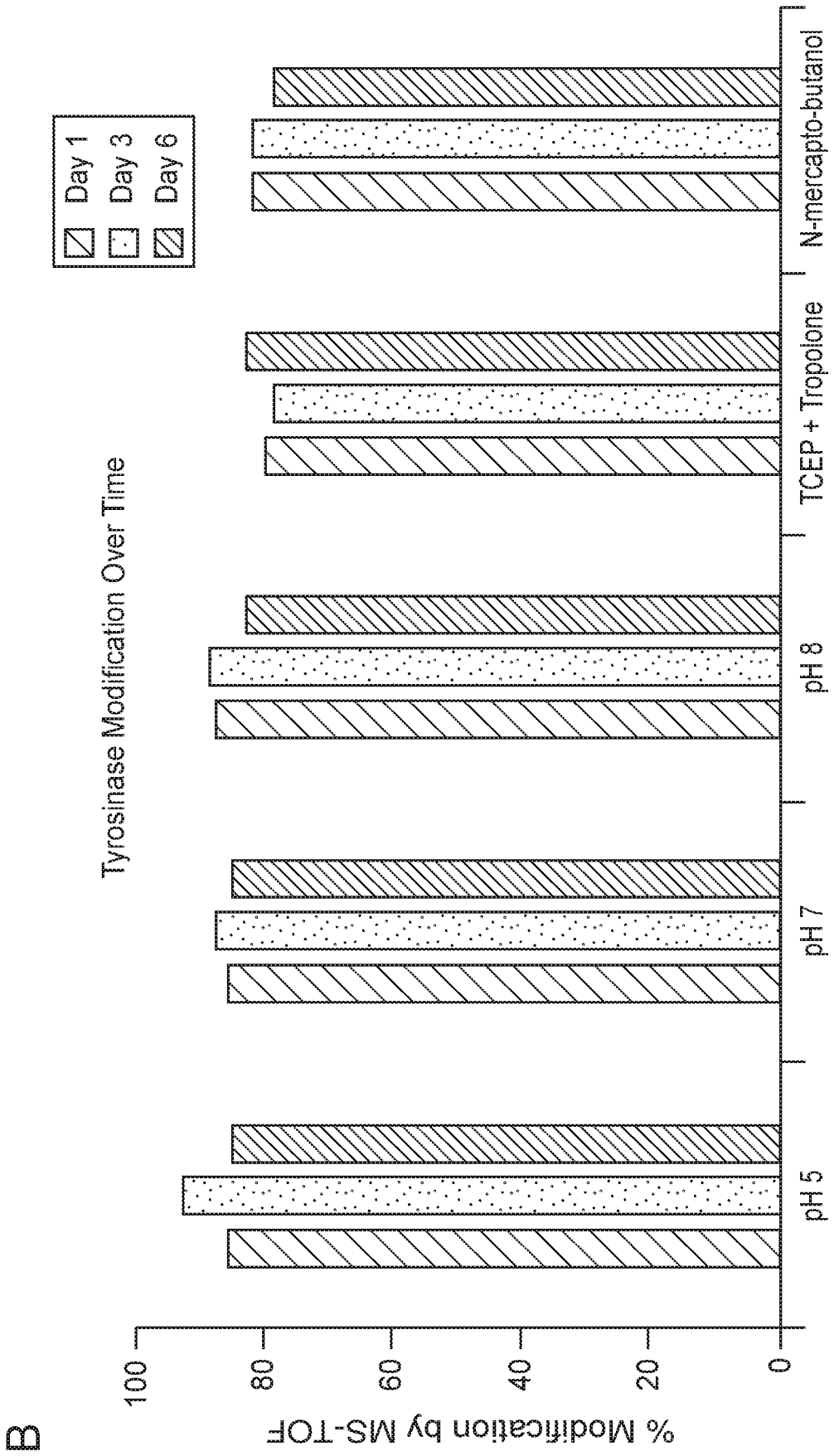

A
13719
N87C-Cont
13844
N87C-N-Ethyl-Maleimide+Endorphine
15521
N87C-Endorphine
13719
15521
N87C-N-Endorphine+N-Ethyl-Maleimide
13844
N87C-N-Ethyl-Maleimide
13000
14000
15000
16000
17000
18000
19000

FIG. 2 (Cont.)


B
Tyrosinase Modification Over Time
Day 1
Day 3
Day 6
% Modification by MS-TOF
100
80
60
40
20
0
pH 5
pH 7
pH 8
TCEP + Tropolone
N-mercapto-butanol

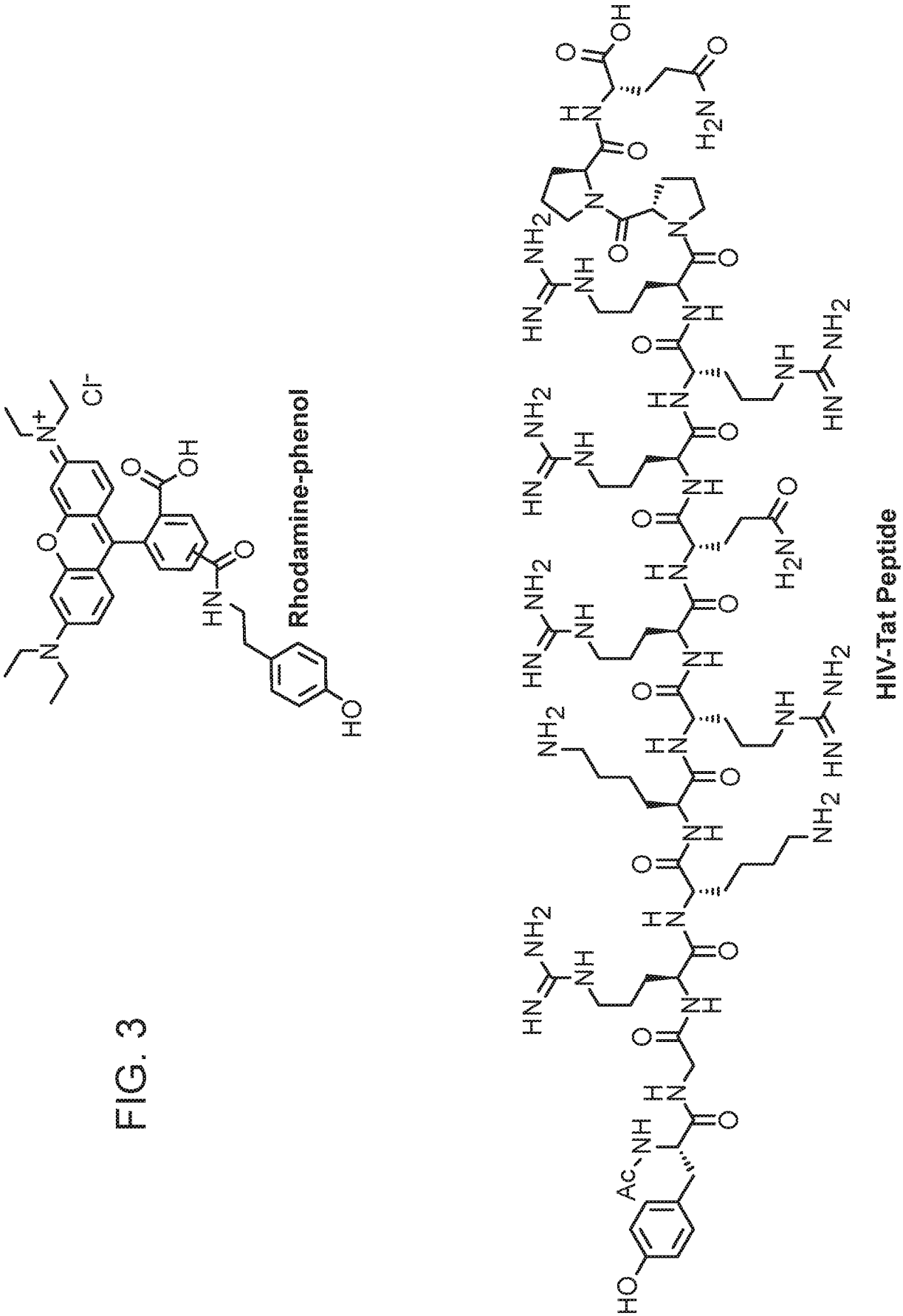
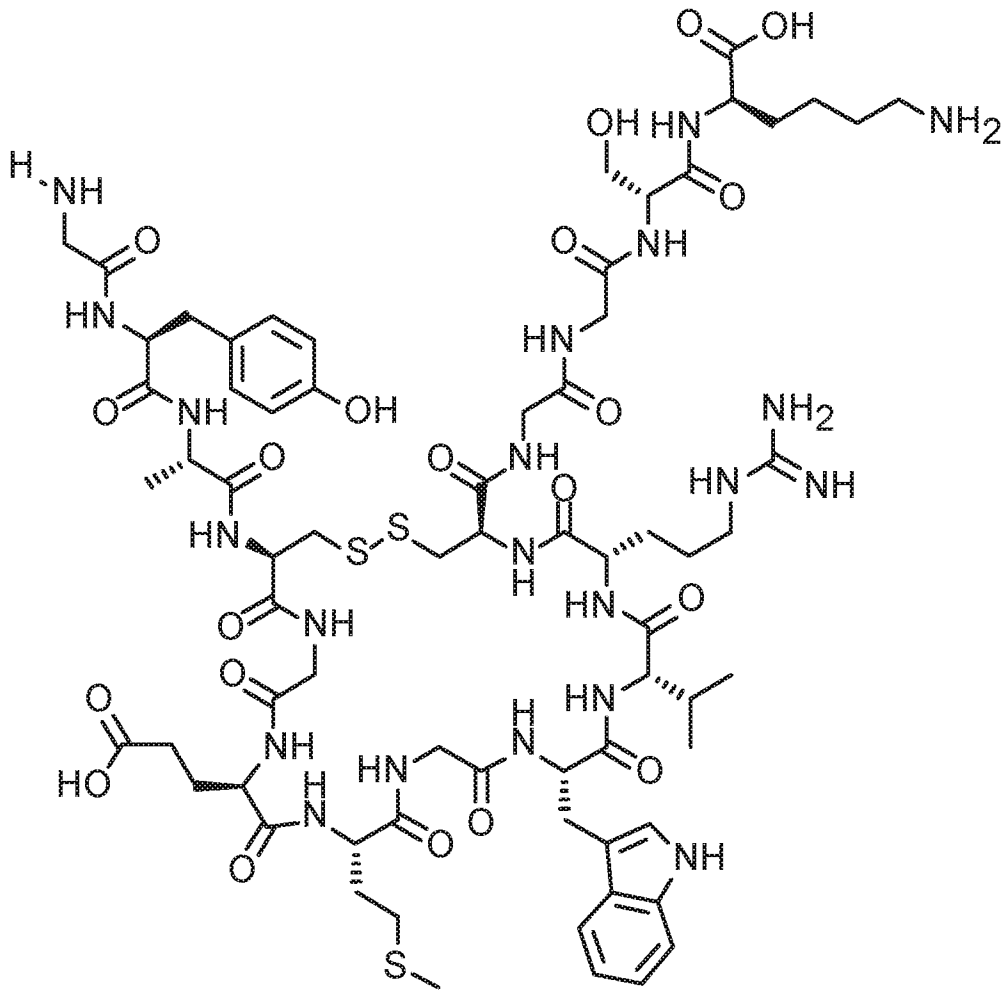
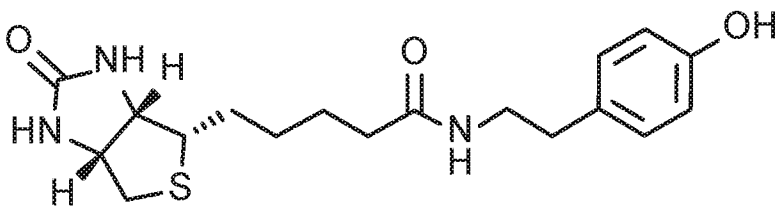


FIG. 3

FIG. 3 (Cont.)



IL-13 Peptide



Biotin-Phenol

FIG. 4

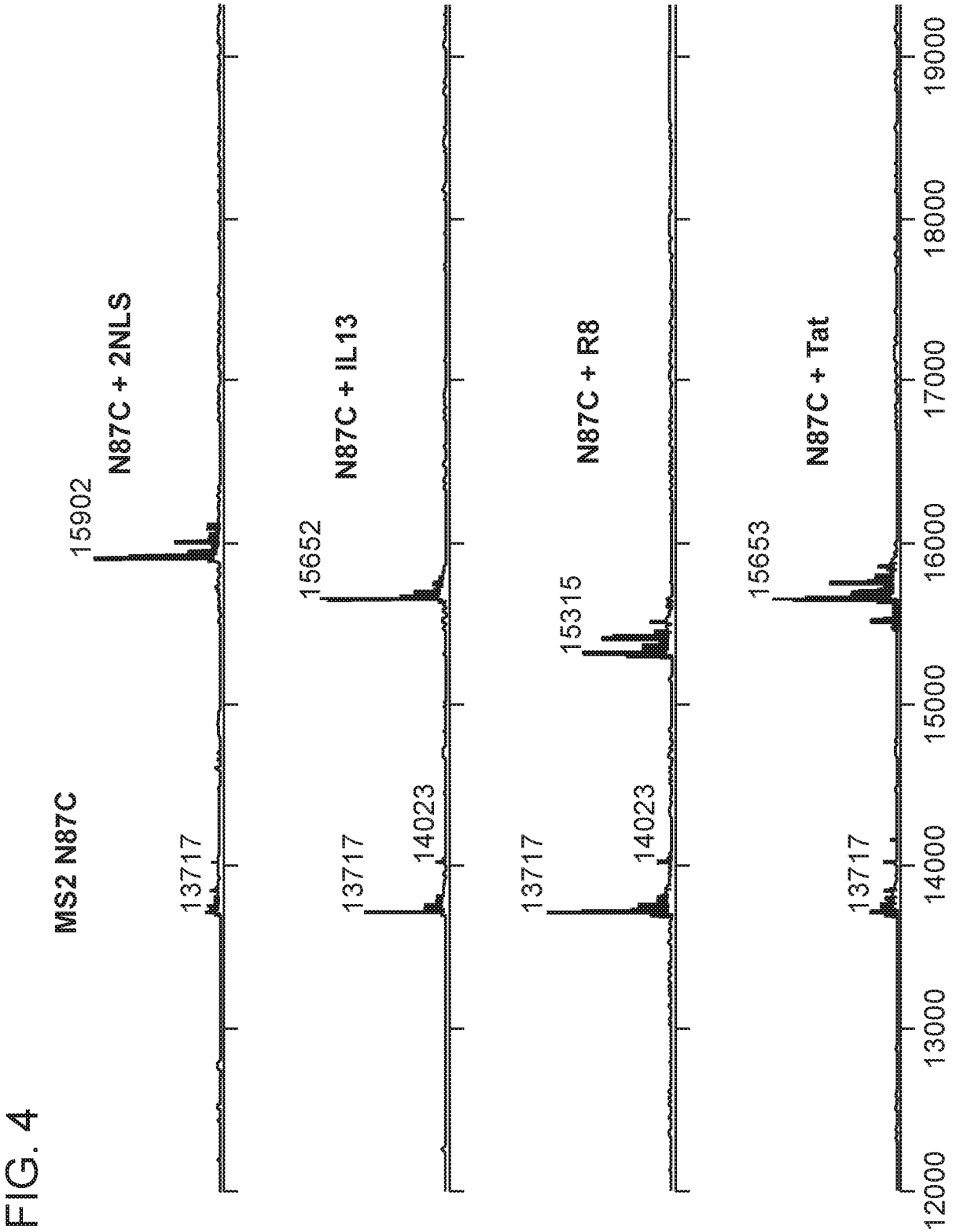
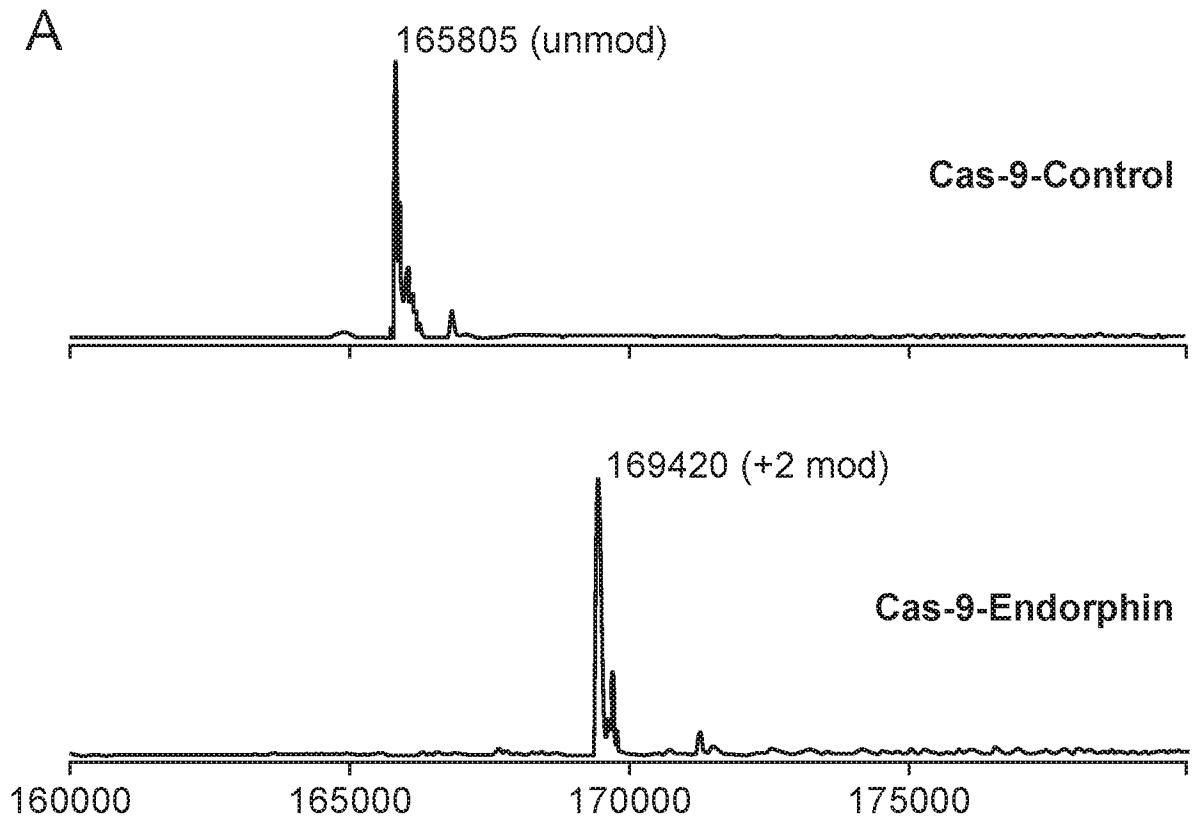

MS2 N87C
13717
14023
15902
N87C + 2NLS
13717
14023
15652
N87C + IL13
13717
14023
15315
N87C + R8
13717
15653
N87C + Tat
12000
13000
14000
15000
16000
17000
18000
19000

FIG. 5


A
165805 (unmod)
Cas-9-Control
169420 (+2 mod)
Cas-9-Endorphin
160000
165000
170000
175000

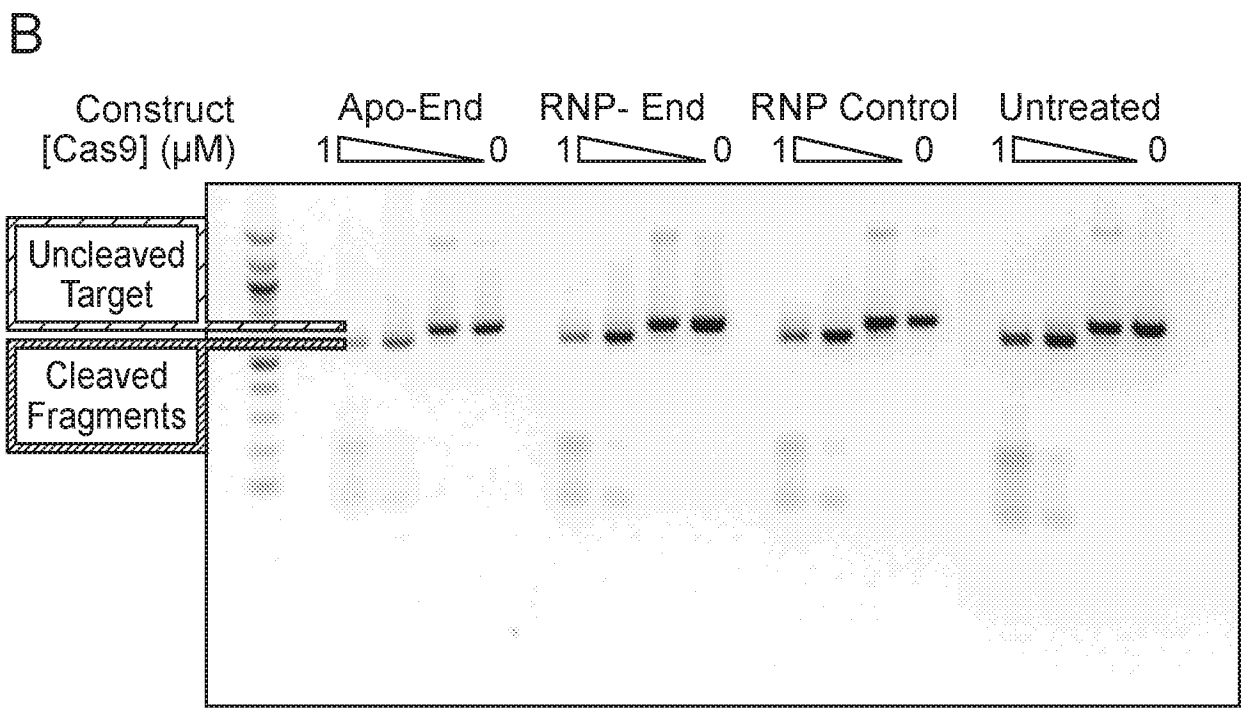
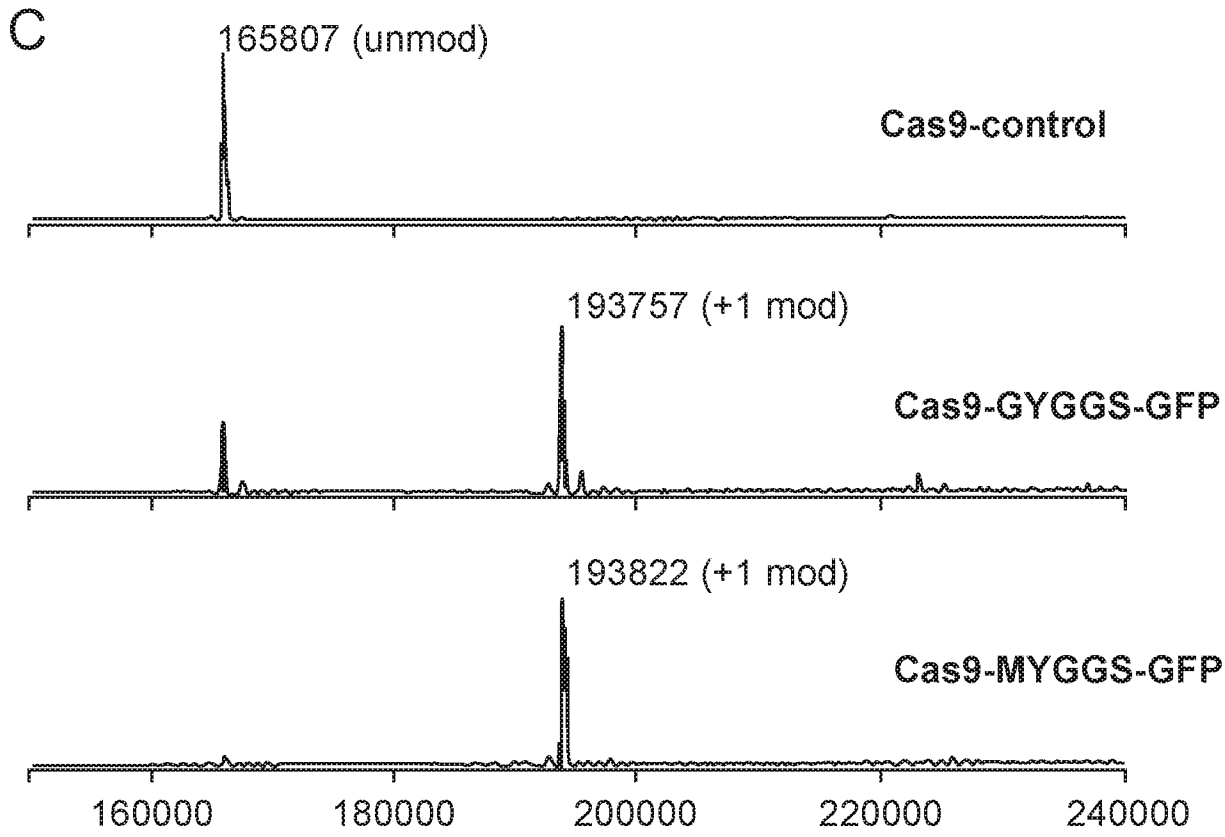

B
Construct
[Cas9] (μM)
Apo-End
1
0
RNP- End
1
0
RNP Control
1
0
Untreated
1
0
Uncleaved Target
Cleaved Fragments

FIG. 5 (Cont.)


C
165807 (unmod)
Cas9-control
193757 (+1 mod)
Cas9-GYGGS-GFP
193822 (+1 mod)
Cas9-MYGGS-GFP
160000
180000
200000
220000
240000

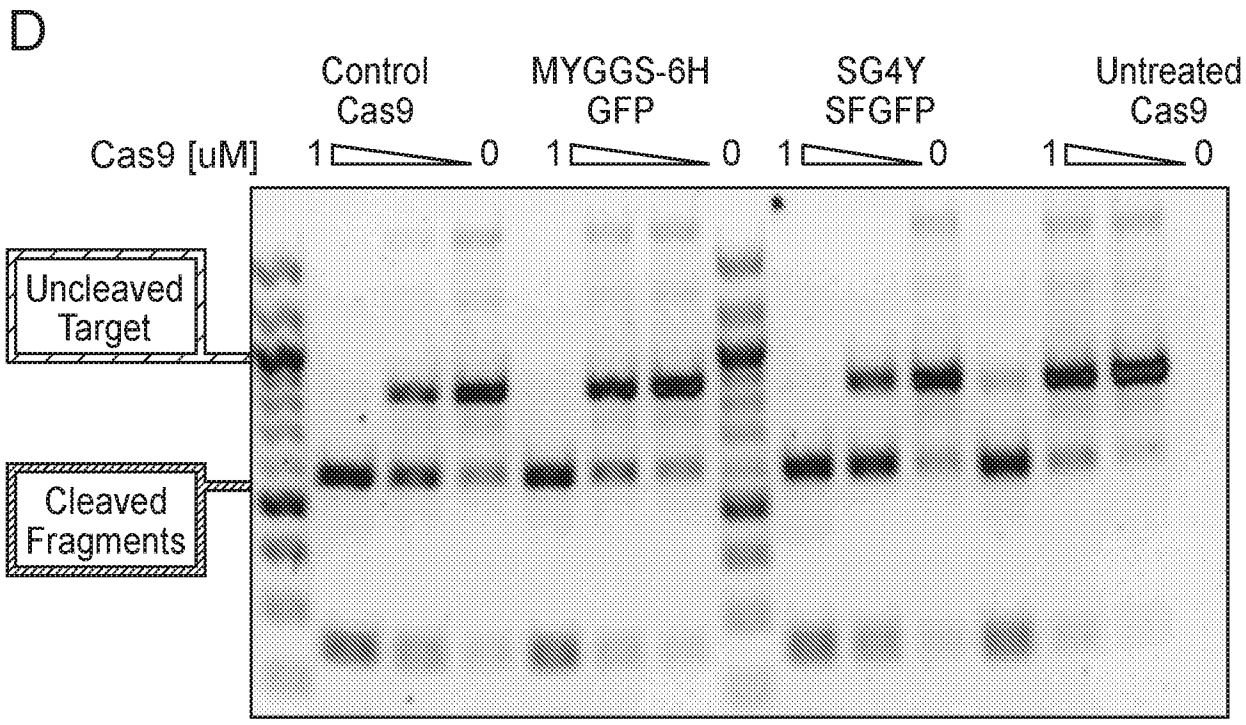

D
Control Cas9
MYGGS-6H GFP
SG4Y SFGFP
Untreated Cas9
Cas9 [uM]
1
0
Uncleaved Target
Cleaved Fragments

FIG. 6

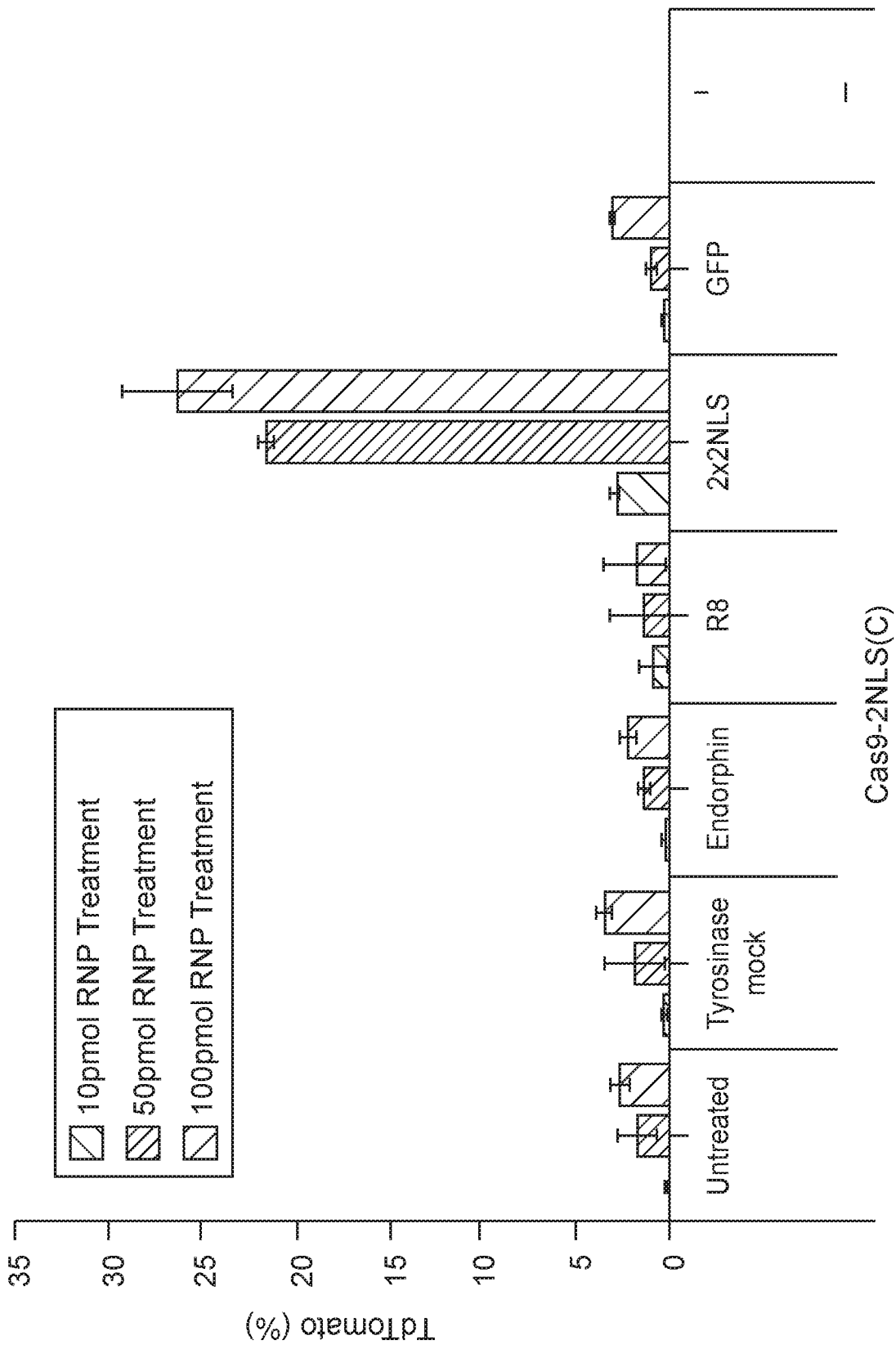

10pmol RNP Treatment
50pmol RNP Treatment
100pmol RNP Treatment
Untreated
Tyrosinase mock
Endorphin
R8
2x2NLS
GFP
Cas9-2NLS(C)
tdTomato (%)
0
5
10
15
20
25
30
35

FIG. 7

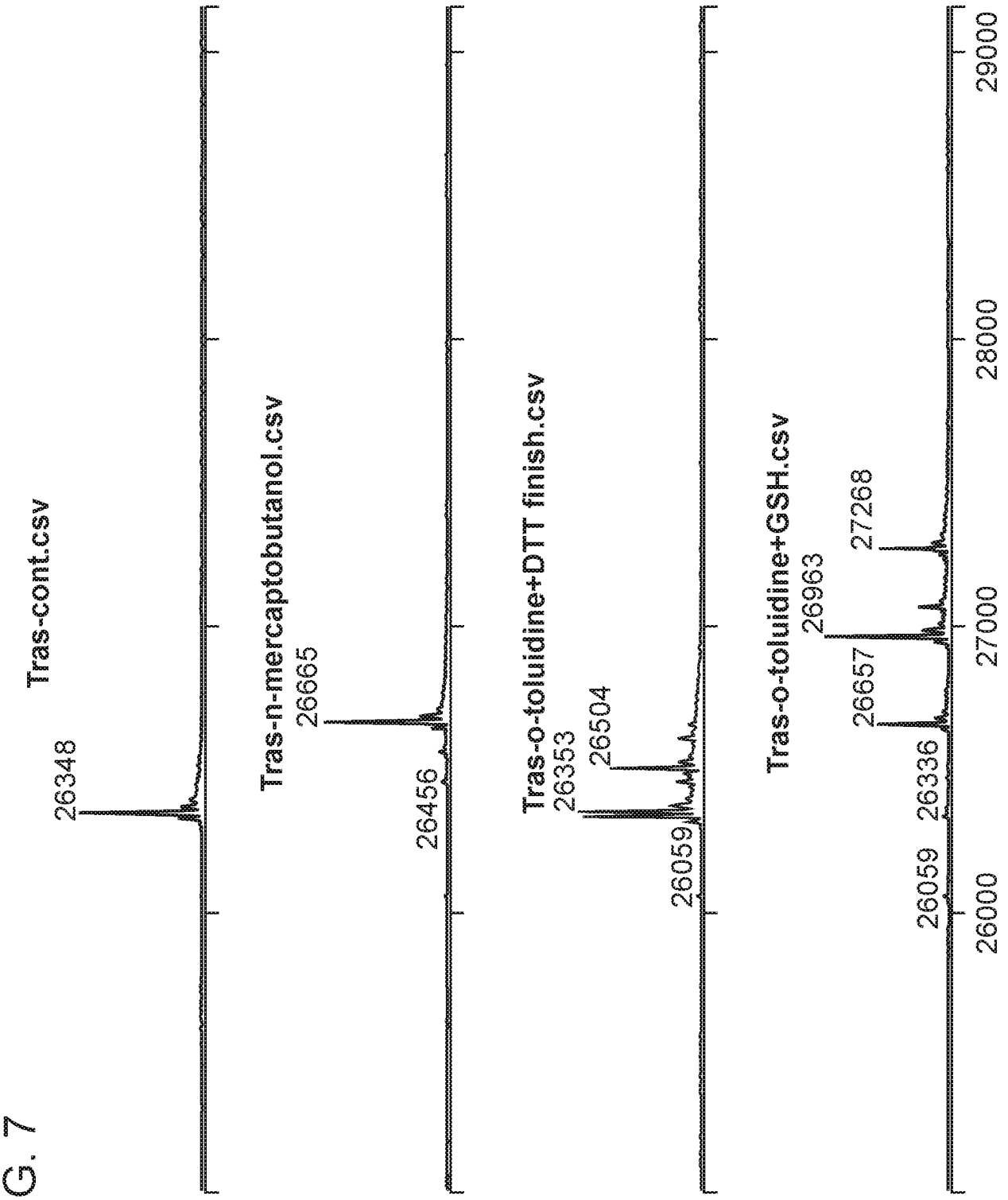

Tras-cont.csv
26348
Tras-n-mercaptobutanol.csv
26665
26456
Tras-o-toluidine+DTT finish.csv
26353
26504
26059
Tras-o-toluidine+GSH.csv
26963
27268
26657
26336
26059
26000
27000
28000
29000

FIG. 8

Agricus bisporus abPPO4
>4OUA:A|PDBID|CHAIN|SEQUENCE

SLLATVGPTGGVKNRLDIVDFVRDEKFFTLYIRALQAIQDKDQSDYSSFFQLSGIHGLPFTPWAKPKDTPTVPYE
SGYCTHSQVLFPTWHRVYVSIYEQILQEAAKGIAKKFTVHKKEWAQAAEDLRQPYWDTGFALVPPDEIIKLEQ
VKITNYDGTKITVRNPILRYSFHPIDPSFNGYPNFDTWKTTVRNPDADKKENIPALIGKLDLEADSTREKTYNML
KFNANWEAFSNHGEFDDTHANSLEAVHDDIHGFVGRGAIRGHMTHALFAAFDPIFWLHHSNVDRHLSLWQ
ALYPGVWVTQGPEREGSMGFAPGTELNKDSALEPFYETEDKPWTSVPLTDTALLNYSYPDFDKVKGGTPDLV
RDYINDHIDRRYGIKKS (SEQ ID NO://)

FIG. 9

Agricus bisporus abPPO3
>2Y9X:A|PDBID|CHAIN|SEQUENCE

SDKKSLMPLVGIPGEIKNRLNILDFVKNDKFFTLYVRALQVLQARDQSDYSSFFQLGGIHGLPYTEWAKAQPQL
HLYKANYCTHGTVLFPTWHRAYESTWEQTLWEAAGTVAQRFTTSDQAEWIQAAKDLRQPFWDWGYWPN
DPDFIGLPDQVIRDKQVEITDYNGTKIEVENPILHYKFHPIEPTFEGDFAQWQTTMRYPDVQKQENIEGMIAGI
KAAAPGFREWTFNMLTKNYTWELFSNHGAVVGAHANSLEMVHNTVHFLIGRDPTLDPLVPGHMGSVPHA
AFDPIFWMHHCNVDRLLALWQTMNYDVYVSEGMNREATMGLIPGQVLTEDSPLEPFYTKNQDPWQSDDL
EDWETLGFSYPDFDPVKGKSKEEKSVYINDWVHKHYG (SEQ ID NO://)

FIG. 10A

Bacillus megaterium Tyrosinase WT

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHRWVGGQMGVVPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10B

Bacillus megaterium Tyrosinase F197A (Reduced Copper Plasticity)

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHRWVGGQMGVVPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10C

Bacillus megaterium Tyrosinase R209H (Increased monophenolase activity[3])

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHHWVGGQMGVVPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10D

Bacillus megaterium Tyrosinase V218G (Reduced active site steric interactions)

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHRWVGGQMGVGPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10E

Bacillus megaterium Tyrosinase V218F (Increased active site steric interactions[4])

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHRWVGGQMGVFPTAPNDPVFFL
HHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10F

Bacillus megaterium Tyrosinase F197A, R209H

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHHWVGGQMGVVPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10G

Bacillus megaterium Tyrosinase F197A, V218G

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHRWVGGQMGVGPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10H

Bacillus megaterium Tyrosinase F197A, V218F

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHRWVGGQMGVFPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10I

Bacillus megaterium Tyrosinase R209H, V218G

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHHWVGGQMGVGPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10J

Bacillus megaterium Tyrosinase R209H, V218F

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHHWVGGQMGVFPTAPNDPVFFL
HHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10K

Bacillus megaterium Tyrosinase F197A, R209H, V218G

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHHWVGGQMGVGPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10L

Bacillus megaterium Tyrosinase F197A, R209H, V218F

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHHWVGGQMGVFPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10M

Bacillus megaterium Tyrosinase D55K (Increased negative charge affinity)

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHRWVGGQMGVVPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10N

Bacillus megaterium Tyrosinase D55K, F197A

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHRWVGGQMGVVPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10O

Bacillus megaterium Tyrosinase D55K, R209H

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHHWVGGQMGVVPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10P

Bacillus megaterium Tyrosinase D55K, V218G

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHRWVGGQMGVGPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10Q

Bacillus megaterium Tyrosinase D55K, V218F

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHRWVGGQMGVFPTAPNDPVFFL
HHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10R

Bacillus megaterium Tyrosinase D55K, F197A, R209H

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHHWVGGQMGVVPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10S

Bacillus megaterium Tyrosinase D55K, F197A, V218G

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHRWVGGQMGVGPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10T

Bacillus megaterium Tyrosinase D55K, F197A, V218F

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHRWVGGQMGVFPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10U

Bacillus megaterium Tyrosinase D55K, R209H, V218G

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHHWVGGQMGVGPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10V

Bacillus megaterium Tyrosinase D55K, R209H, V218F

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHHWVGGQMGVFPTAPNDPVFFL
HHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10W

Bacillus megaterium Tyrosinase D55K, F197A, R209H, V218G

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHHWVGGQMGVGPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10X

Bacillus megaterium Tyrosinase D55K, F197A, R209H, V218F

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDEQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHHWVGGQMGVFPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10Y

Bacillus megaterium Tyrosinase E141K (Increased negative charge affinity)

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHRWVGGQMGVVPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10Z

Bacillus megaterium Tyrosinase E141K, F197A

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHRWVGGQMGVVPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10AA

Bacillus megaterium Tyrosinase E141K, R209H

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHHWVGGQMGVVPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10BB

Bacillus megaterium Tyrosinase E141K, V218G

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHRWVGGQMGVGPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10CC

Bacillus megaterium Tyrosinase E141K, V218F

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHRWVGGQMGVFPTAPNDPVFFL
HHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10DD

Bacillus megaterium Tyrosinase E141K, F197A, R209H

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHHWVGGQMGVVPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10EE

Bacillus megaterium Tyrosinase E141K, F197A, V218G

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHRWVGGQMGVGPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10FF

Bacillus megaterium Tyrosinase E141K, F197A, V218F

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHRWVGGQMGVFPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10GG

Bacillus megaterium Tyrosinase E141K, R209H, V218G

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHHWVGGQMGVGPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10HH

Bacillus megaterium Tyrosinase E141K, R209H, V218F

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHHWVGGQMGVFPTAPNDPVFFL
HHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10II

Bacillus megaterium Tyrosinase E141K, F197A, R209H, V218G

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHHWVGGQMGVGPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10JJ

Bacillus megaterium Tyrosinase E141K, F197A, R209H, V218F

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHHWVGGQMGVFPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10KK

Bacillus megaterium Tyrosinase D55K, E141K (Increased negative charge affinity x2)

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHRWVGGQMGVVPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10LL

Bacillus megaterium Tyrosinase D55K, E141K, F197A

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHRWVGGQMGVVPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10MM

Bacillus megaterium Tyrosinase D55K, E141K, R209H

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHHWVGGQMGVVPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10NN

Bacillus megaterium Tyrosinase D55K, E141K, V218G

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHRWVGGQMGVGPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10OO

Bacillus megaterium Tyrosinase D55K, E141K, V218F

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHRWVGGQMGVFPTAPNDPVFFL
HHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10PP

Bacillus megaterium Tyrosinase D55K, E141K, F197A, R209H

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHHWVGGQMGVVPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10QQ

Bacillus megaterium Tyrosinase D55K, E141K, F197A, V218G

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHRWVGGQMGVGPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10RR

Bacillus megaterium Tyrosinase D55K, E141K, F197A, V218F

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHRWVGGQMGVFPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10SS

Bacillus megaterium Tyrosinase D55K, E141K, R209H, V218G

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHHWVGGQMGVGPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10TT

Bacillus megaterium Tyrosinase D55K, E141K, R209H, V218F

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRVHHWVGGQMGVFPTAPNDPVFFL
HHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10UU

Bacillus megaterium Tyrosinase D55K, E141K, F197A, R209H, V218G

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHHWVGGQMGVGPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 10VV

Bacillus megaterium Tyrosinase D55K, E141K, F197A, R209H, V218F

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSKRNAAHMSSAFLPWHREYLLRFER
DLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTTIDKQGNPSGGLKRNF
GATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGAINGPQLHNRVHHWVGGQMGVFPTAPNDPVFF
LHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPEDVMNHRKLGYVYDIELRKSKRSSLEHHHH
HH

FIG. 11

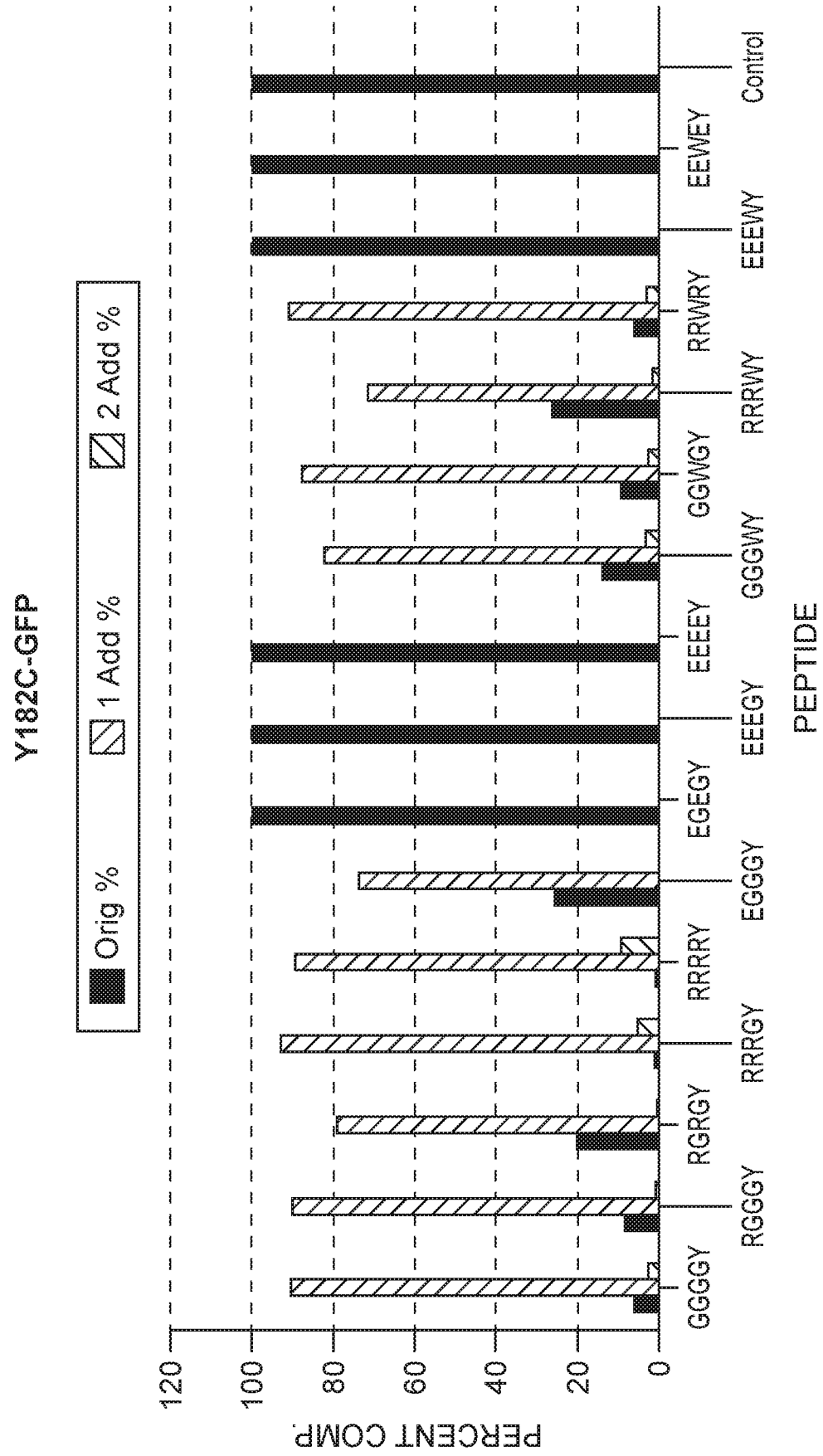

Y182C-GFP
Orig %
1 Add %
2 Add %
PERCENT COMP.
120
100
80
60
40
20
0
GGGGY
RGGGY
RGRGY
RRRGY
RRRRY
EGGGY
EGEGY
EEEGY
EEEEY
GGGWY
GGWGY
RRRWY
RRWRY
EEEWY
EEWEY
Control
PEPTIDE

FIG. 11 (Cont.)

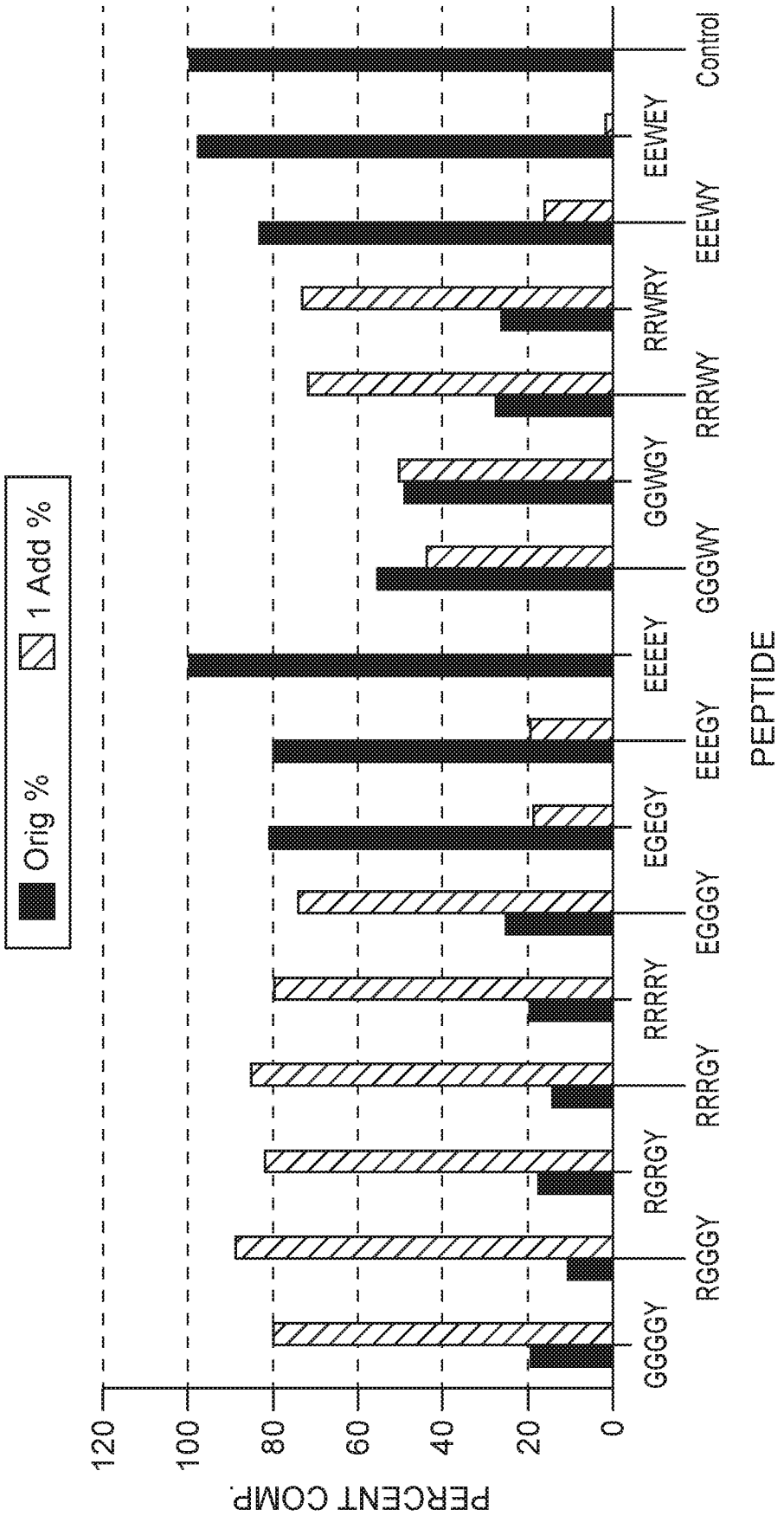

pAF-MS2
Orig %
1 Add %
PERCENT COMP.
120
100
80
60
40
20
0
GGGGY
RGGGY
RGRGY
RRRGY
RRRRY
EGGGY
EGEGY
EEEGY
EEEEY
GGGWY
GGWGY
RRRWY
RRWRY
EEEWY
EEWEY
Control
PEPTIDE

FIG. 12

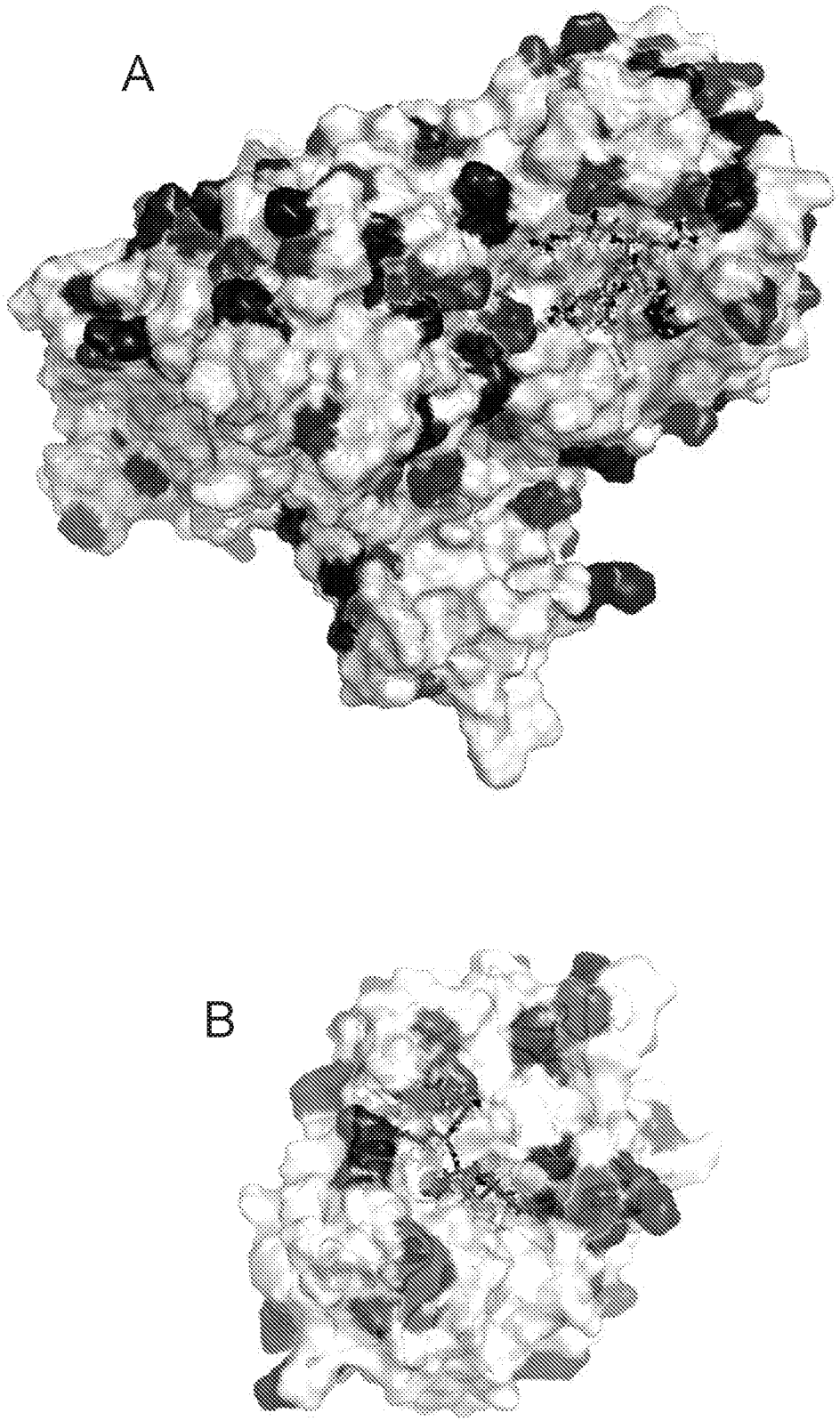


FIG. 13

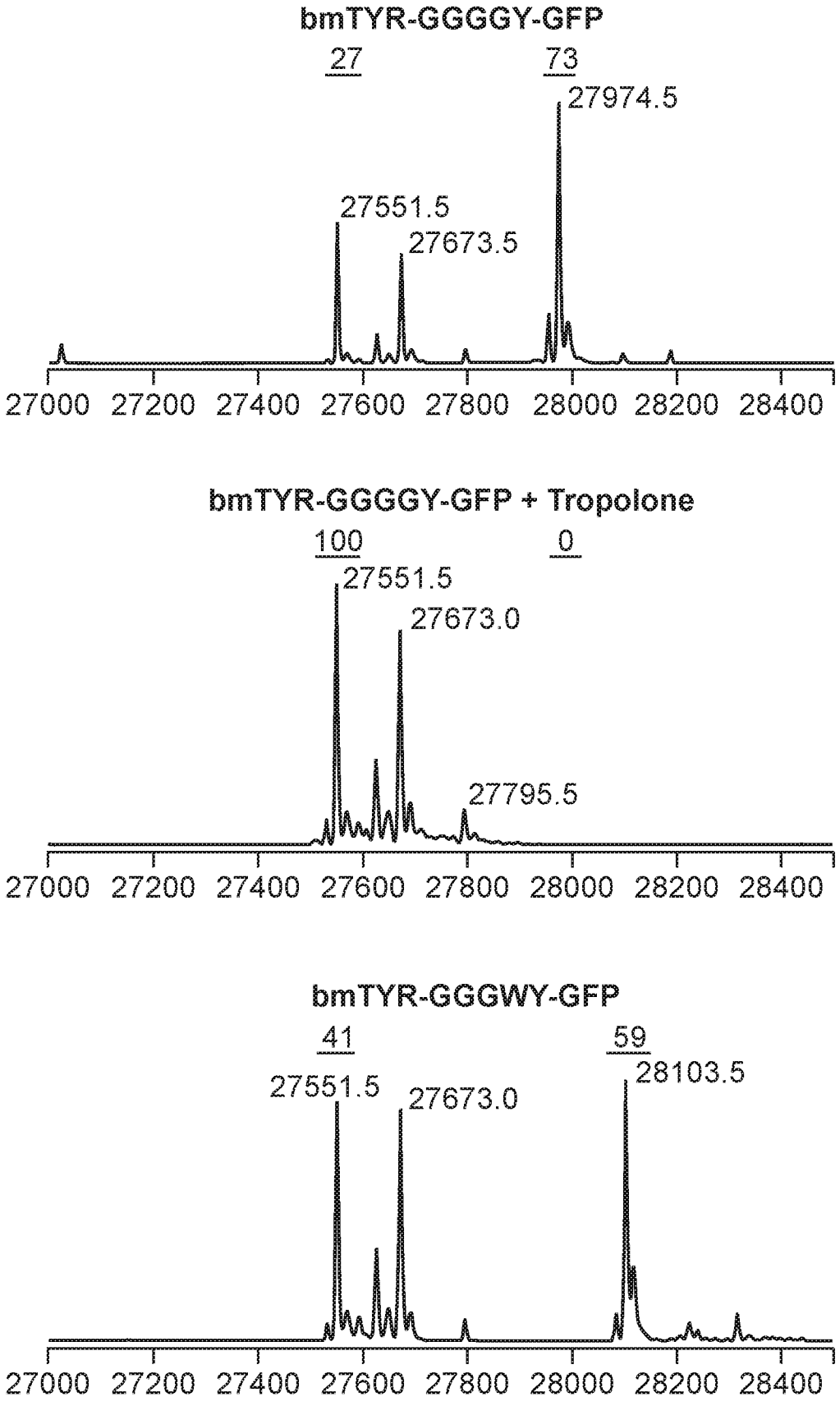

bmTYR-GGGGY-GFP
27
73
27974.5
27551.5
27673.5
27000 27200 27400 27600 27800 28000 28200 28400
bmTYR-GGGGY-GFP + Tropolone
100
0
27551.5
27673.0
27795.5
27000 27200 27400 27600 27800 28000 28200 28400
bmTYR-GGGWY-GFP
41
59
27551.5
27673.0
28103.5
27000 27200 27400 27600 27800 28000 28200 28400

FIG. 13 (Cont.)

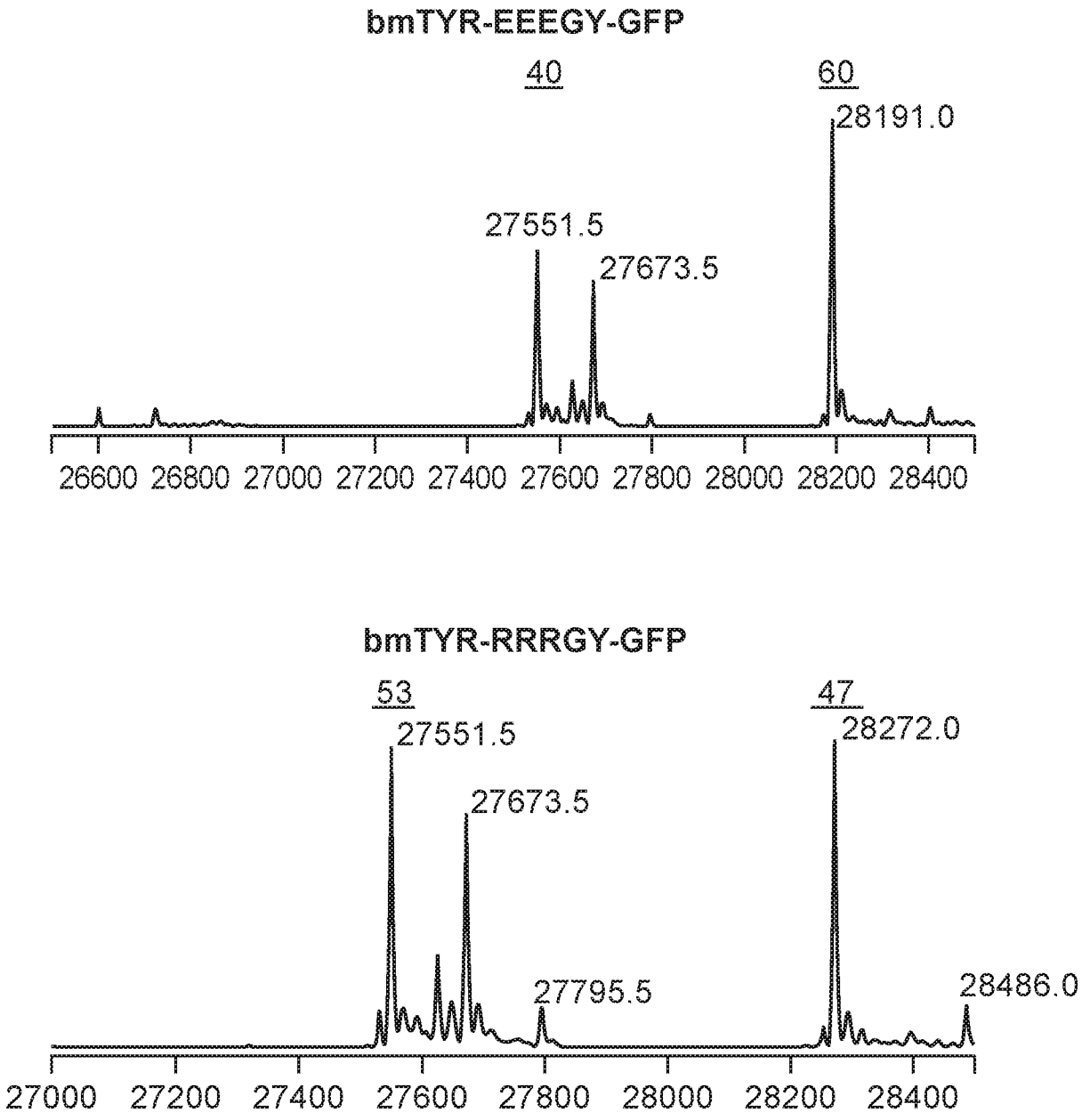

bmTYR-EEEGY-GFP
40
60
28191.0
27551.5
27673.5
26600 26800 27000 27200 27400 27600 27800 28000 28200 28400
bmTYR-RRRGY-GFP
53
47
27551.5
28272.0
27673.5
27795.5
28486.0
27000 27200 27400 27600 27800 28000 28200 28400

FIG. 14

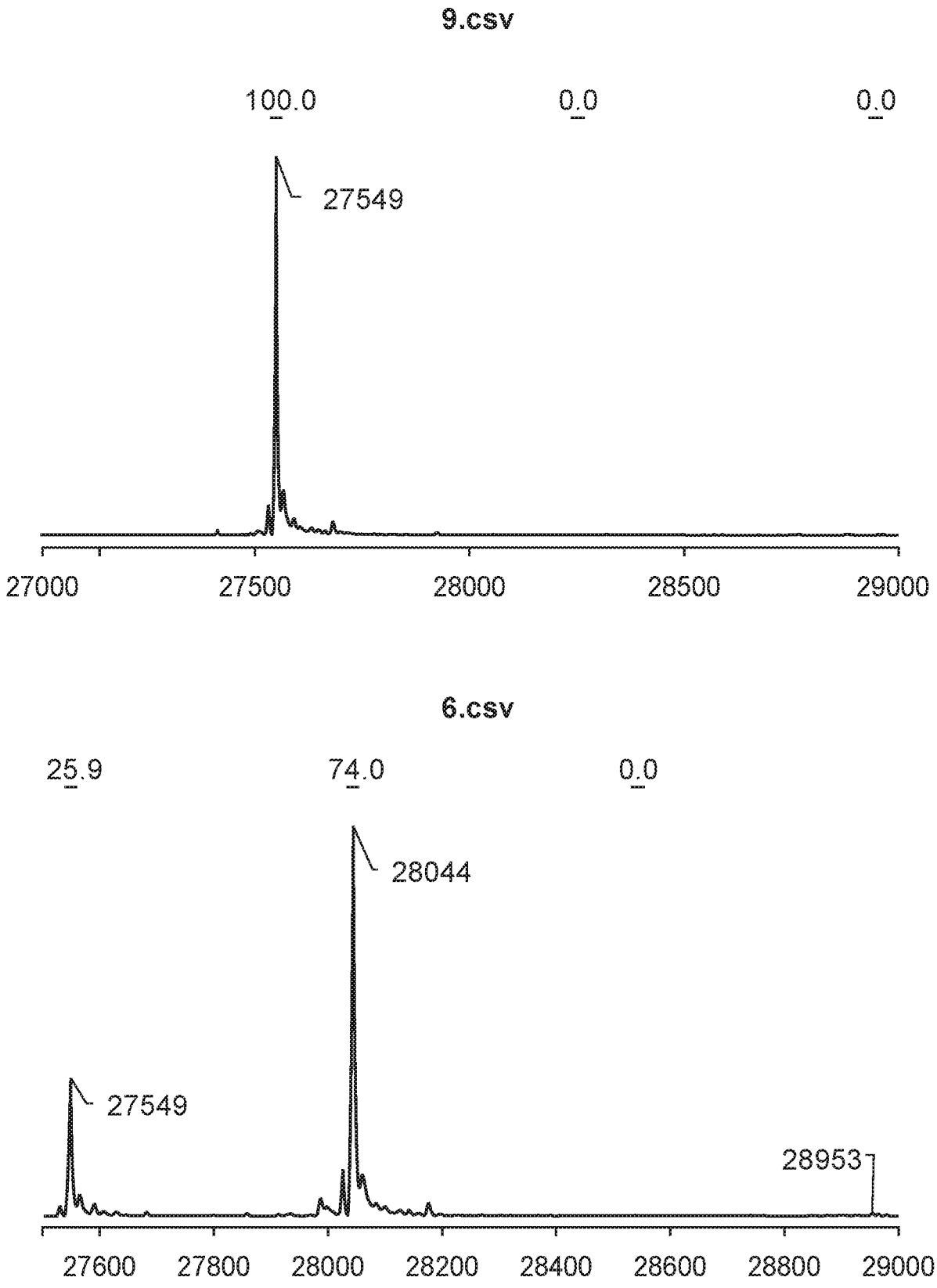
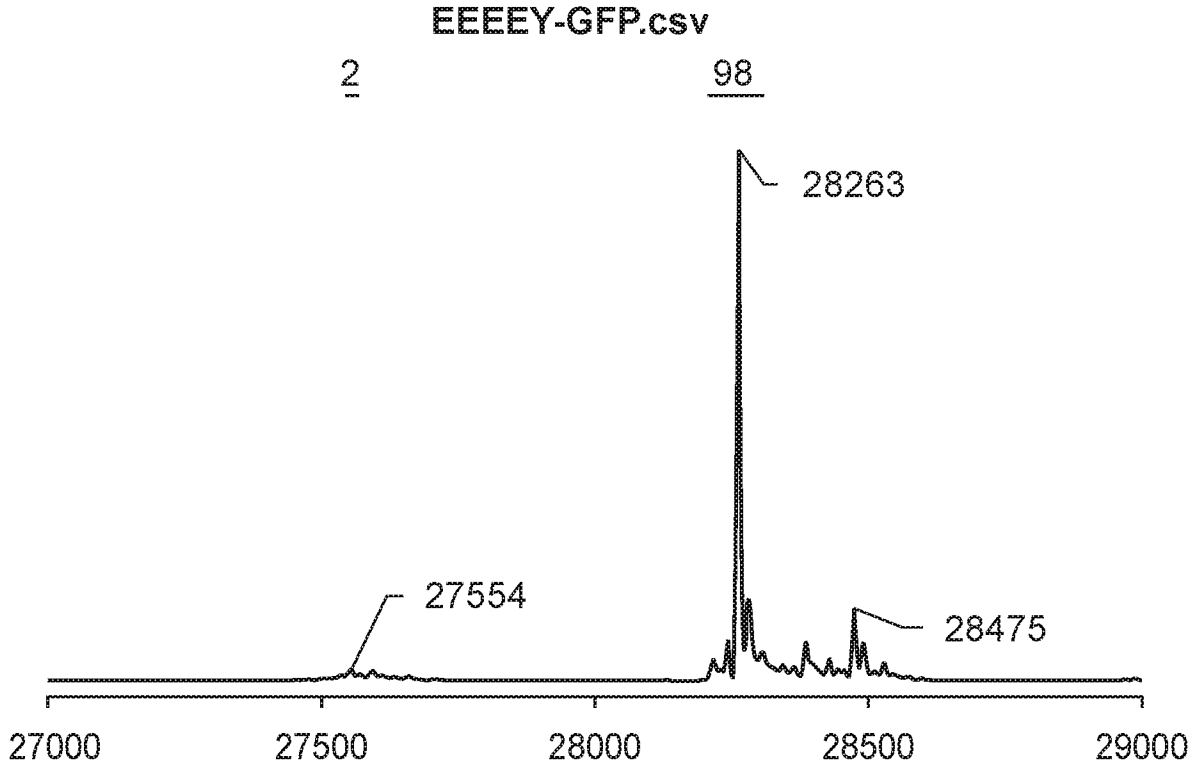

9.csv
100.0
0.0
0.0
27549
27000
27500
28000
28500
29000
6.csv
25.9
74.0
0.0
28044
27549
28953
27600
27800
28000
28200
28400
28600
28800
29000

FIG. 14 (Cont.)


EEEEY-GFP.csv
2
98
28263
27554
28475
27000
27500
28000
28500
29000

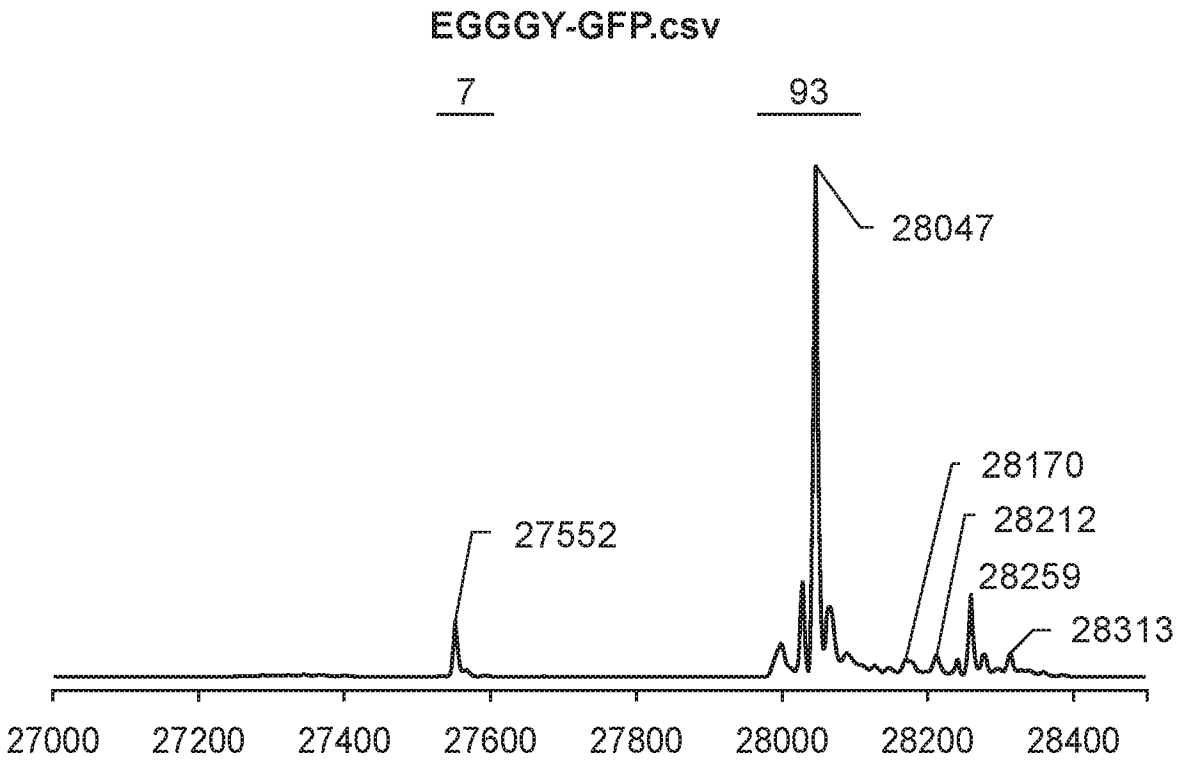
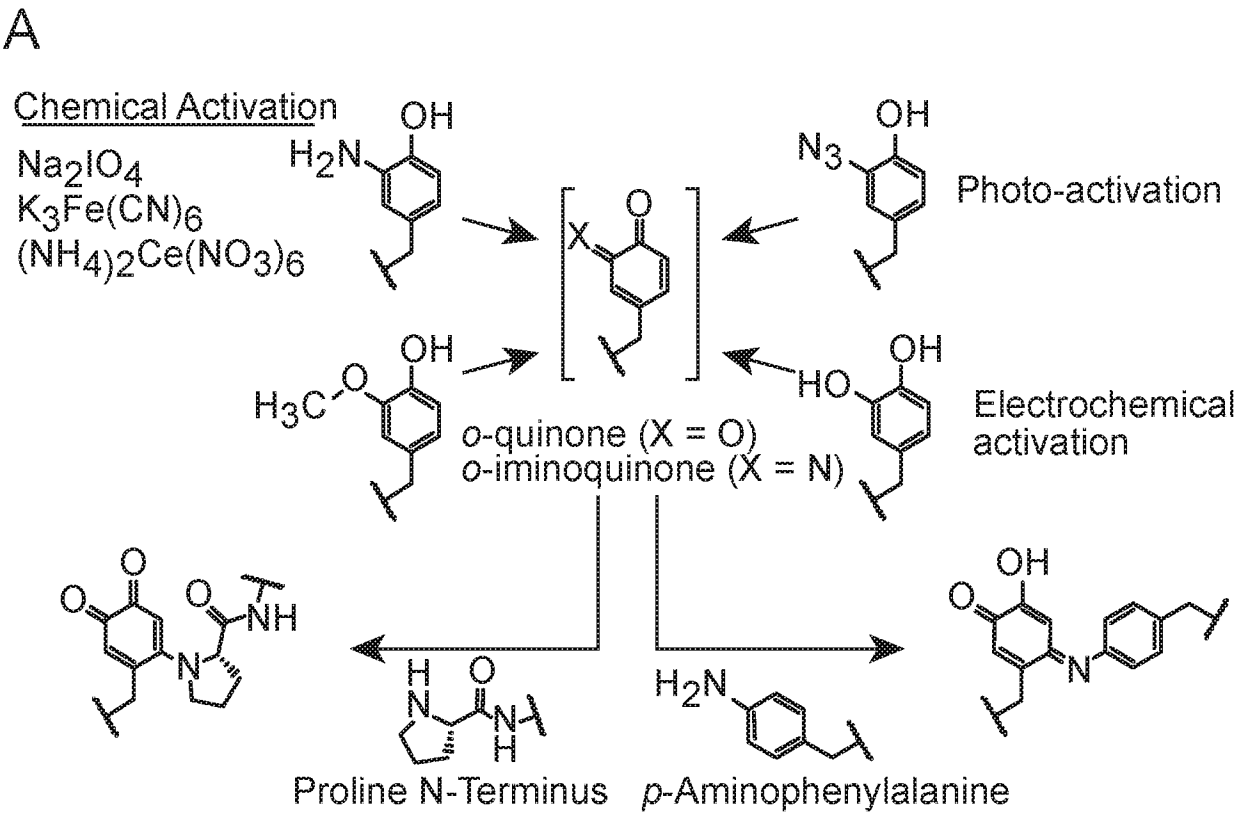
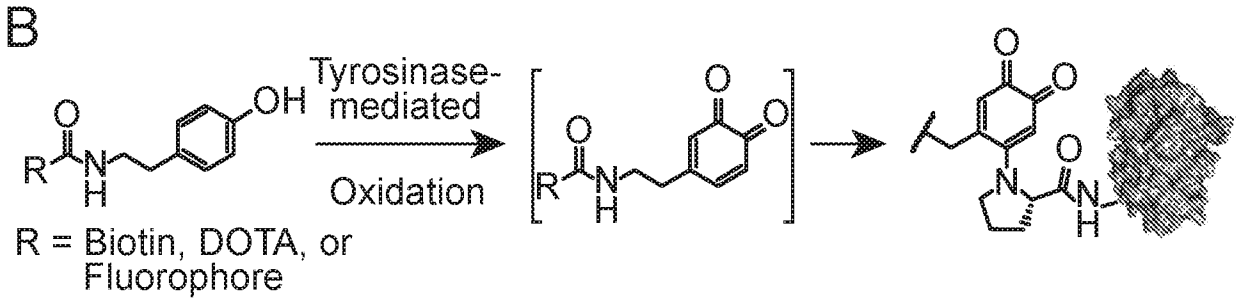

EGGGY-GFP.csv
7
93
28047
28170
28212
28259
28313
27552
27000
27200
27400
27600
27800
28000
28200
28400

FIG. 15


A
Chemical Activation
Na_2IO_4
$K_3Fe(CN)_6$
$(NH_4)_2Ce(NO_3)_6$
Photo-activation
Electrochemical activation
o-quinone (X = O)
o-iminoquinone (X = N)
Proline N-Terminus
p-Aminophenylalanine


B
Tyrosinase-mediated
Oxidation
R = Biotin, DOTA, or Fluorophore

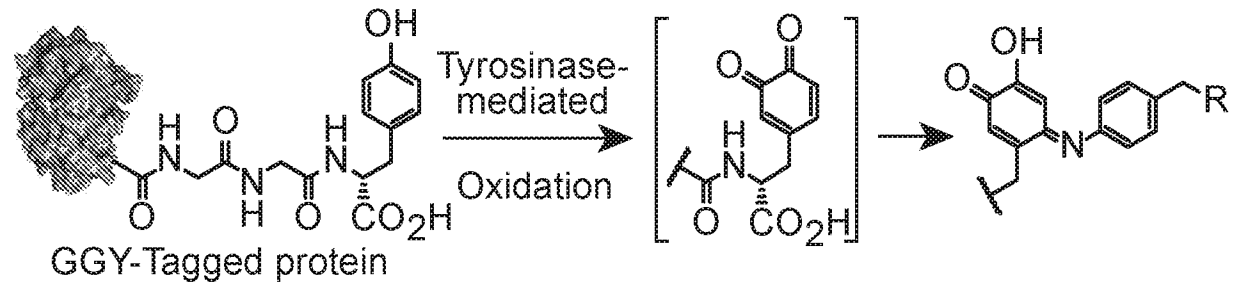

C
Tyrosinase-mediated
Oxidation
GGY-Tagged protein

FIG. 16

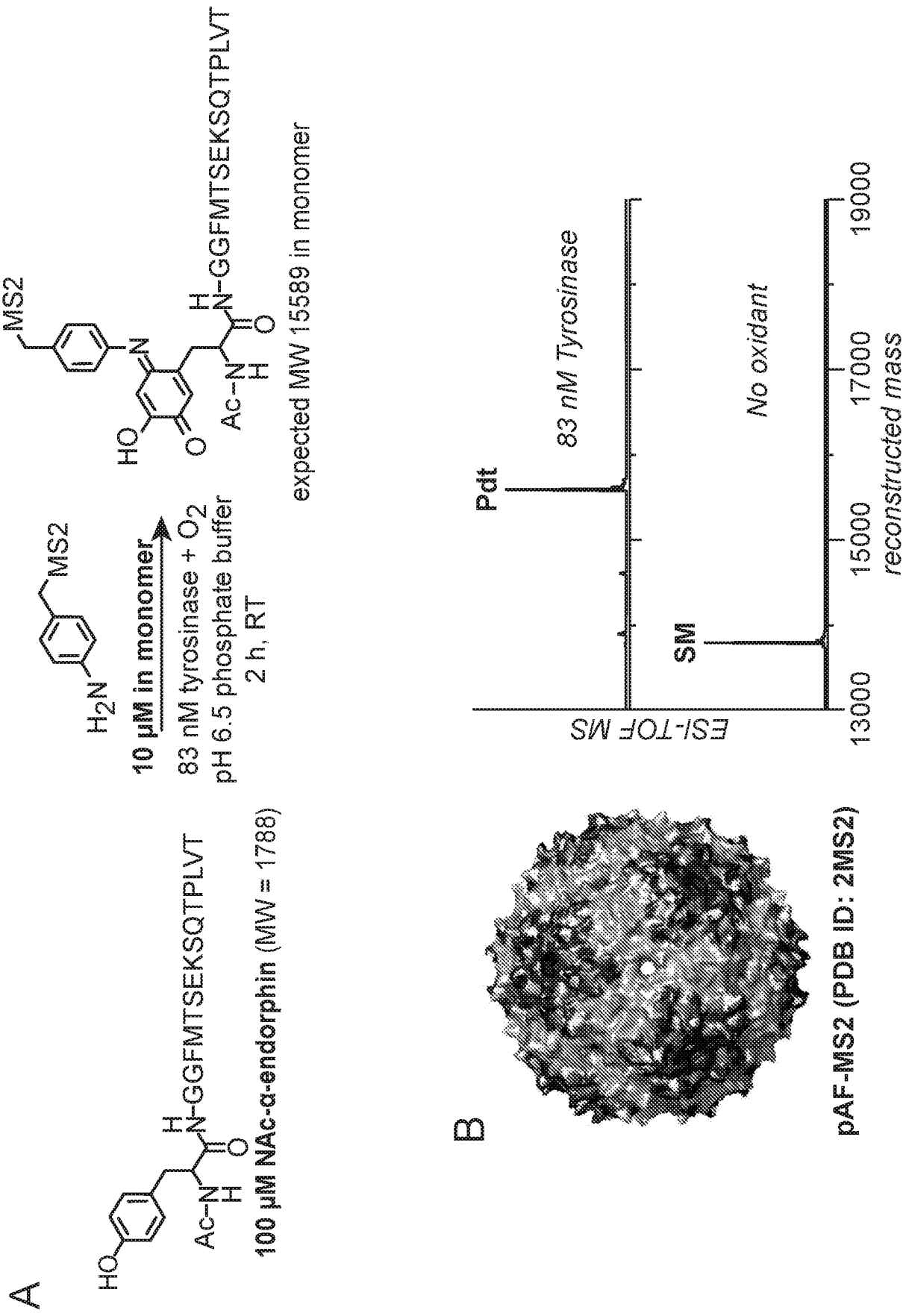

A
100 µM NAc-α-endorphin (MW = 1788)
10 µM in monomer
83 nM tyrosinase + O2
pH 6.5 phosphate buffer
2 h, RT
expected MW 15589 in monomer
B
pAF-MS2 (PDB ID: 2MS2)
Pdt
83 nM Tyrosinase
SM
No oxidant
ESI-TOF MS
13000
15000
17000
19000
reconstructed mass

FIG. 17

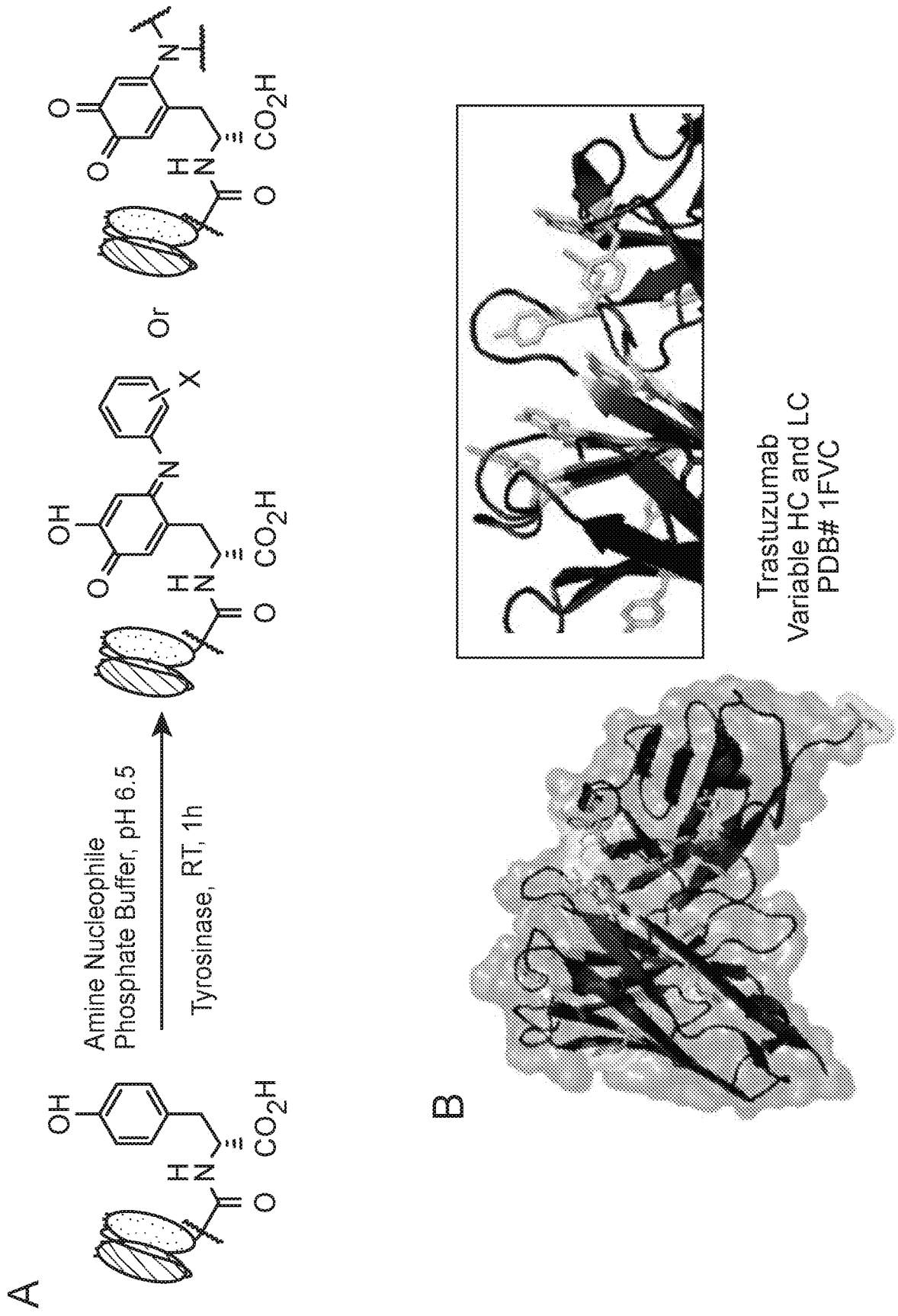

A
Amine Nucleophile
Phosphate Buffer, pH 6.5
Tyrosinase, RT, 1h
Or
B
Trastuzumab
Variable HC and LC
PDB# 1FVC

FIG. 17 (Cont.)

C

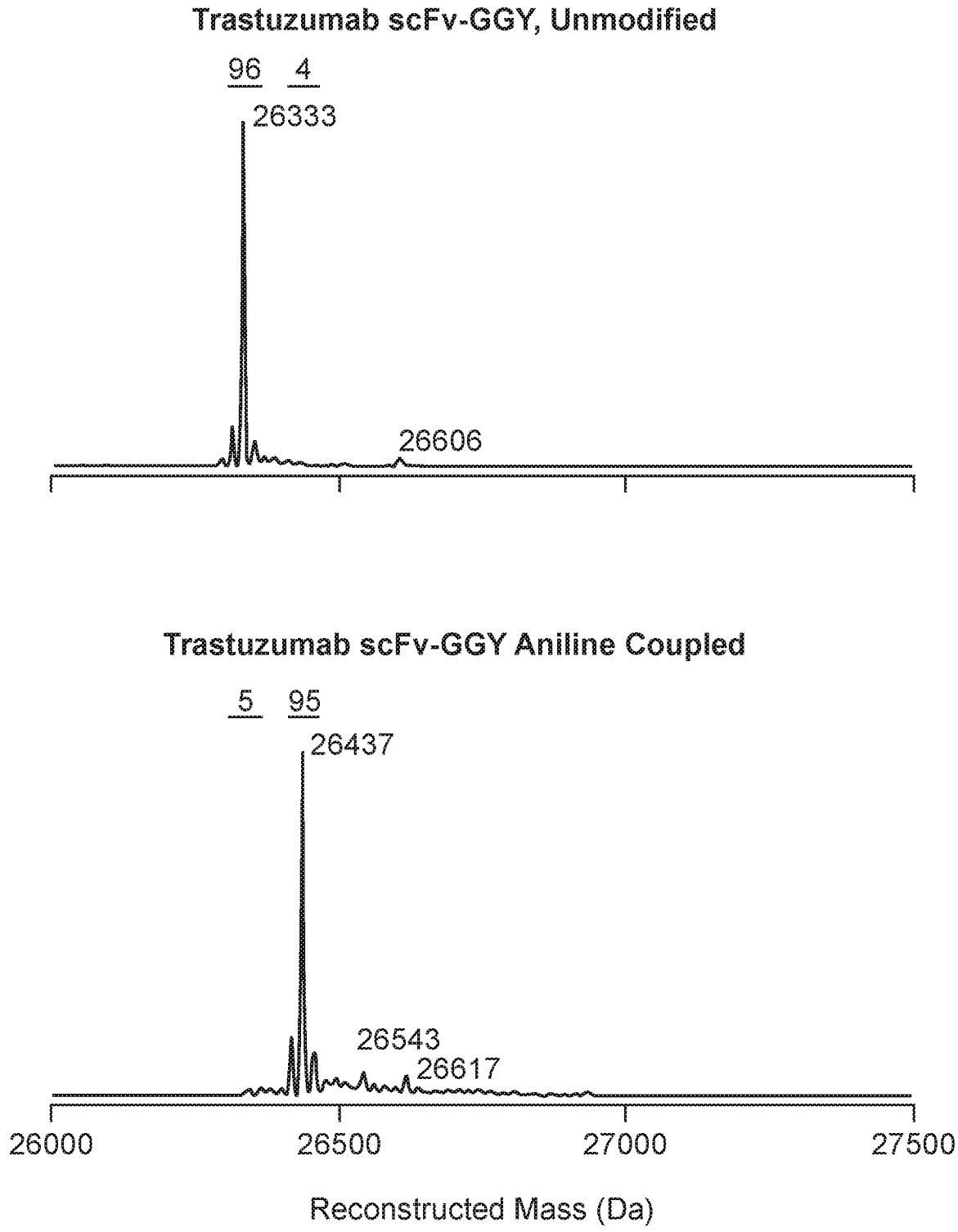
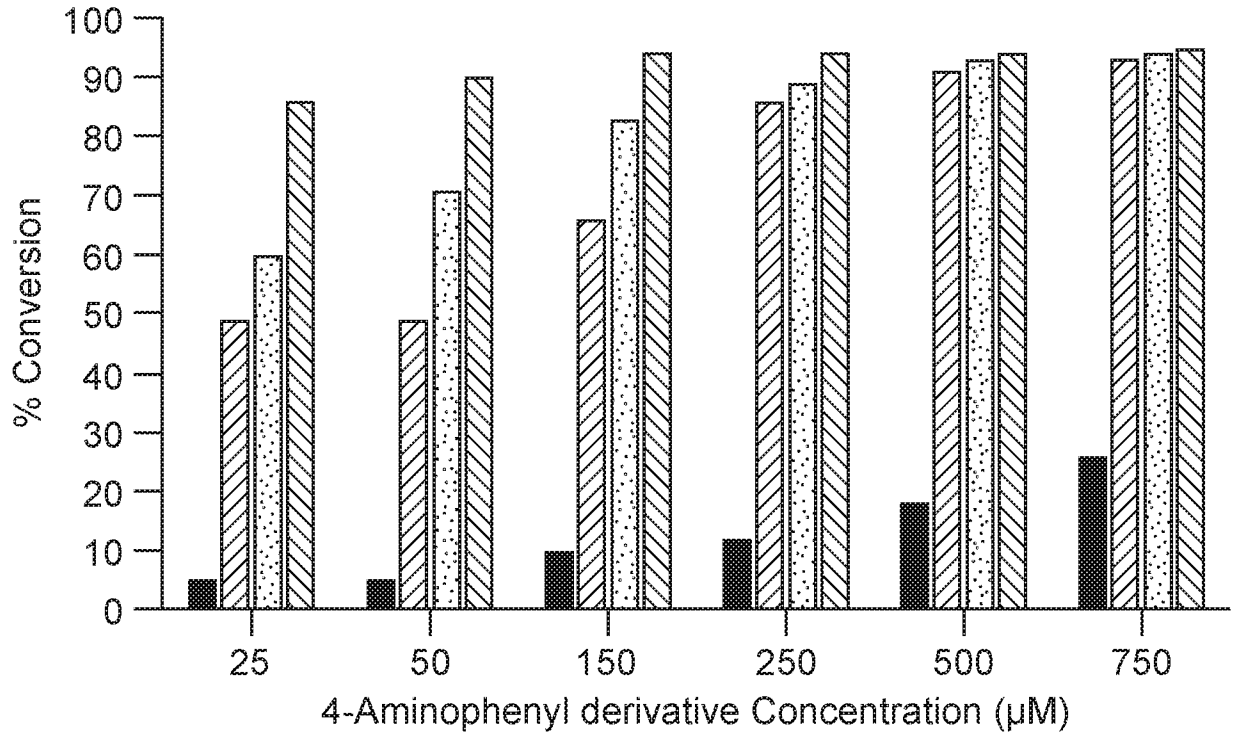

Trastuzumab scFv-GGY, Unmodified
96 4
26333
26606
Trastuzumab scFv-GGY Aniline Coupled
5 95
26437
26543
26617
26000
26500
27000
27500
Reconstructed Mass (Da)

FIG. 17 (Cont.)

D


100
90
80
70
60
50
40
30
20
10
0
% Conversion
25
50
150
250
500
750
4-Aminophenyl derivative Concentration (μM)

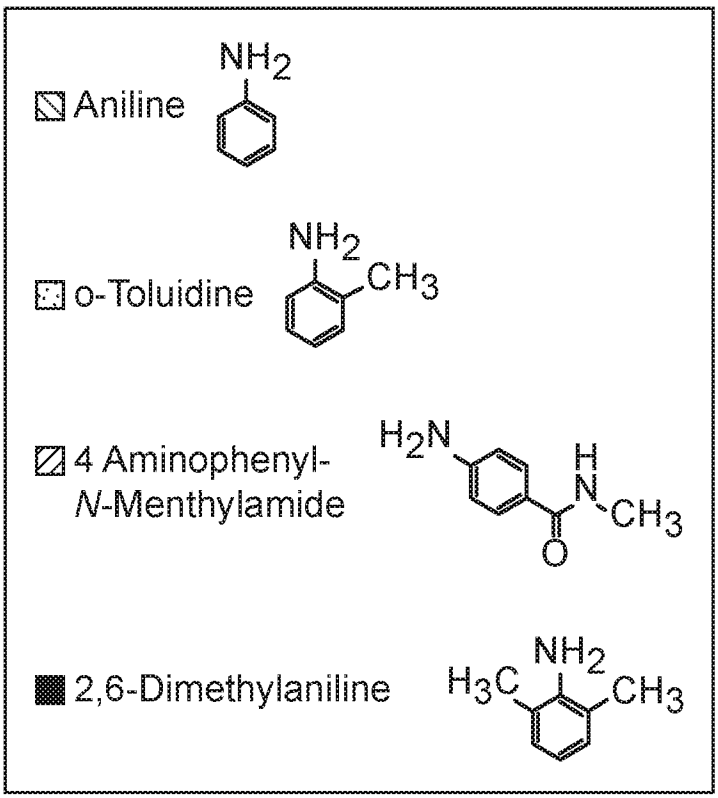

Aniline
NH2
o-Toluidine
NH2
CH3
4 Aminophenyl-
N-Menthylamide
H2N
H
N
CH3
O
2,6-Dimethylaniline
NH2
H3C
CH3

FIG. 17 (Cont.)

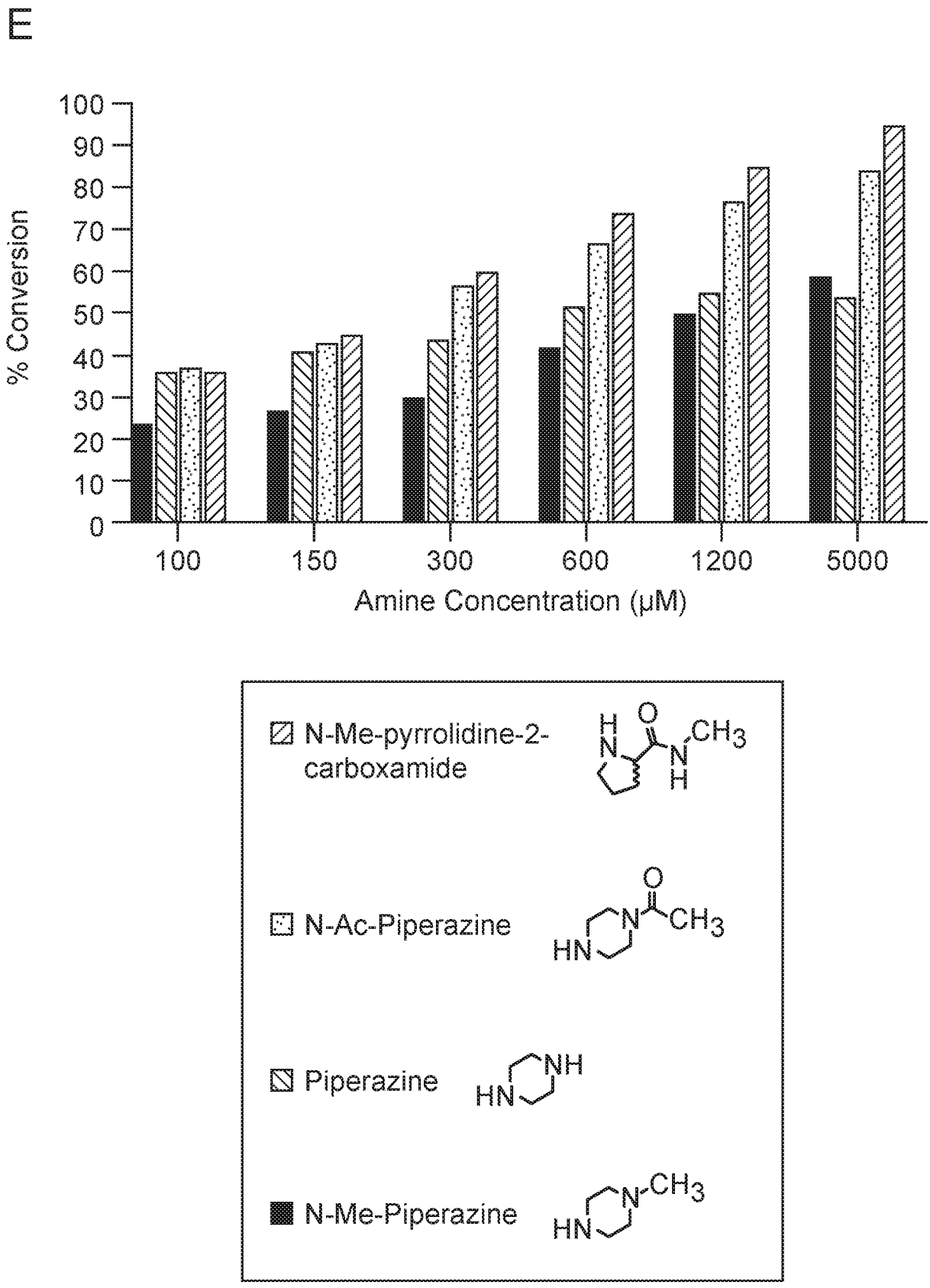
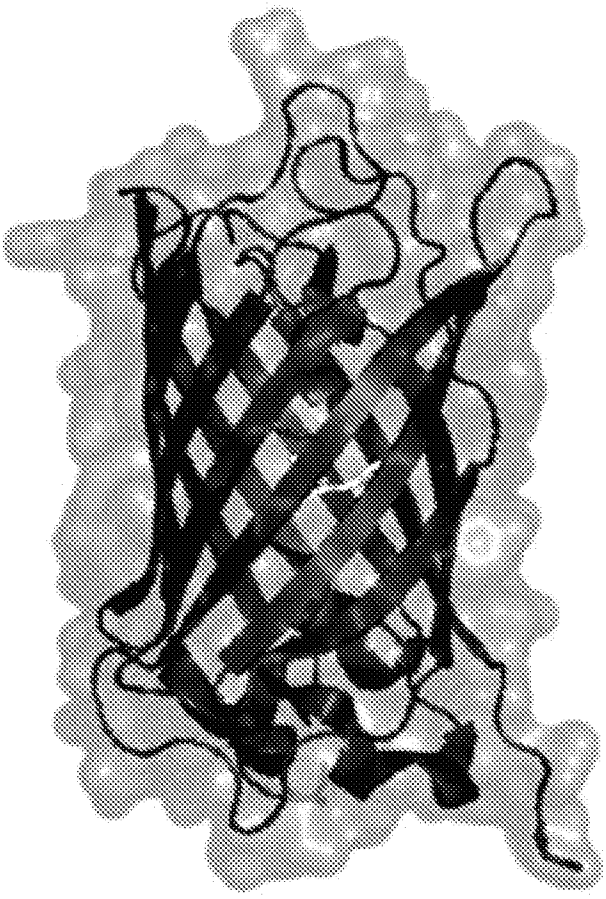

Π
% Conversion
100
90
80
70
60
50
40
30
20
10
0
100
150
300
600
1200
5000
Amine Concentration (μM)
N-Me-pyrrolidine-2-carboxamide
N-Ac-Piperazine
Piperazine
N-Me-Piperazine

FIG. 18



Ubiquitin
PDB# 1UBQ

TOF-LCMS Data Coupling to Tyrosine-Tagged Ubiquitin



sfGFP - SGGGGY
PDB# 2BP3
Red N-Terminus

TOF-LCMS Data Coupling to N-Terminally Tyrosine-Tagged sfGFP

FIG. 18 (Cont.)

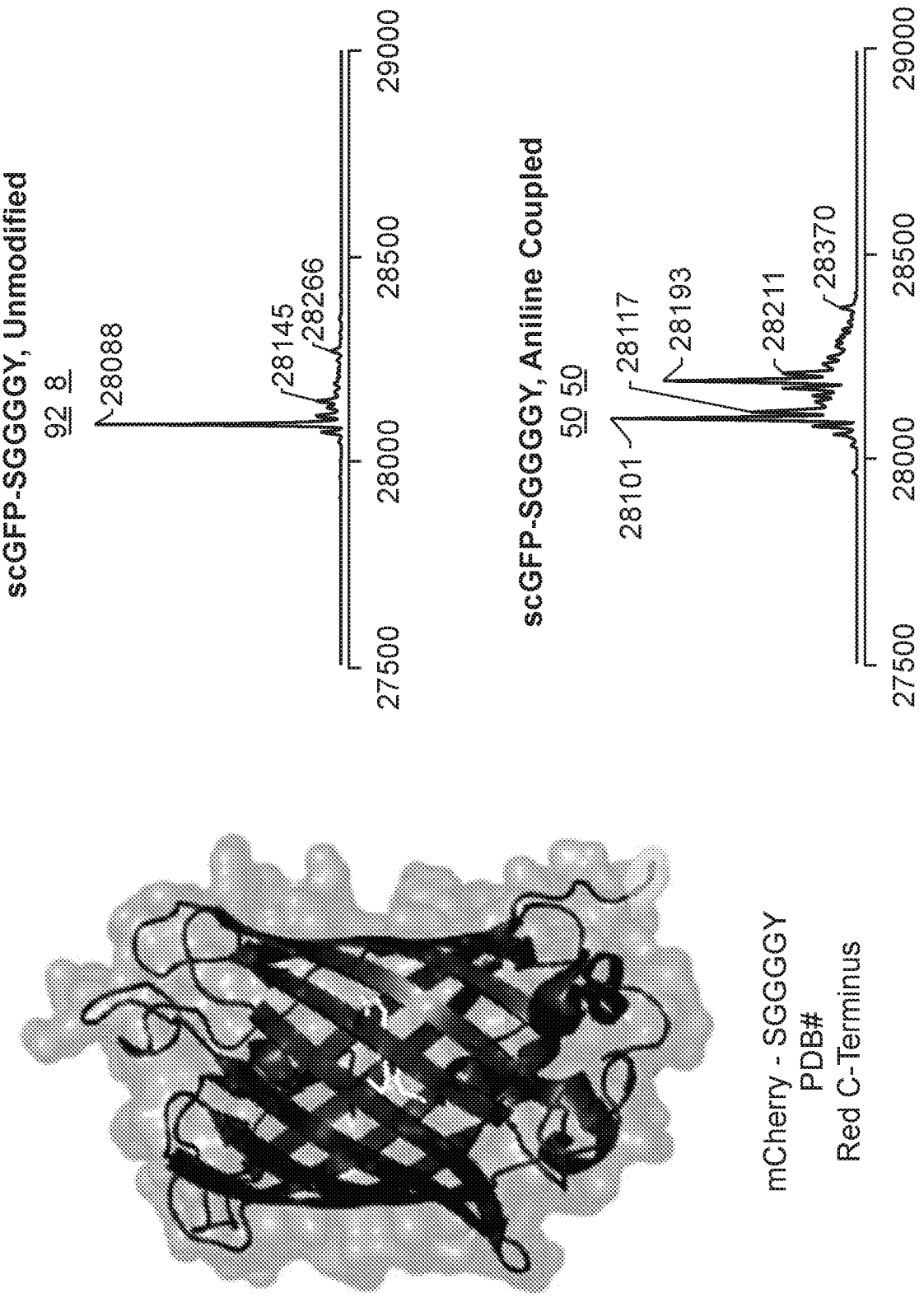

scGFP-SGGGGY, Unmodified
92 8
28088
28145
28266
27500
28000
28500
29000
scGFP-SGGGGY, Aniline Coupled
50 50
28101
28117
28193
28211
28370
27500
28000
28500
29000
mCherry - SGGGGY
PDB#
Red C-Terminus

FIG. 19

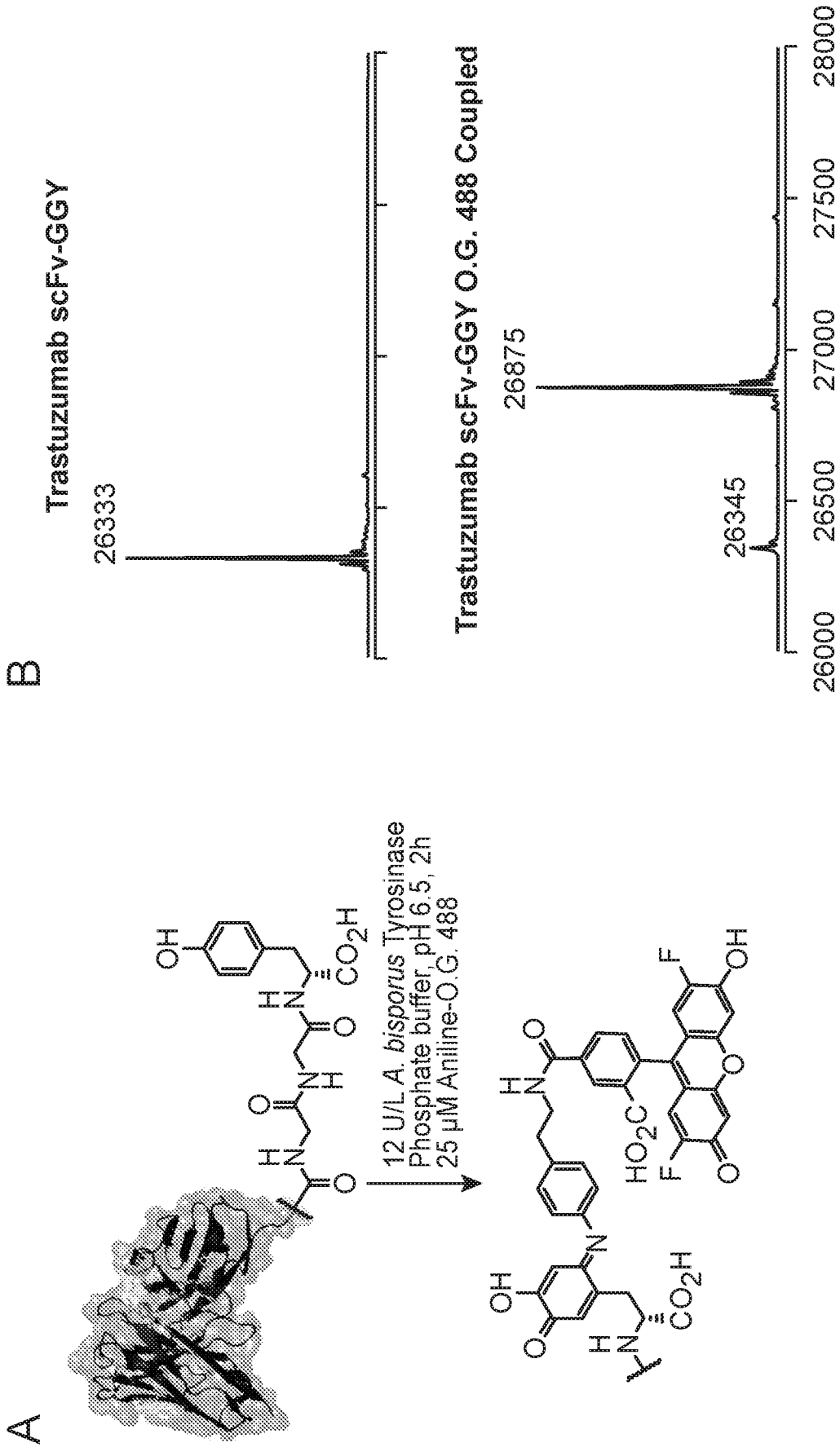

A
12 U/L A. bisporus Tyrosinase
Phosphate buffer, pH 6.5, 2h
25 µM Aniline-O.G. 488
B
Trastuzumab scFv-GGY
26333
Trastuzumab scFv-GGY O.G. 488 Coupled
26875
26345
26000
26500
27000
27500
28000

FIG. 19 (Cont.)

C

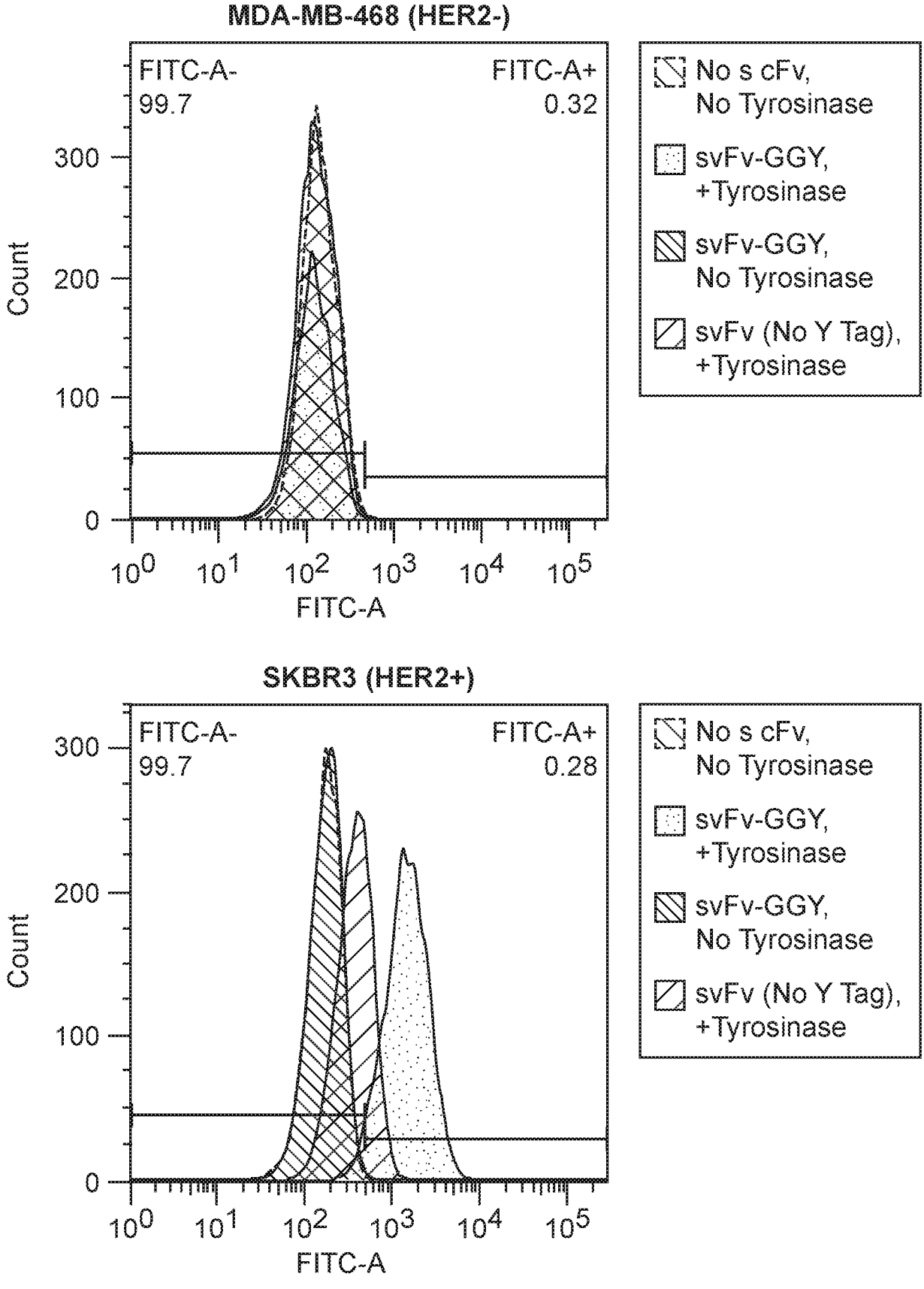

MDA-MB-468 (HER2-)
FITC-A-
99.7
FITC-A+
0.32
Count
300
200
100
0
10^0 10^1 10^2 10^3 10^4 10^5
FITC-A
No s cFv,
No Tyrosinase
svFv-GGY,
+Tyrosinase
svFv-GGY,
No Tyrosinase
svFv (No Y Tag),
+Tyrosinase
SKBR3 (HER2+)
FITC-A-
99.7
FITC-A+
0.28
Count
300
200
100
0
10^0 10^1 10^2 10^3 10^4 10^5
FITC-A
No s cFv,
No Tyrosinase
svFv-GGY,
+Tyrosinase
svFv-GGY,
No Tyrosinase
svFv (No Y Tag),
+Tyrosinase

FIG. 20

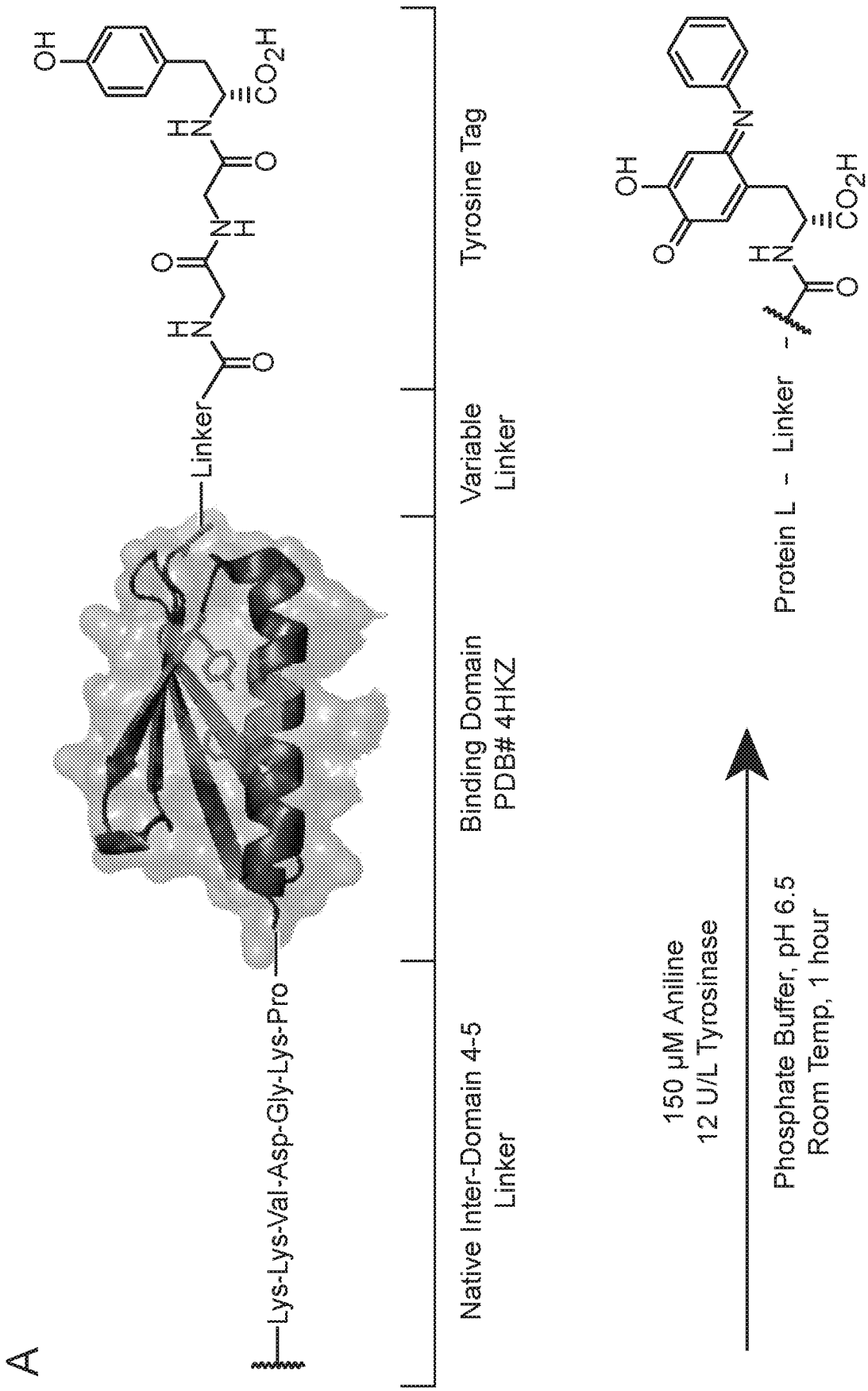

A
Lys-Lys-Val-Asp-Gly-Lys-Pro
Linker
Native Inter-Domain 4-5 Linker
Binding Domain PDB# 4HKZ
Variable Linker
Tyrosine Tag
150 µM Aniline
12 U/L Tyrosinase
Phosphate Buffer, pH 6.5
Room Temp, 1 hour
Protein L - Linker -

FIG. 20 (Cont.)

B

Variant	Type	Linker	Length	% Conversion
1	Flexible	-GGY	3	94
2	Flexible	$-(G_4S)_2GGY$	13	98
3	Flexible	$-(G_4S)_3GGY$	18	98
4	Alpha-helical	$-A(EAAAK)_2AGGY$	15	99
5	Rigid Ala/Pro	$-(AP)_3GGY$	9	99
6	Poly-Asn	$-AN_{20}GGY$	24	98
7	scFv C-Term. Seq.	-EIKRTGGY	8	97
8	ΔDomain 5	-(Domain 4-5 Linker)GGY	10	96
9	ΔDomain 5	$-$(Domain 4-5 Linker)G_4SGGY	15	95
10	None	None	0	0

FIG. 21

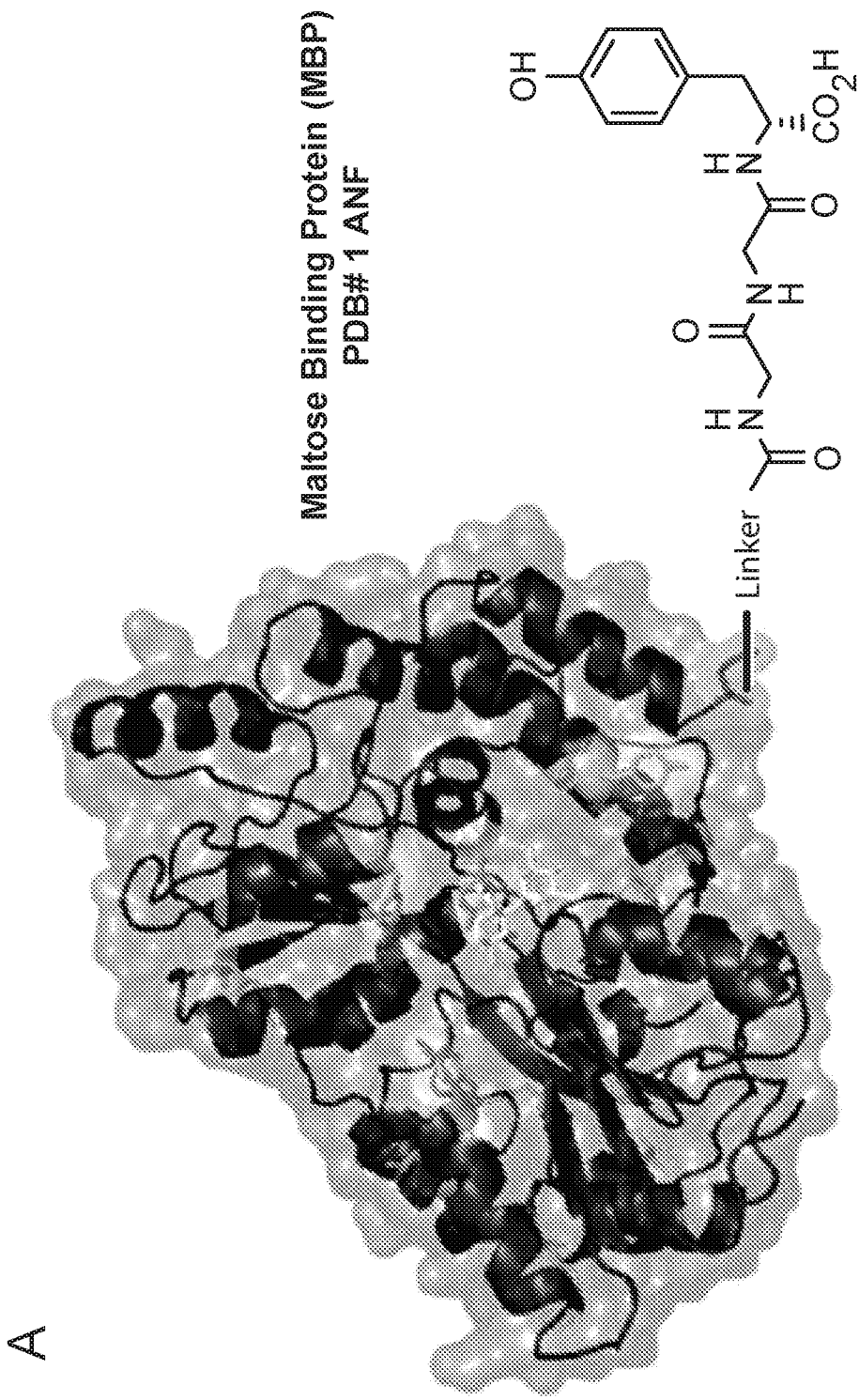

A
Maltose Binding Protein (MBP)
PDB# 1 ANF
Linker
OH
CO_2H
H
N
O
N
H
O
H
N
O

FIG. 21 (Cont.)

B

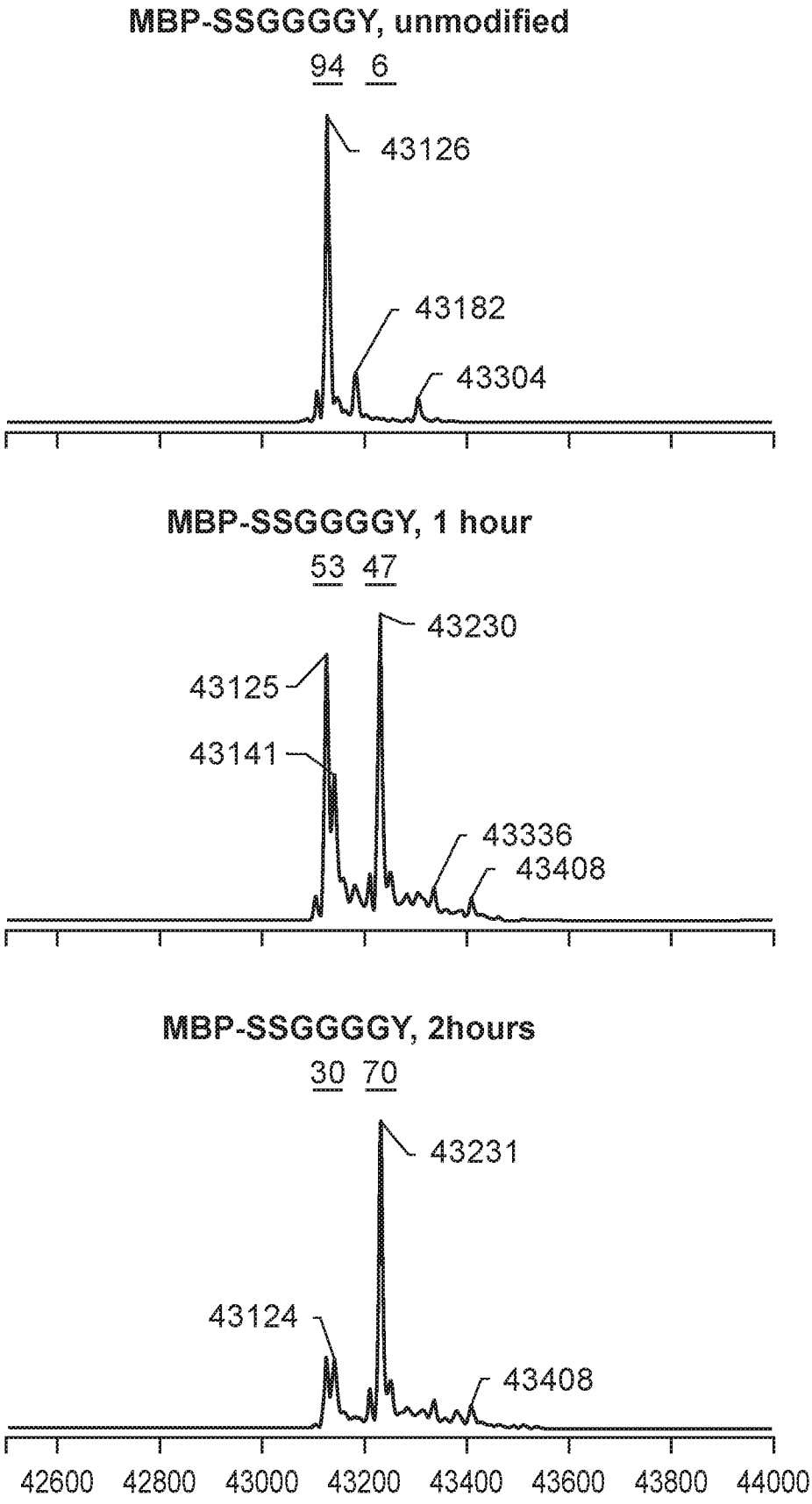

MBP-SSGGGGY, unmodified
94 6
43126
43182
43304
MBP-SSGGGGY, 1 hour
53 47
43230
43125
43141
43336
43408
MBP-SSGGGGY, 2hours
30 70
43231
43124
43408
42600 42800 43000 43200 43400 43600 43800 44000

FIG. 21 (Cont.)

C

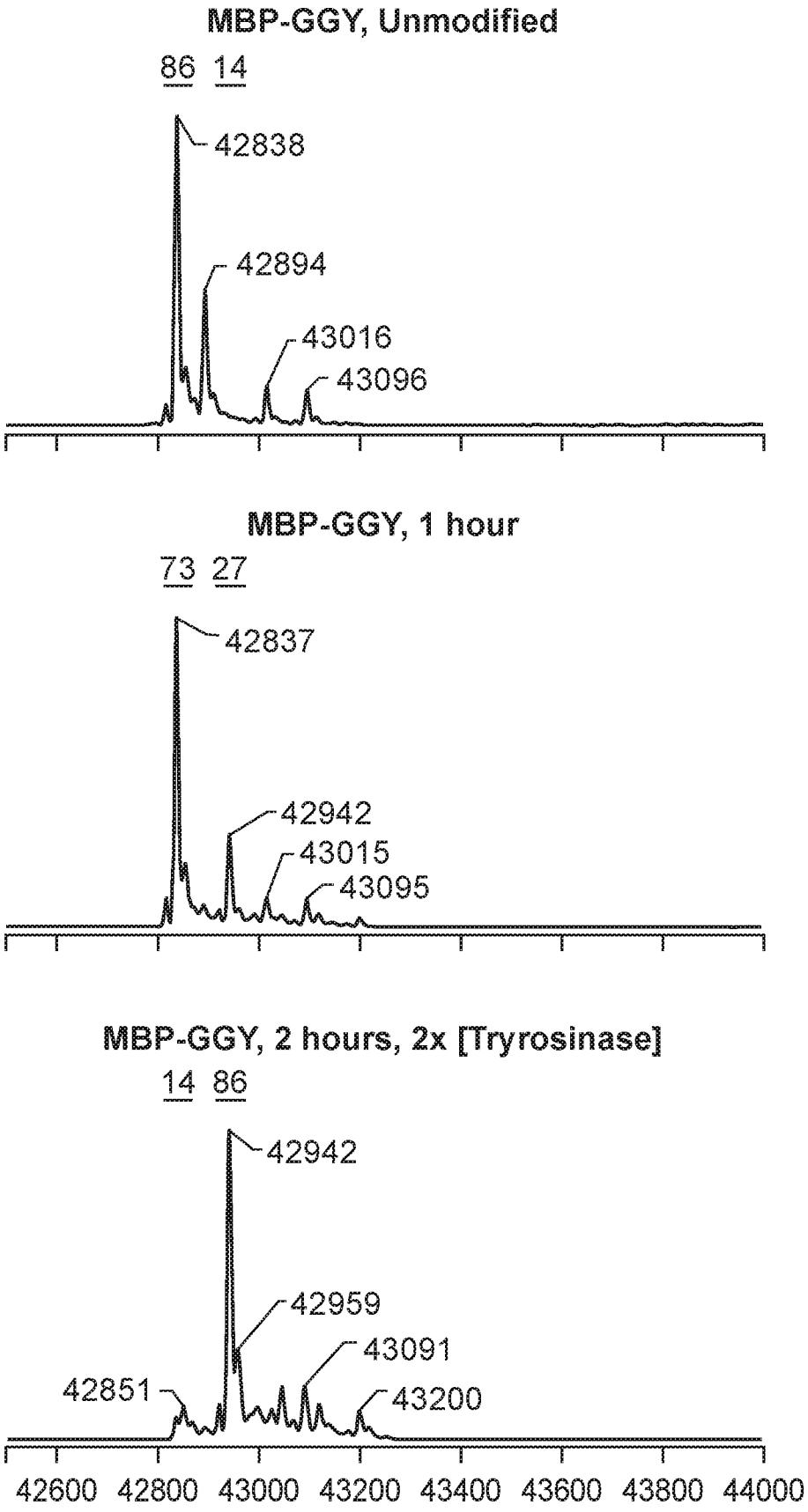

MBP-GGY, Unmodified
86 14
42838
42894
43016
43096
MBP-GGY, 1 hour
73 27
42837
42942
43015
43095
MBP-GGY, 2 hours, 2x [Tyrosinase]
14 86
42942
42959
43091
42851
43200
42600 42800 43000 43200 43400 43600 43800 44000

FIG. 22

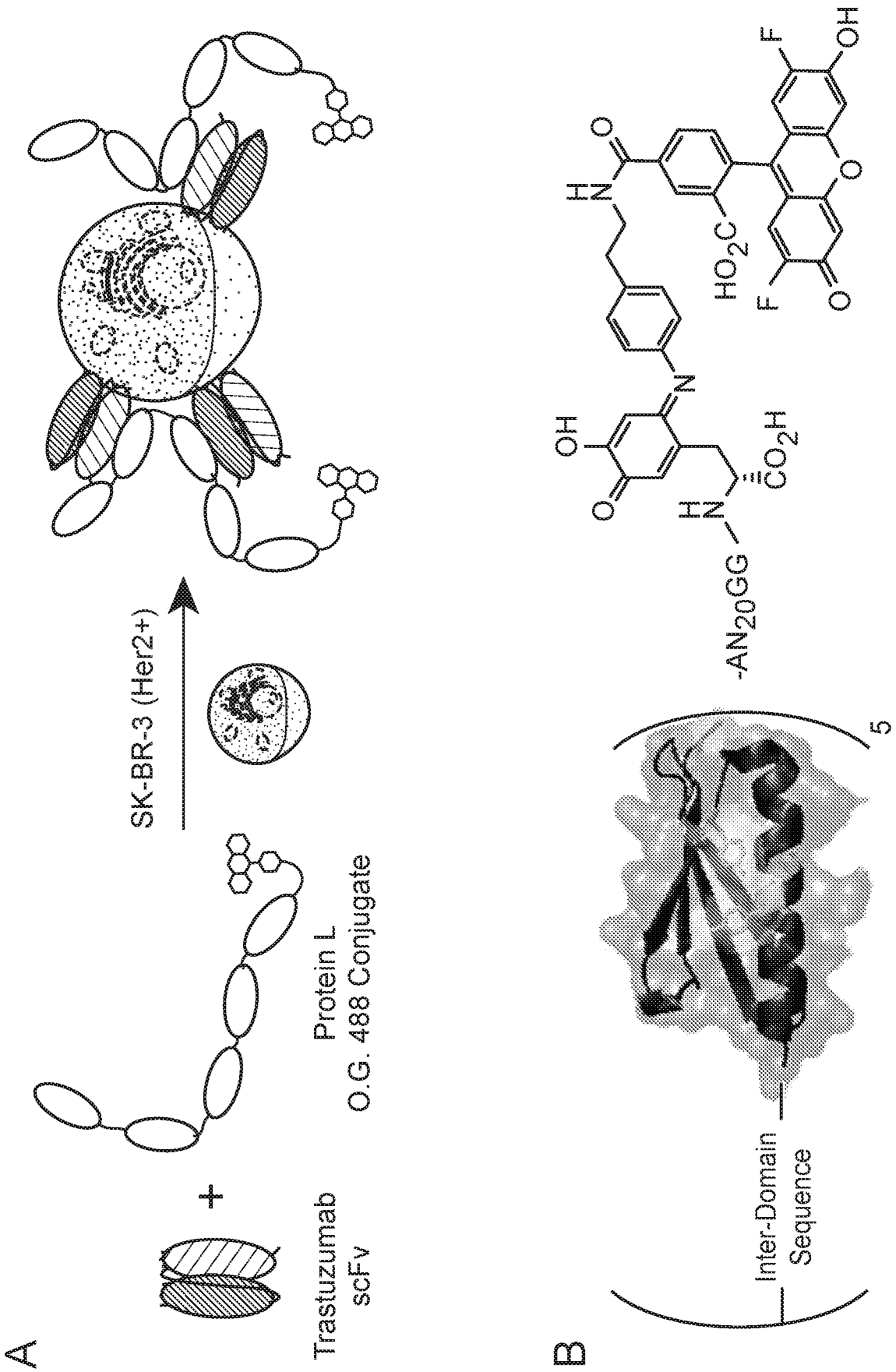
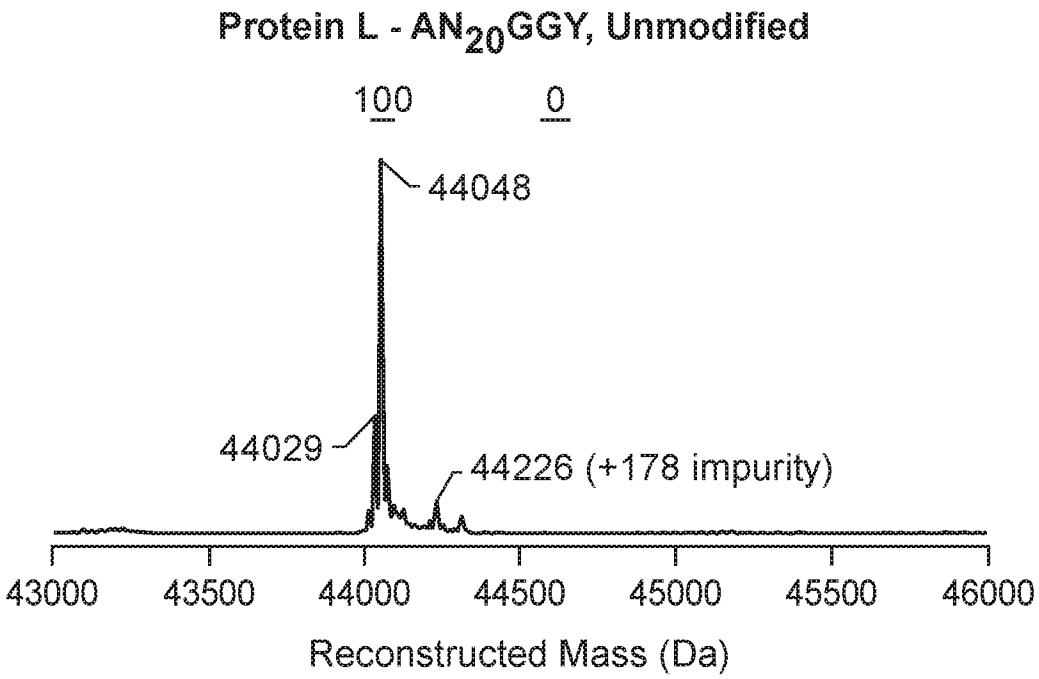

A
Trastuzumab scFv
+
Protein L O.G. 488 Conjugate
SK-BR-3 (Her2+)
B
Inter-Domain Sequence
-AN20GG
HO2C
CO2H
OH
F
O
N
H

FIG. 22 (Cont.)

C


Protein L - AN20GGY, Unmodified
100
0
44048
44029
44226 (+178 impurity)
43000
43500
44000
44500
45000
45500
46000
Reconstructed Mass (Da)

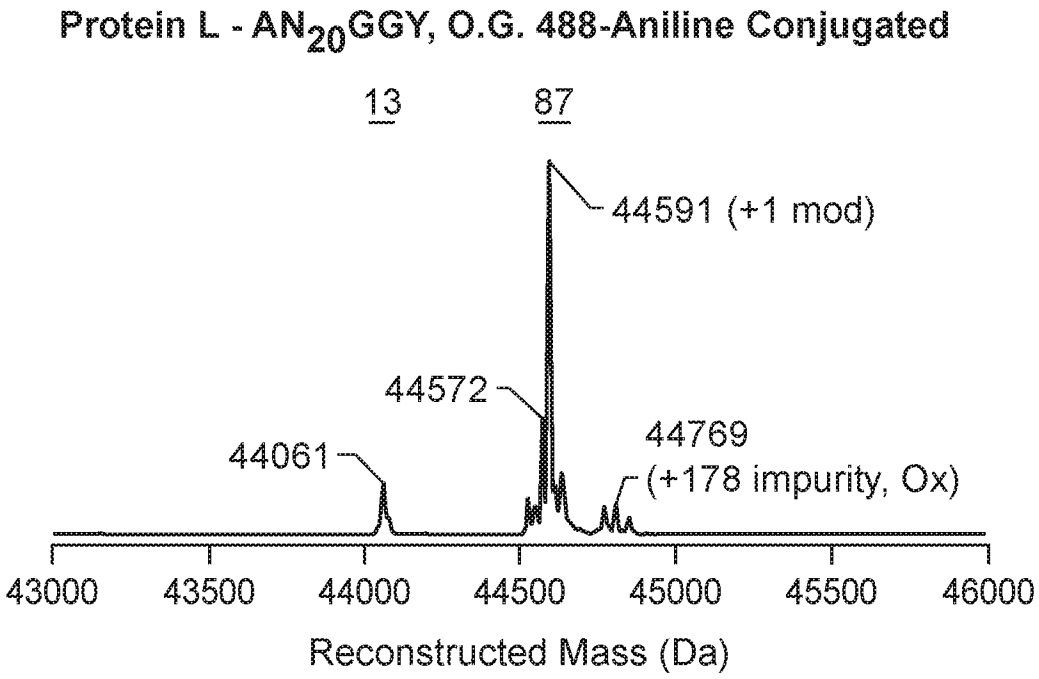
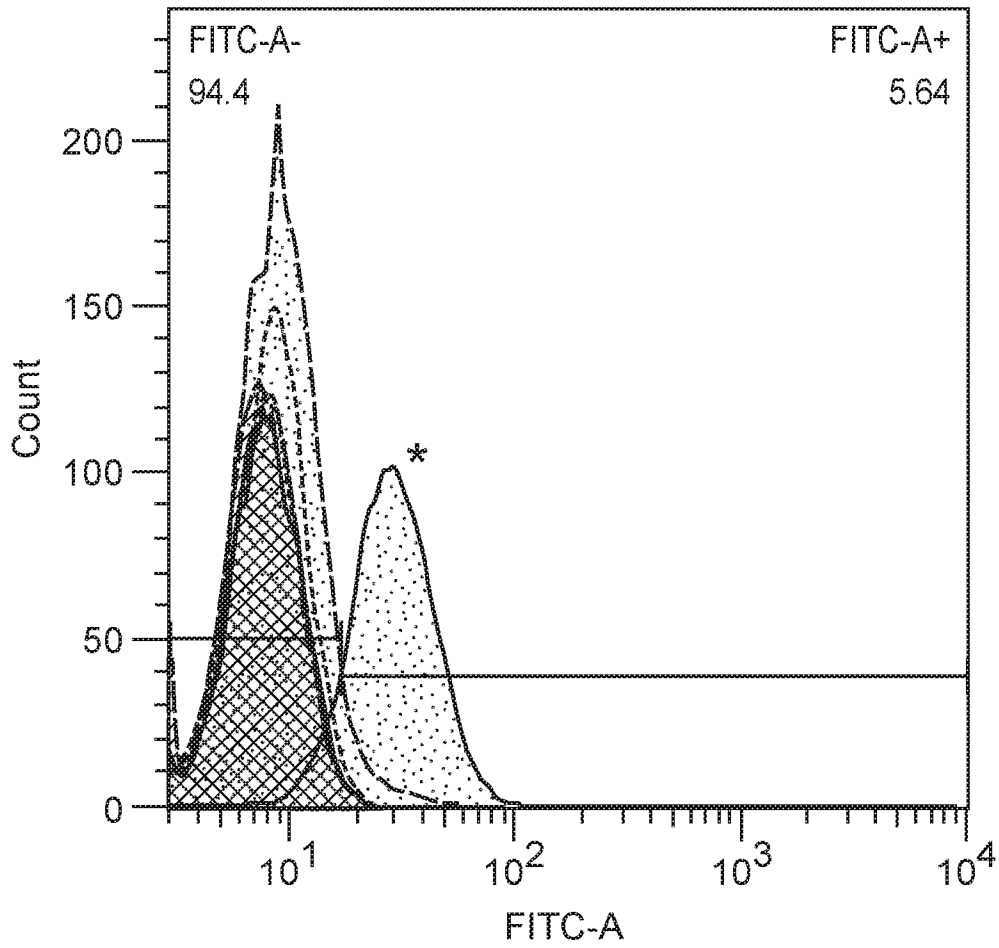

Protein L - AN20GGY, O.G. 488-Aniline Conjugated
13
87
44591 (+1 mod)
44572
44061
44769
(+178 impurity, Ox)
43000
43500
44000
44500
45000
45500
46000
Reconstructed Mass (Da)

FIG. 22 (Cont.)

D



Sample	Her2 +/-	scFv	Protein-L C-Terminus	An-O.G. 488	Tyrosinase
1	Negative	+	(Prot. L)-AN_{20}GGY	+	+
2	+	None	(Prot. L)-AN_{20}GGY	+	+
3	+	+	None	+	+
4	+	+	(Prot. L)-No Y Tag	+	+
5	+	+	(Prot. L)-AN_{20}GGY	None	+
6	+	+	(Prot. L)-AN_{20}GGY	+	None
7	+	+	(Prot. L)-AN_{20}GGY	+	+

FIG. 23

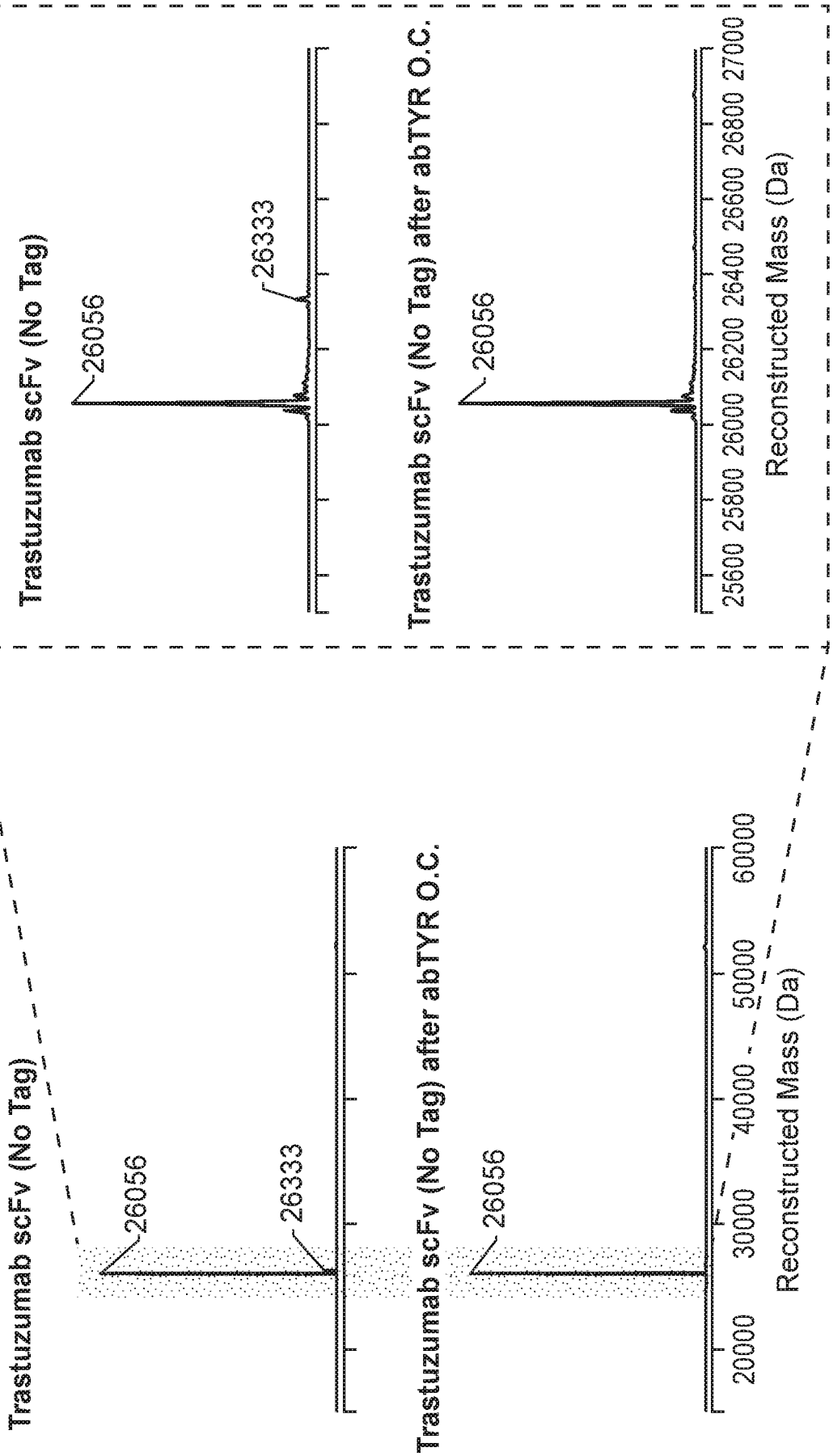

Trastuzumab scFv (No Tag)
26056
26333
Trastuzumab scFv (No Tag) after abTYR O.C.
26056
25600 25800 26000 26200 26400 26600 26800 27000
Reconstructed Mass (Da)
Trastuzumab scFv (No Tag)
26056
26333
Trastuzumab scFv (No Tag) after abTYR O.C.
26056
20000 30000 40000 50000 60000
Reconstructed Mass (Da)

FIG. 24

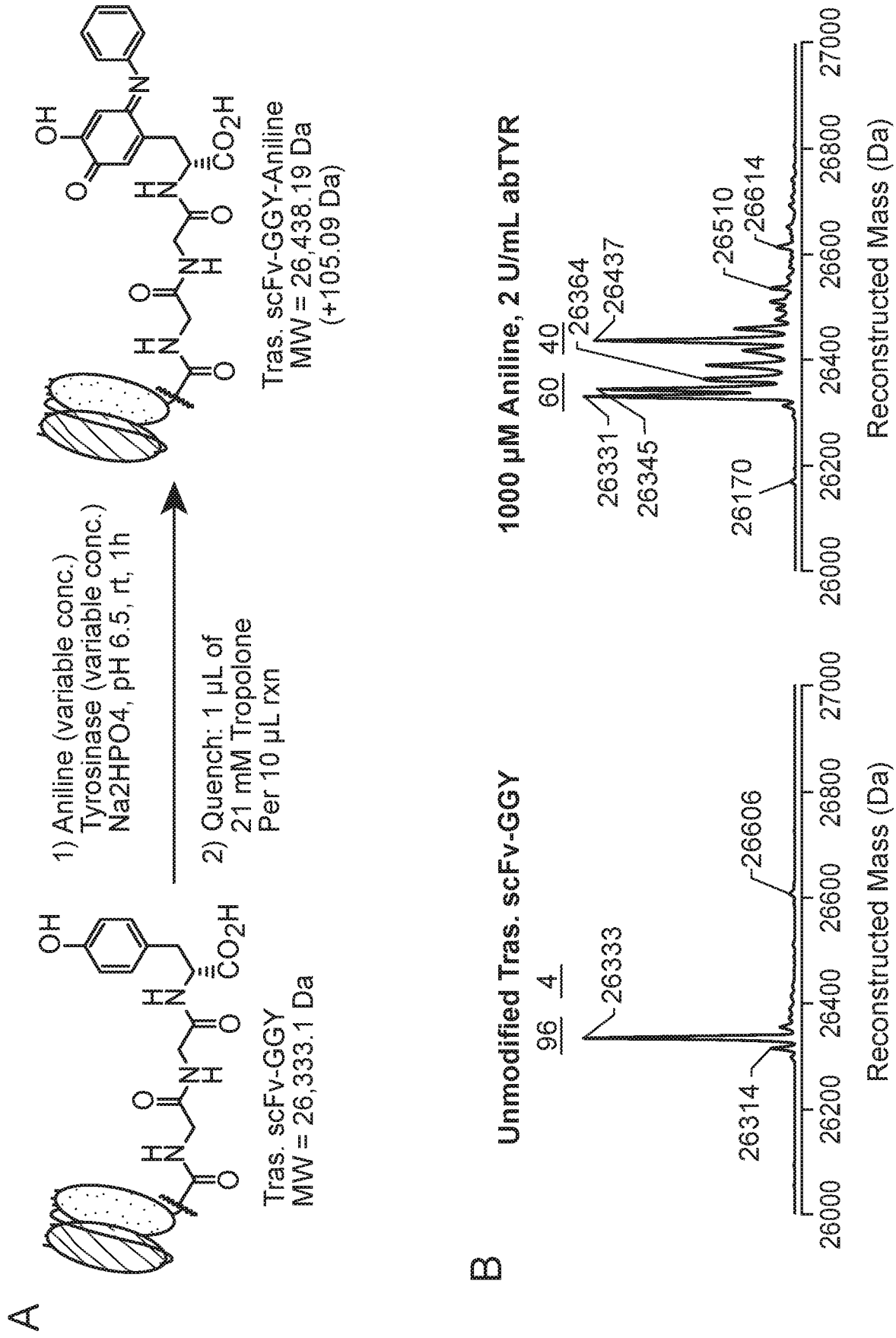

A
1) Aniline (variable conc.)
Tyrosinase (variable conc.)
Na2HPO4, pH 6.5, rt, 1h
2) Quench: 1 µL of
21 mM Tropolone
Per 10 µL rxn
Tras. scFv-GGY
MW = 26,333.1 Da
Tras. scFv-GGY-Aniline
MW = 26,438.19 Da
(+105.09 Da)
B
Unmodified Tras. scFv-GGY
1000 µM Aniline, 2 U/mL abTYR
Reconstructed Mass (Da)
26000
26200
26400
26600
26800
27000
26333
26606
26314
26364
26437
26331
26345
26510
26614
26170

FIG. 24 (Cont.)

B (Cont.)

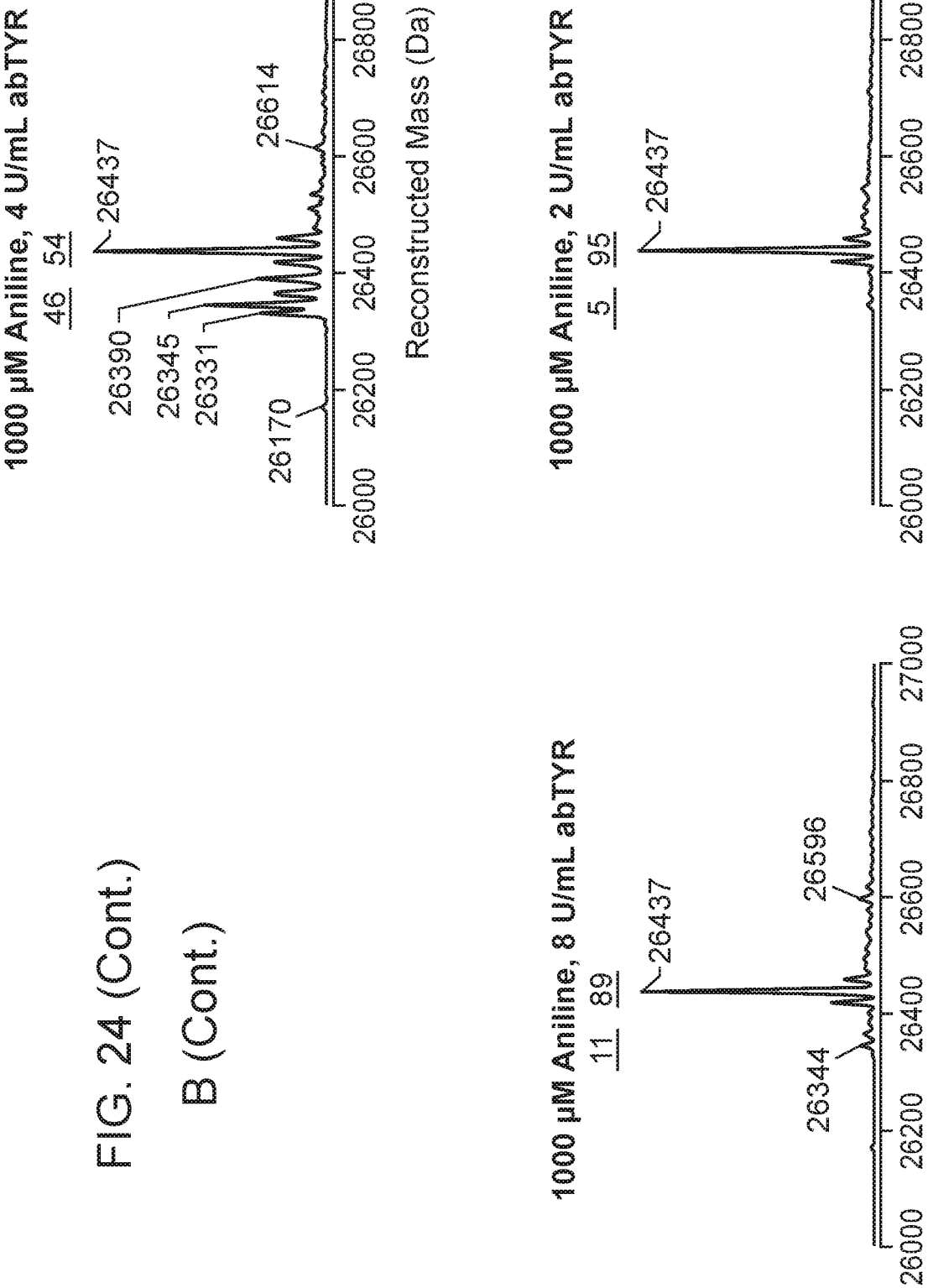


FIG. 24 (Cont.)

C

% Conversion to Tras. scFv-GGY-An

abTYR (U/mL)	Aniline Concentration (μM)						
	25	50	150	250	500	750	1000
2	77	75	64	55	48	50	40
4	80	86	86	79	64	54	54
8	88	92	95	95	93	92	89
12	86	90	94	95	94	95	95

D

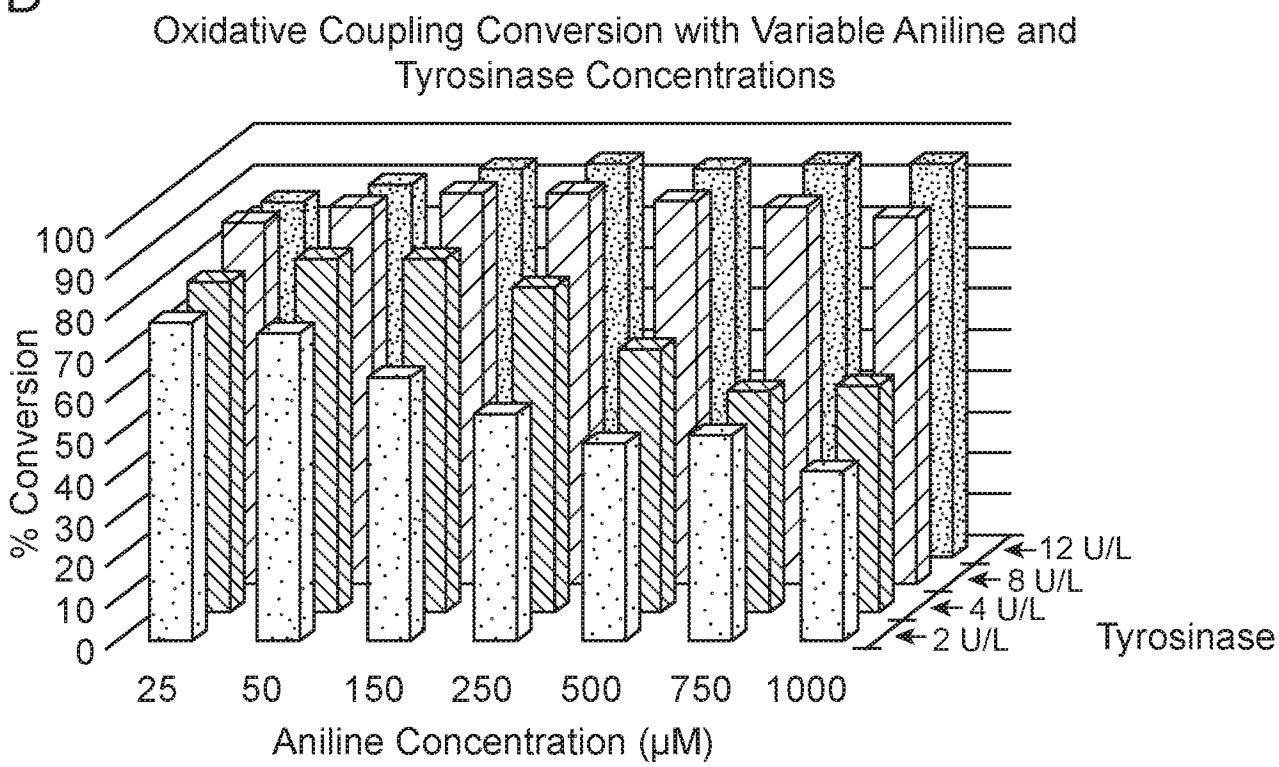


FIG. 25

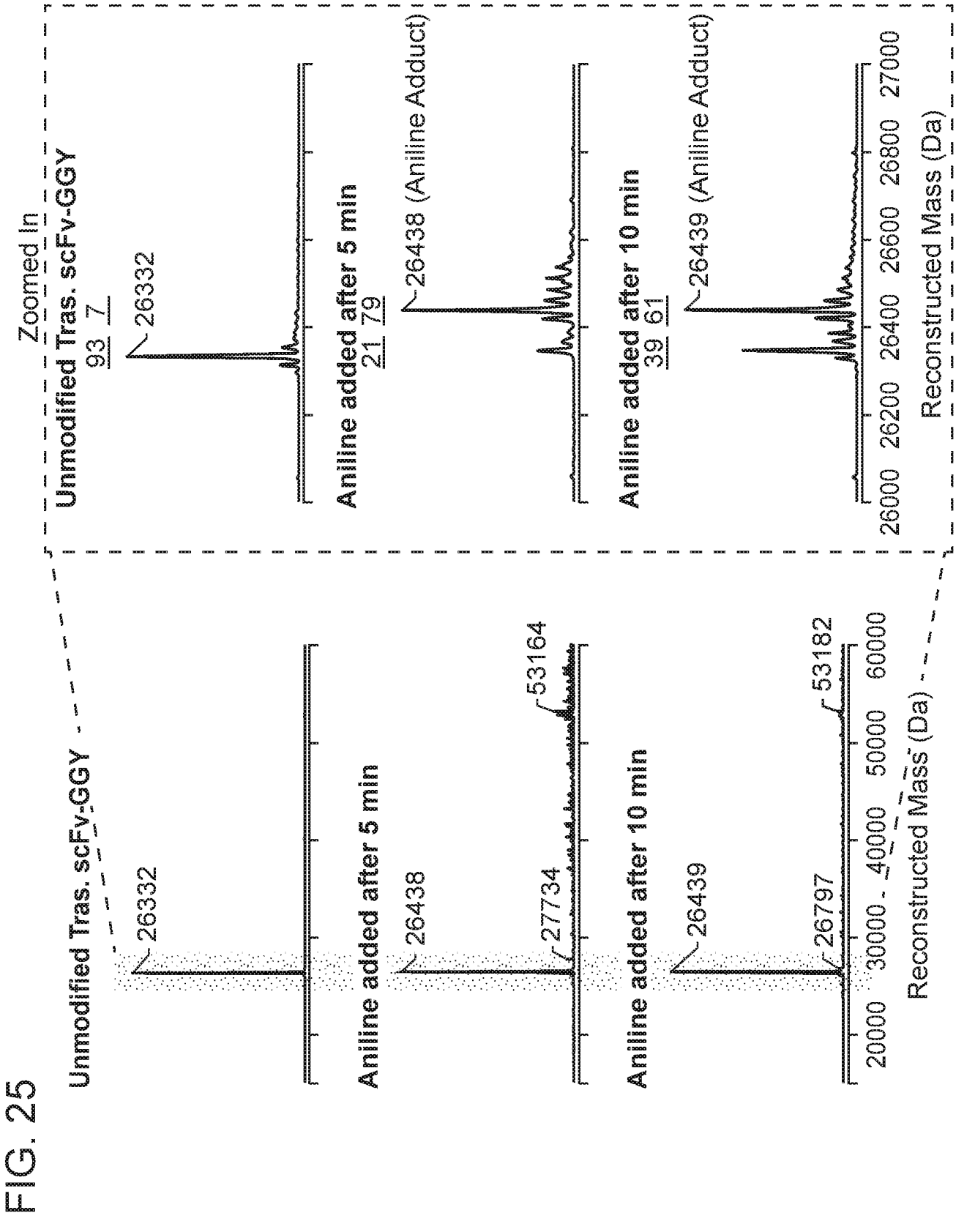

Unmodified Tras. scFv-GGY
26332
Aniline added after 5 min
26438
27734
53164
Aniline added after 10 min
26439
26797
53182
20000
30000
40000
50000
60000
Reconstructed Mass (Da)
Zoomed In
Unmodified Tras. scFv-GGY
93 7
26332
Aniline added after 5 min
21 79
26438 (Aniline Adduct)
Aniline added after 10 min
39 61
26439 (Aniline Adduct)
26000
26200
26400
26600
26800
27000
Reconstructed Mass (Da)

FIG. 25 (Cont.)

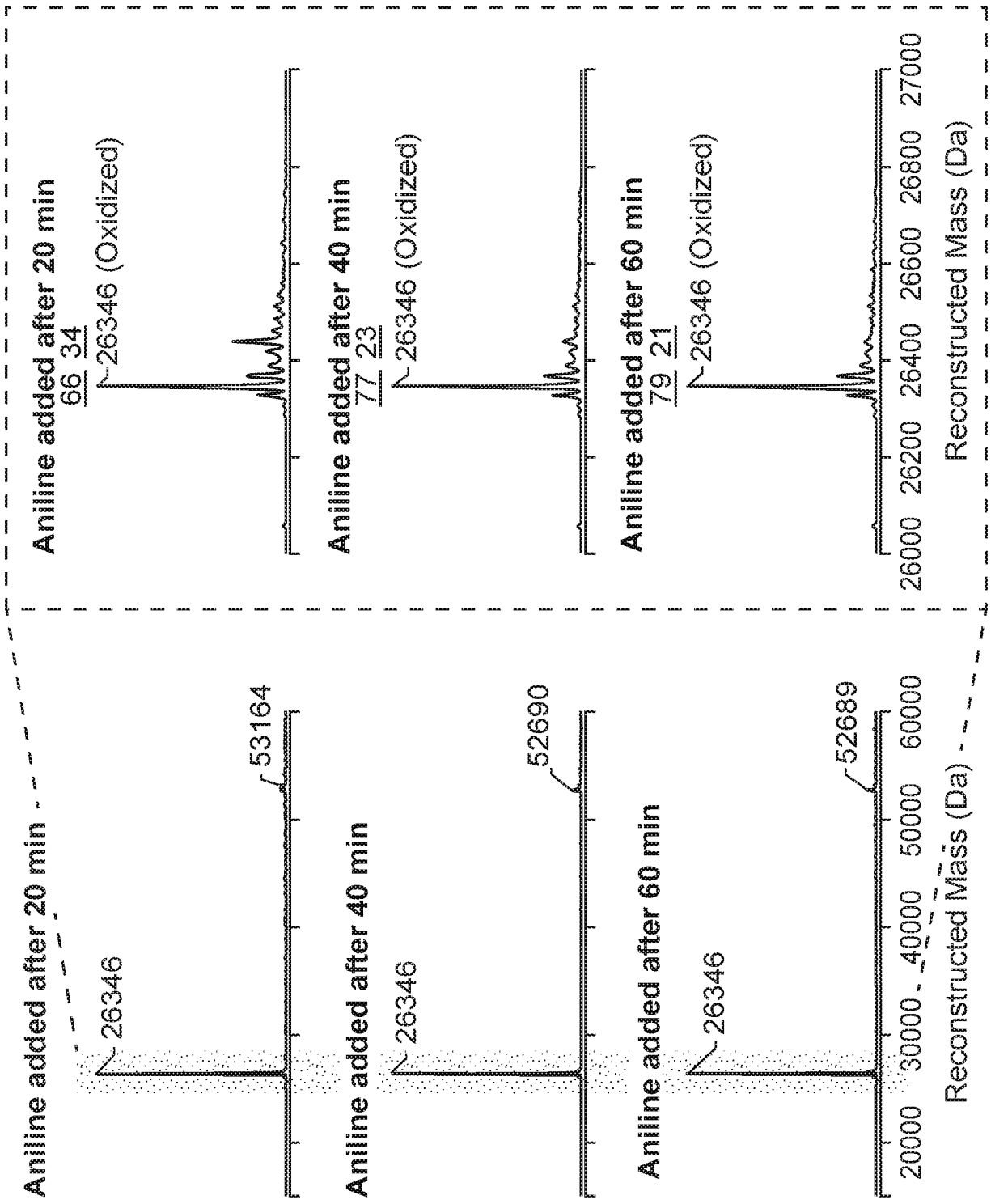

Zoomed In
Aniline added after 20 min
66 34
26346 (Oxidized)
Aniline added after 40 min
77 23
26346 (Oxidized)
Aniline added after 60 min
79 21
26346 (Oxidized)
26000 26200 26400 26600 26800 27000
Reconstructed Mass (Da)
Aniline added after 20 min
26346
53164
Aniline added after 40 min
26346
52690
Aniline added after 60 min
26346
52689
20000 30000 40000 50000 60000
Reconstructed Mass (Da)

FIG. 26

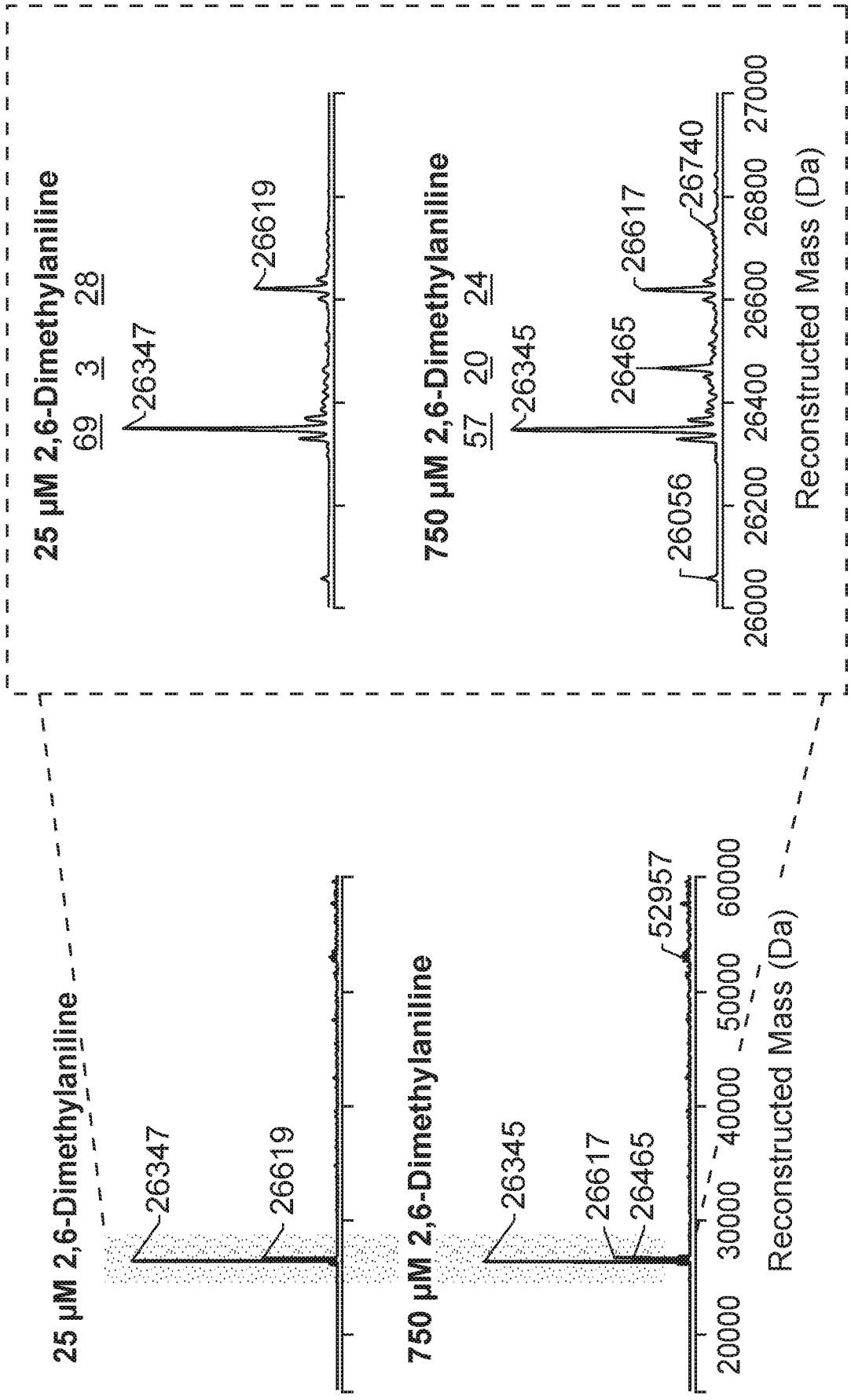

25 µM 2,6-Dimethylaniline
69 3 28
26347
26619
750 µM 2,6-Dimethylaniline
57 20 24
26345
26465
26617
26740
26056
26000 26200 26400 26600 26800 27000
Reconstructed Mass (Da)
25 µM 2,6-Dimethylaniline
26347
26619
750 µM 2,6-Dimethylaniline
26345
26617
26465
52957
20000 30000 40000 50000 60000
Reconstructed Mass (Da)

FIG. 26 (Cont.)

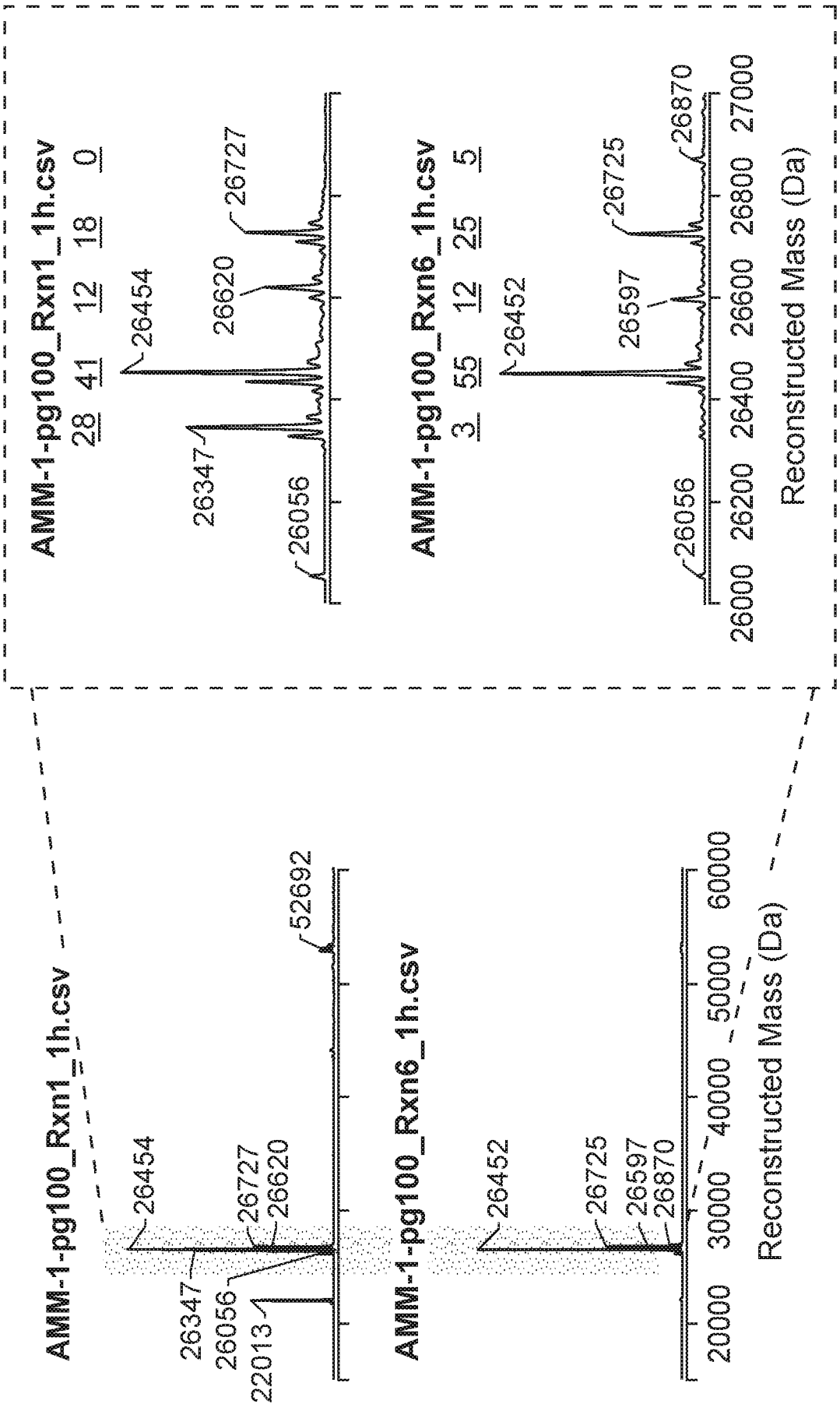

AMM-1-pg100_Rxn1_1h.csv
28 41 12 18 0
26454
26620
26727
26347
26056
AMM-1-pg100_Rxn6_1h.csv
3 55 12 25 5
26452
26725
26597
26870
26056
26000 26200 26400 26600 26800 27000
Reconstructed Mass (Da)
AMM-1-pg100_Rxn1_1h.csv
26454
26727
26620
52692
26347
26056
22013
AMM-1-pg100_Rxn6_1h.csv
26452
26725
26597
26870
20000 30000 40000 50000 60000
Reconstructed Mass (Da)

FIG. 26 (Cont.)

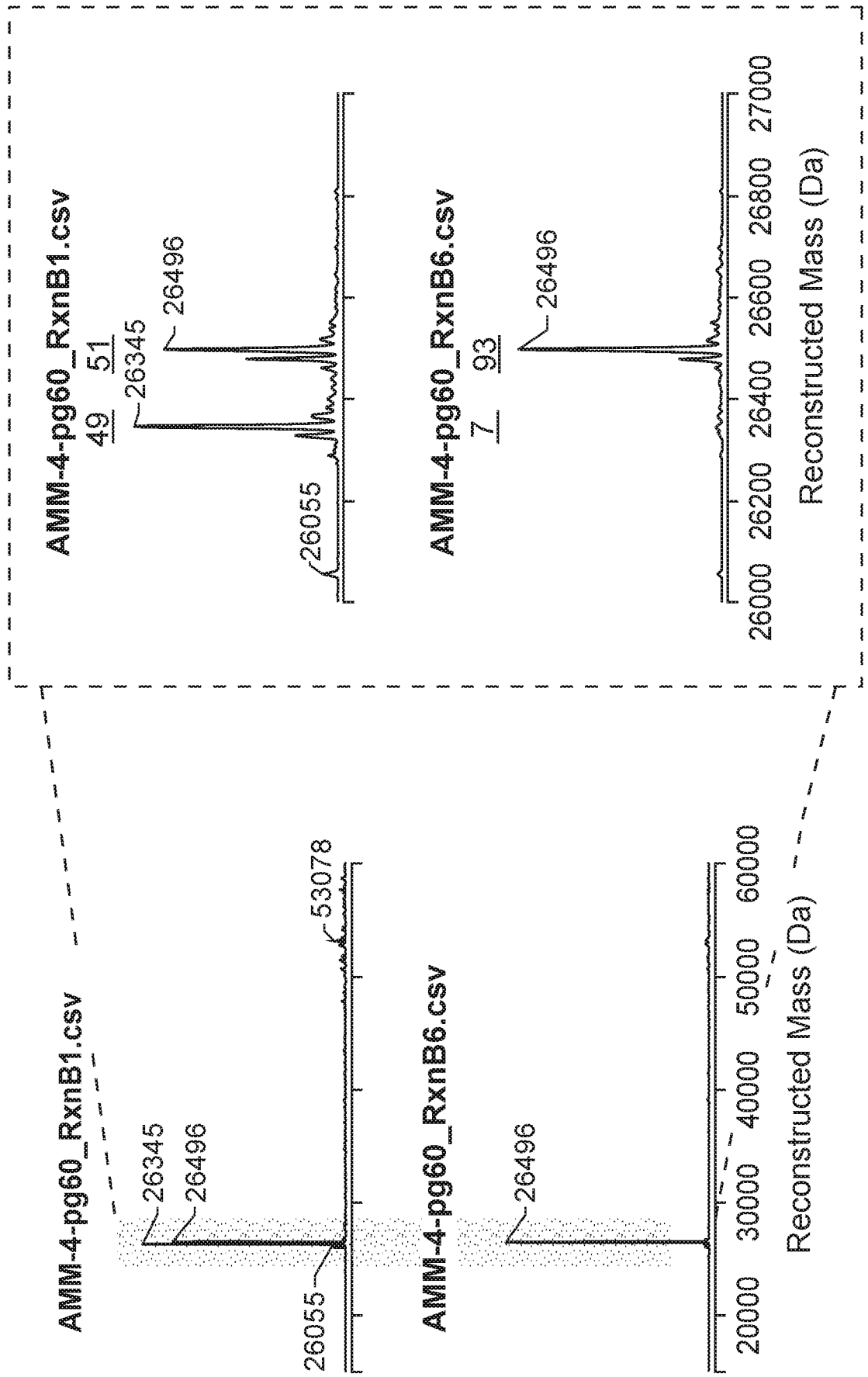

AMM-4-pg60_RxnB1.csv
49
51
26345
26496
26055
AMM-4-pg60_RxnB6.csv
7
93
26496
26000
26200
26400
26600
26800
27000
Reconstructed Mass (Da)
AMM-4-pg60_RxnB1.csv
26345
26496
26055
53078
AMM-4-pg60_RxnB6.csv
26496
20000
30000
40000
50000
60000
Reconstructed Mass (Da)

FIG. 27

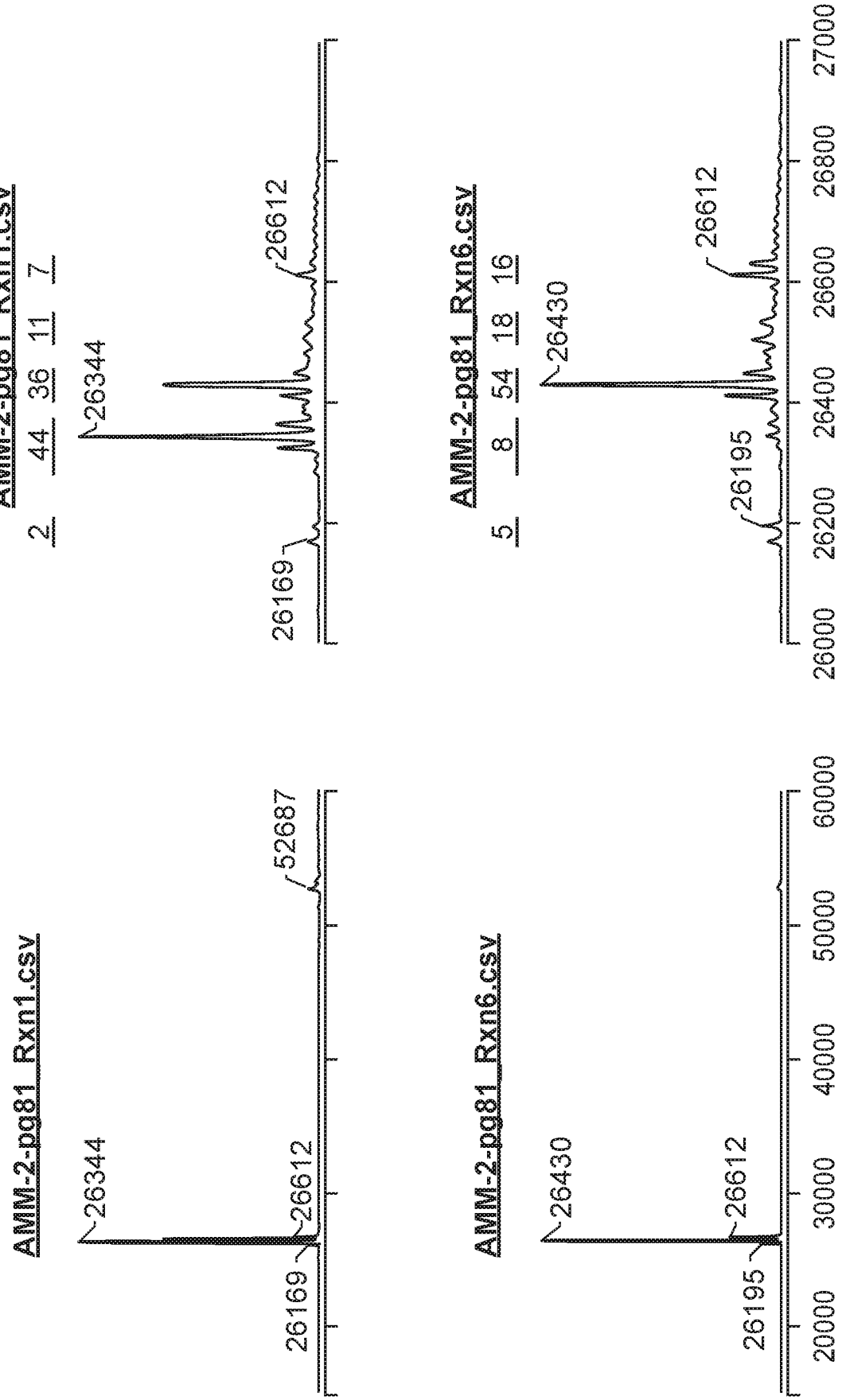

AMM-2-pg81_Rxn1.csv
2 44 36 11 7
26344
26612
26169
AMM-2-pg81_Rxn6.csv
5 8 54 18 16
26430
26612
26195
AMM-2-pg81_Rxn1.csv
26344
52687
26612
26169
AMM-2-pg81_Rxn6.csv
26430
26612
26195
20000 30000 40000 50000 60000
26000 26200 26400 26600 26800 27000

FIG. 27 (Cont.)

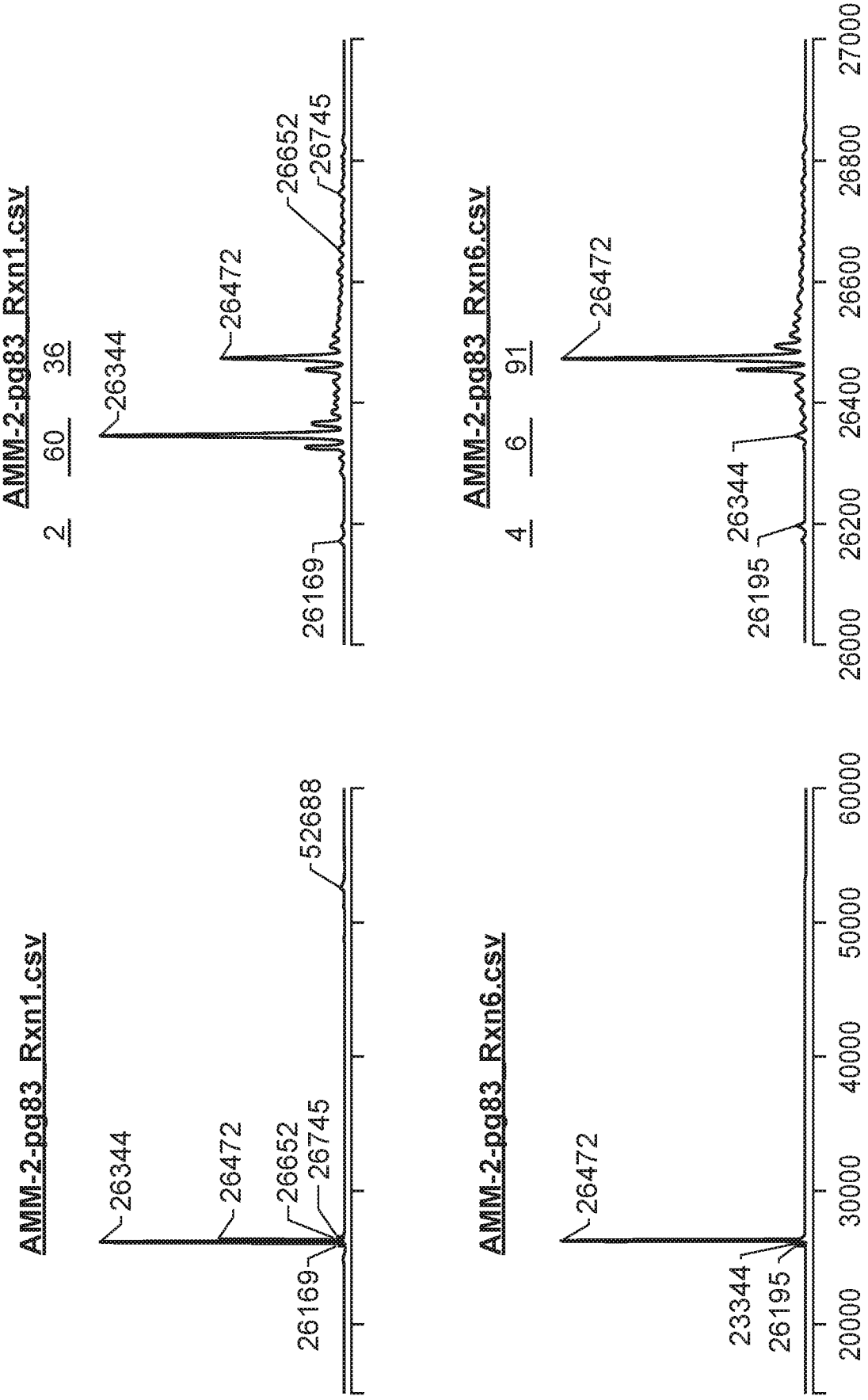

AMM-2-pg83_Rxn1.csv
2
60
36
26344
26472
26652
26745
26169
AMM-2-pg83_Rxn6.csv
4
6
91
26472
26344
26195
26000
26200
26400
26600
26800
27000
AMM-2-pg83_Rxn1.csv
26344
26472
26652
26745
52688
26169
AMM-2-pg83_Rxn6.csv
26472
23344
26195
20000
30000
40000
50000
60000

FIG. 27 (Cont.)

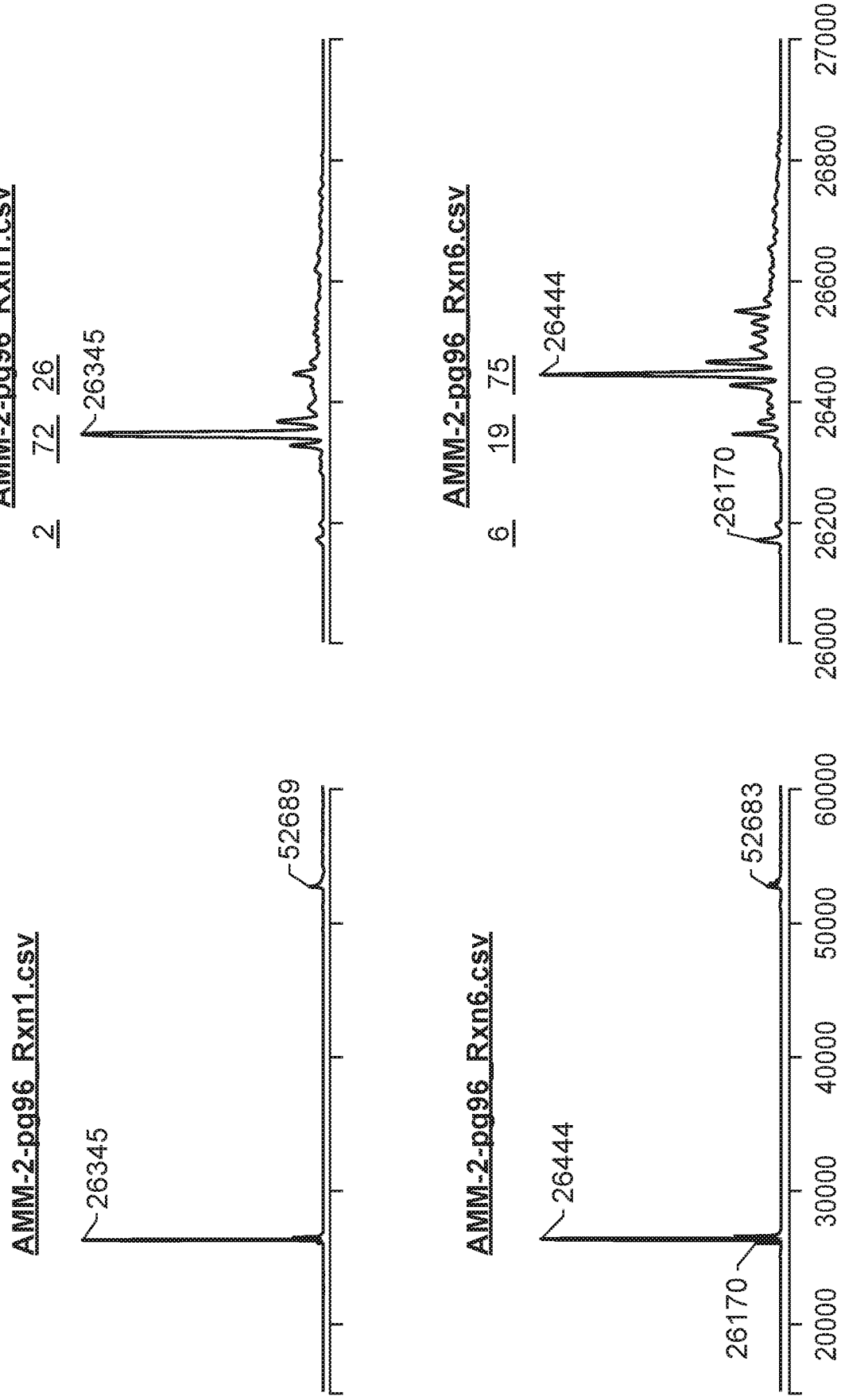

AMM-2-pg96_Rxn1.csv
2 72 26
26345
AMM-2-pg96_Rxn6.csv
6 19 75
26444
26170
26000
26200
26400
26600
26800
27000
AMM-2-pg96_Rxn1.csv
26345
52689
AMM-2-pg96_Rxn6.csv
26444
52683
26170
20000
30000
40000
50000
60000

FIG. 28

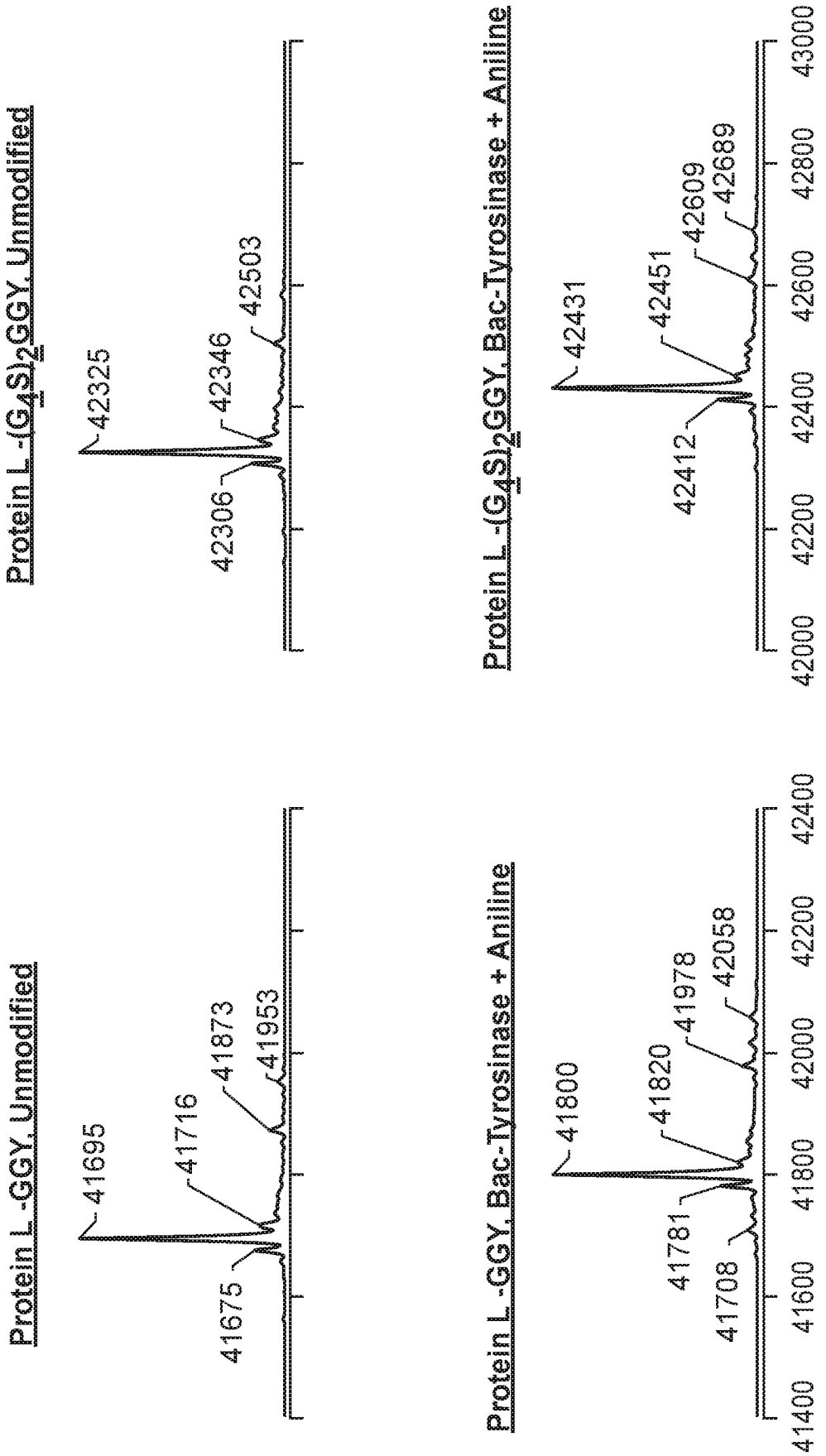

Protein L-(G4S)2GGY, Unmodified
42325
42346
42503
42306
Protein L-(G4S)2GGY, Bac-Tyrosinase + Aniline
42431
42451
42609
42689
42412
Protein L-GGY, Unmodified
41695
41716
41873
41953
41675
Protein L-GGY, Bac-Tyrosinase + Aniline
41800
41820
41978
42058
41781
41708
42000
42200
42400
42600
42800
43000
41400
41600
41800
42000
42200
42400

FIG. 28 (Cont.)

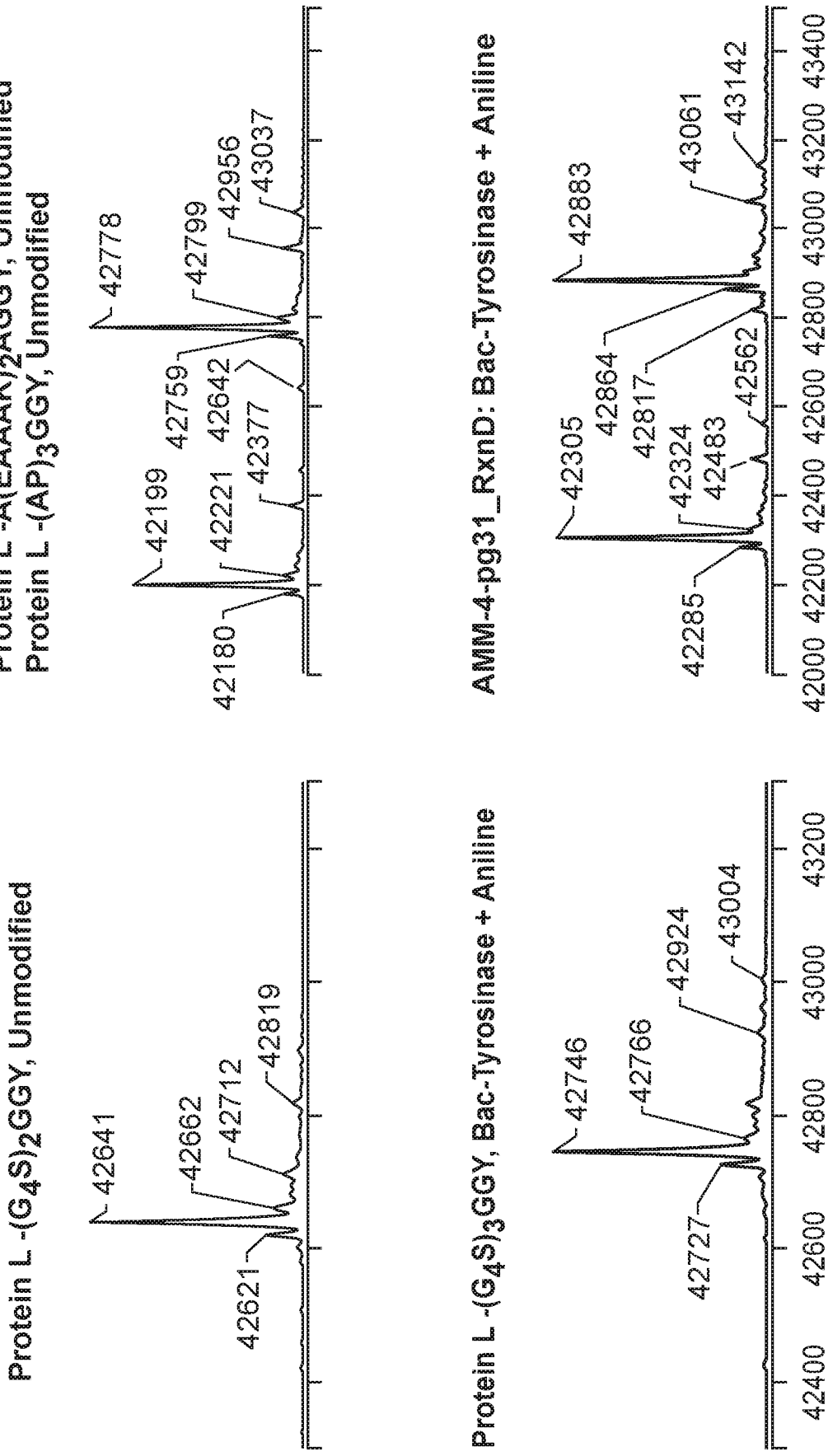

Protein L -A(EAAAK)2AGGY, Unmodified
Protein L -(AP)3GGY, Unmodified
42778
42799
42956
43037
42199
42759
42642
42221
42377
42180
Protein L -(G4S)2GGY, Unmodified
42641
42662
42712
42819
42621
AMM-4-pg31_RxnD: Bac-Tyrosinase + Aniline
42883
43061
43142
42305
42864
42817
42324
42483
42562
42285
Protein L -(G4S)3GGY, Bac-Tyrosinase + Aniline
42746
42766
42924
43004
42727
42000 42200 42400 42600 42800 43000 43200 43400
42400 42600 42800 43000 43200

FIG. 28 (Cont.)

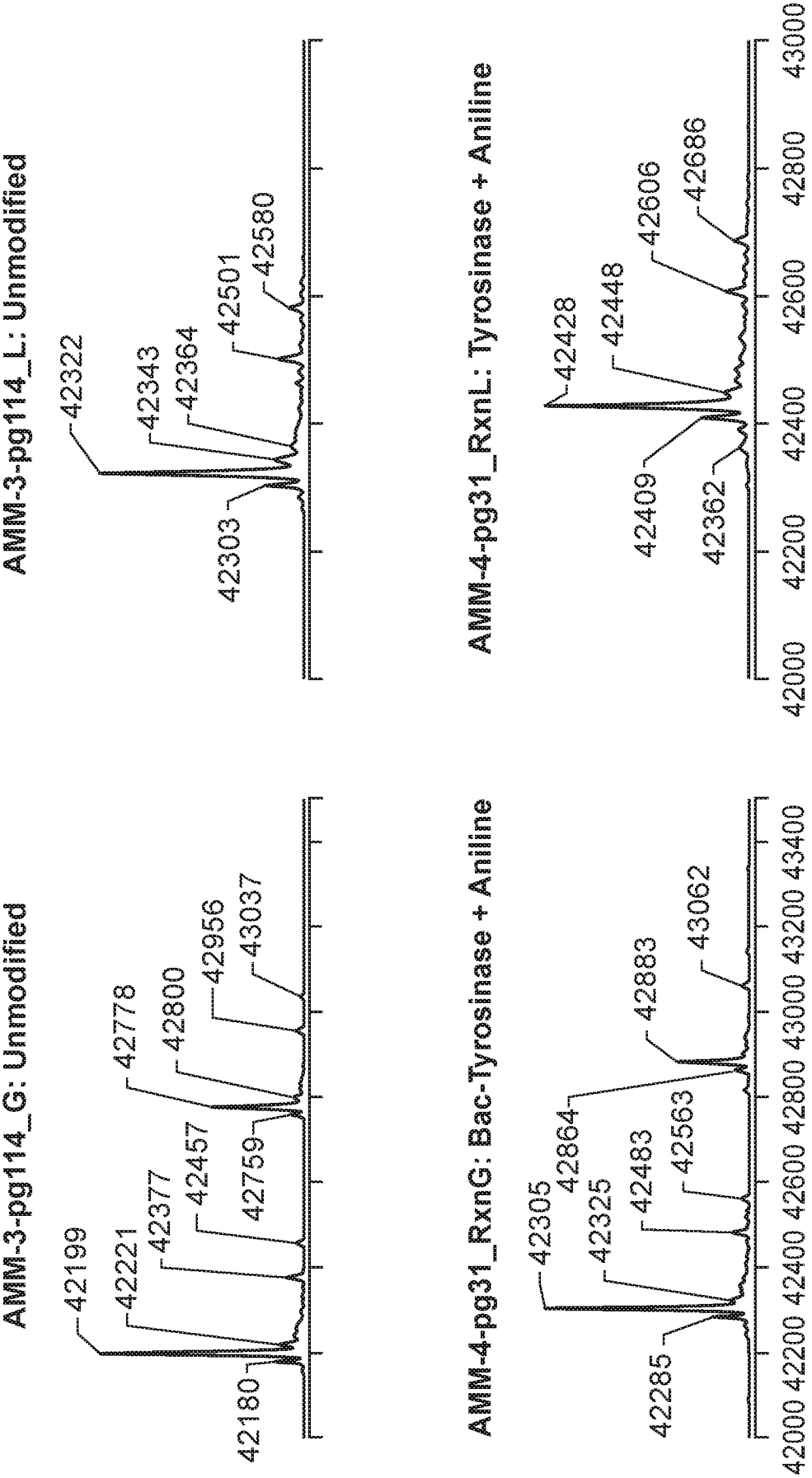

AMM-3-pg114_G: Unmodified
42199
42221
42377
42457
42759
42778
42800
42956
43037
42180
AMM-3-pg114_L: Unmodified
42322
42343
42364
42501
42580
42303
AMM-4-pg31_RxnG: Bac-Tyrosinase + Aniline
42305
42864
42325
42483
42563
42883
43062
42285
AMM-4-pg31_RxnL: Tyrosinase + Aniline
42428
42448
42606
42686
42409
42362
42000 42200 42400 42600 42800 43000 43200 43400
42000 42200 42400 42600 42800 43000

FIG. 28 (Cont.)

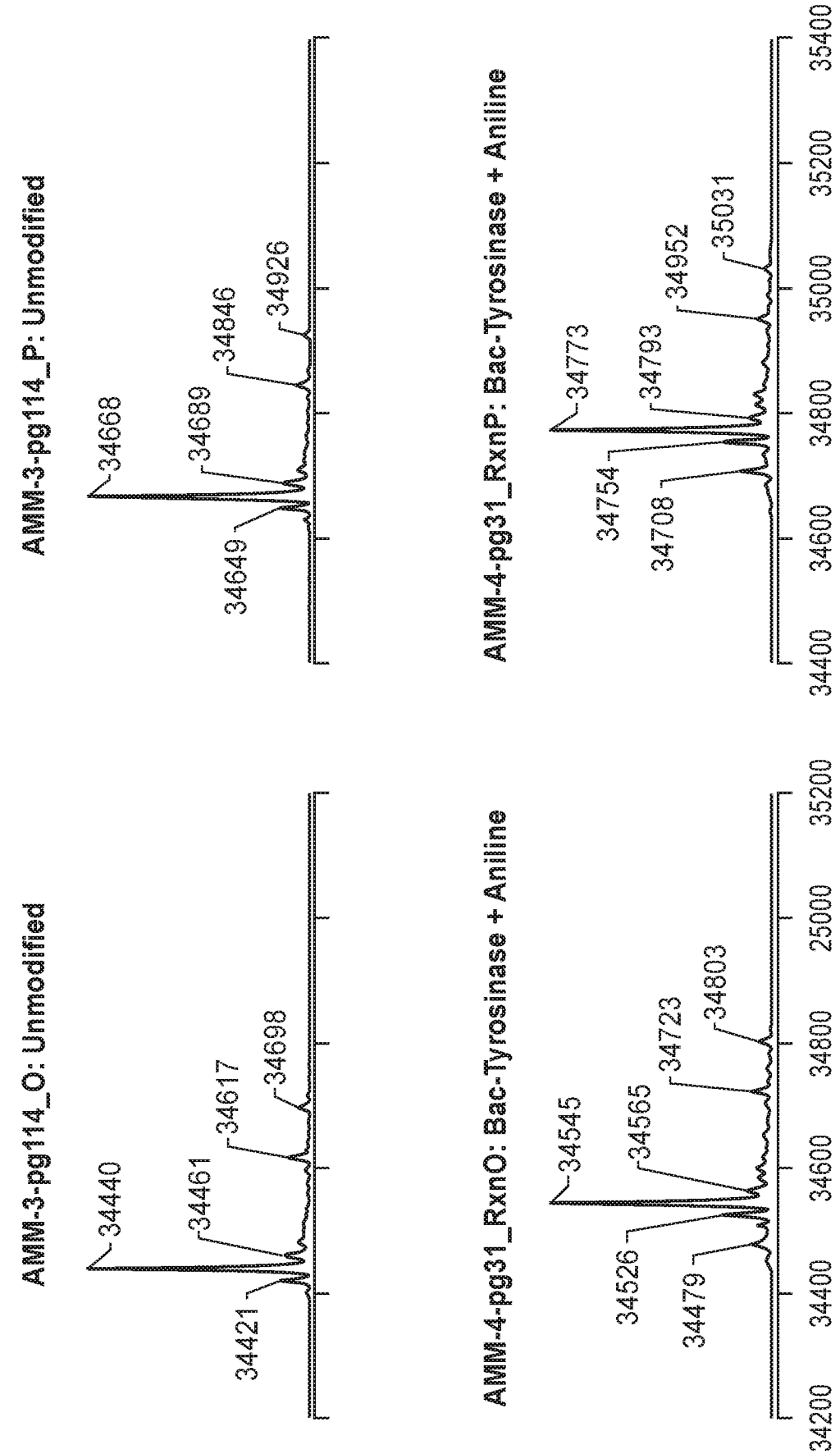

AMM-3-pg114_O: Unmodified
34440
34461
34617
34698
34421
AMM-3-pg114_P: Unmodified
34668
34689
34846
34926
34649
AMM-4-pg31_RxnO: Bac-Tyrosinase + Aniline
34545
34565
34723
34803
34526
34479
AMM-4-pg31_RxnP: Bac-Tyrosinase + Aniline
34773
34793
34952
35031
34754
34708
34200
34400
34600
34800
25000
35200
34400
34600
34800
35000
35200
35400

FIG. 28 (Cont.)

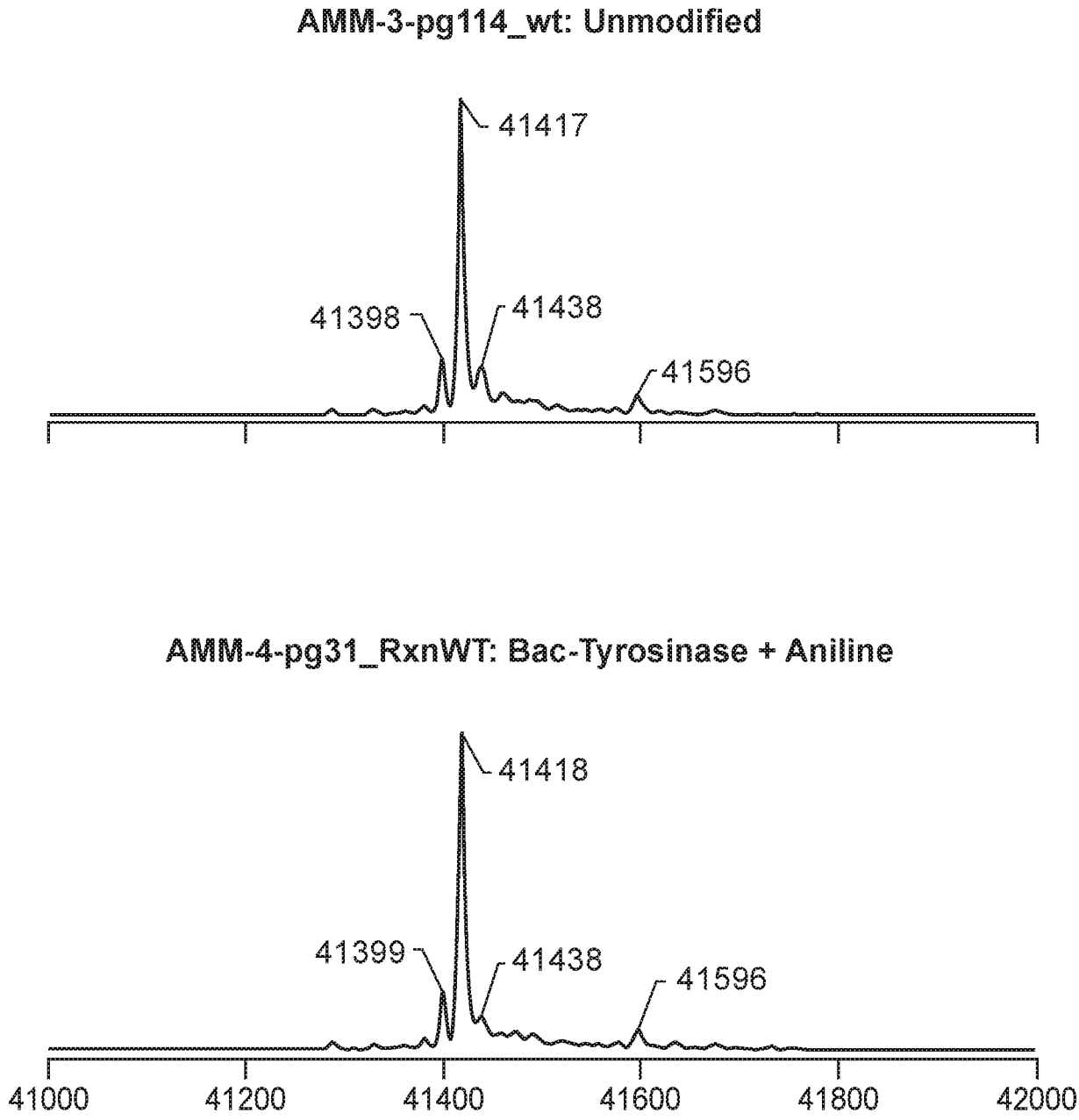

AMM-3-pg114_wt: Unmodified
41417
41398
41438
41596
AMM-4-pg31_RxnWT: Bac-Tyrosinase + Aniline
41418
41399
41438
41596
41000
41200
41400
41600
41800
42000

FIG. 29

A

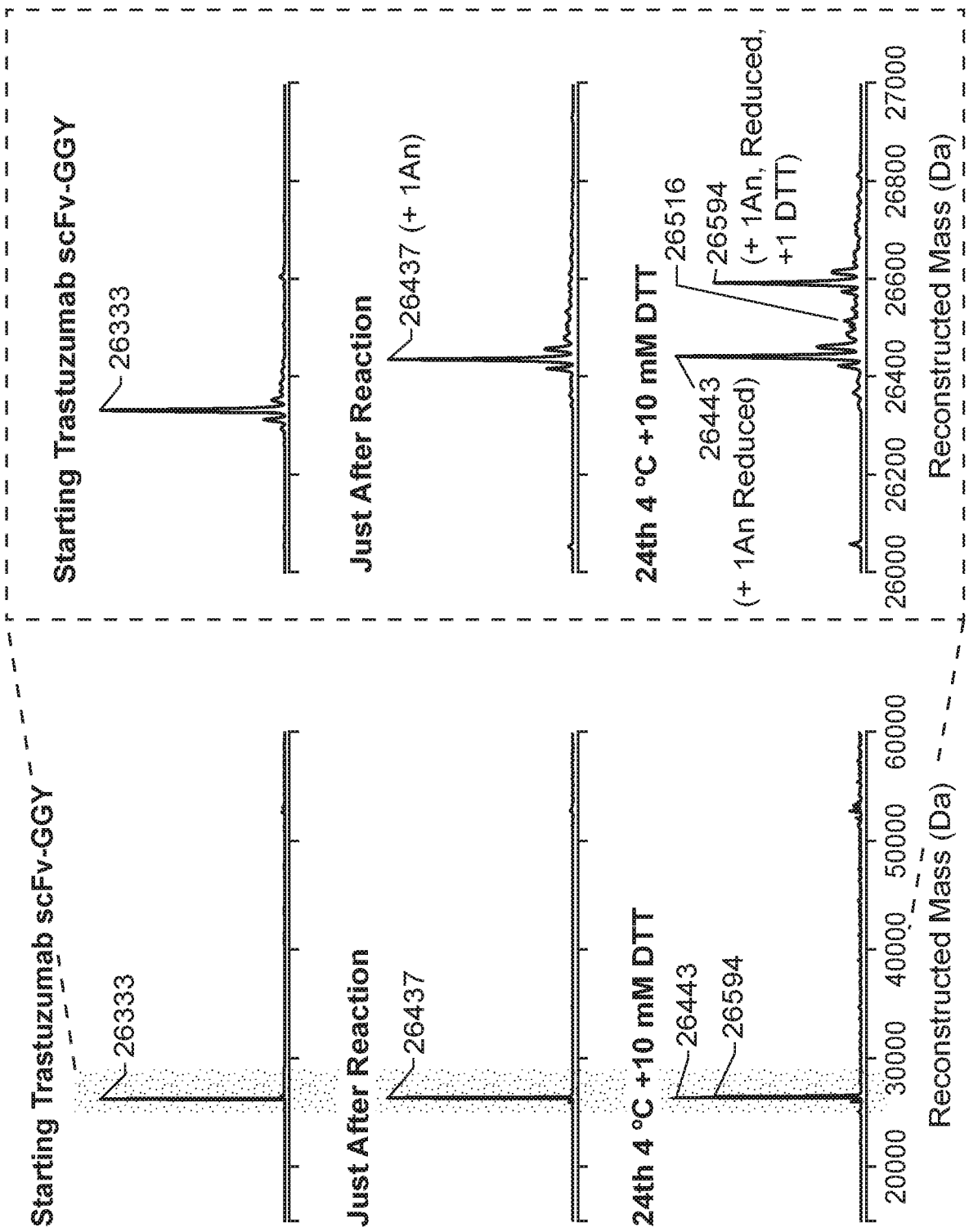

Zoomed In
Starting Trastuzumab scFv-GGY
26333
Just After Reaction
26437 (+ 1An)
24th 4 °C +10 mM DTT
26516
26594
(+ 1An, Reduced, +1 DTT)
26443
(+ 1An Reduced)
26000 26200 26400 26600 26800 27000
Reconstructed Mass (Da)
Starting Trastuzumab scFv-GGY
26333
Just After Reaction
26437
24th 4 °C +10 mM DTT
26443
26594
20000 30000 40000 50000 60000
Reconstructed Mass (Da)

FIG. 29 (Cont.)
A (Cont.)

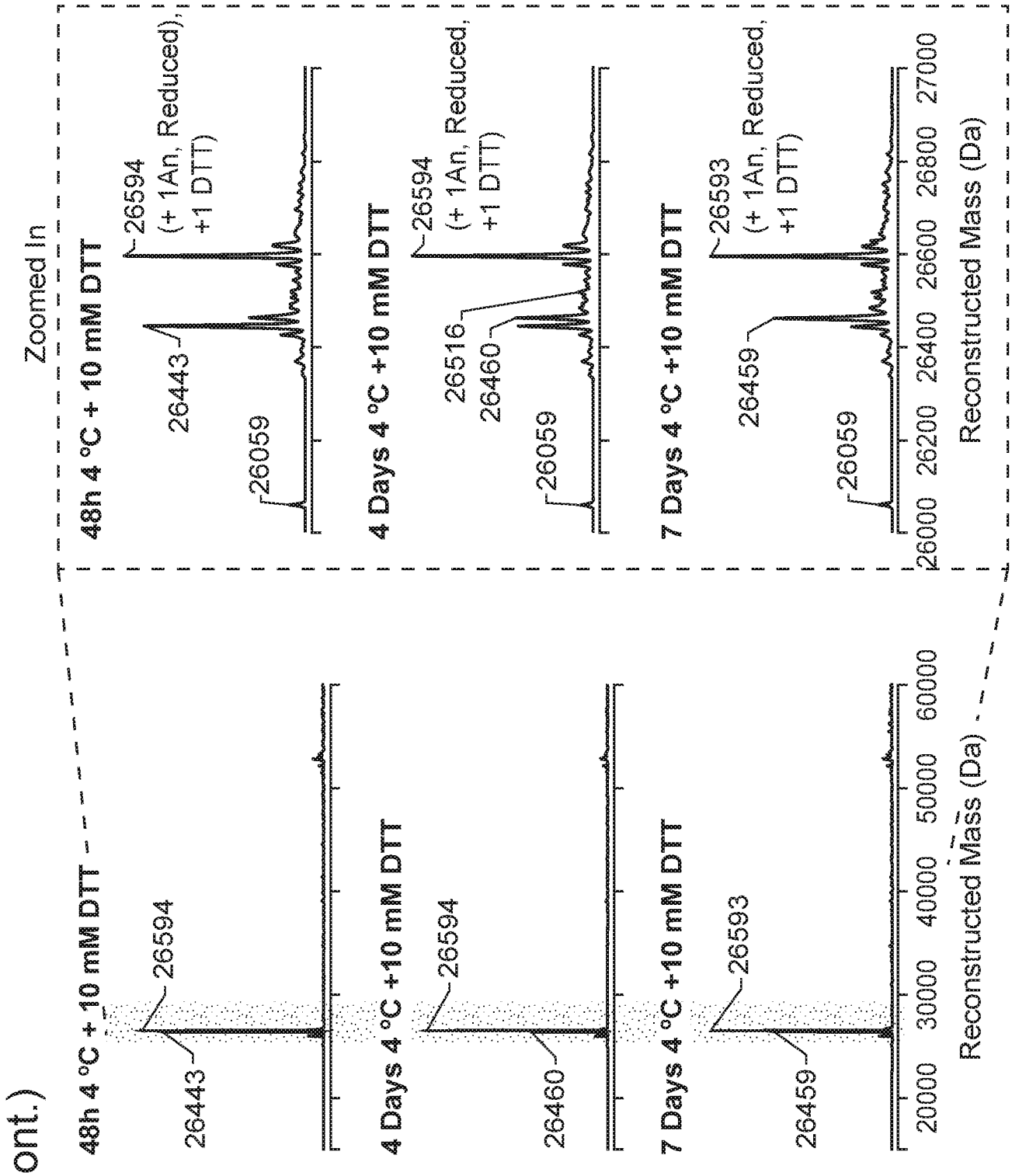


FIG. 29 (Cont.)

B

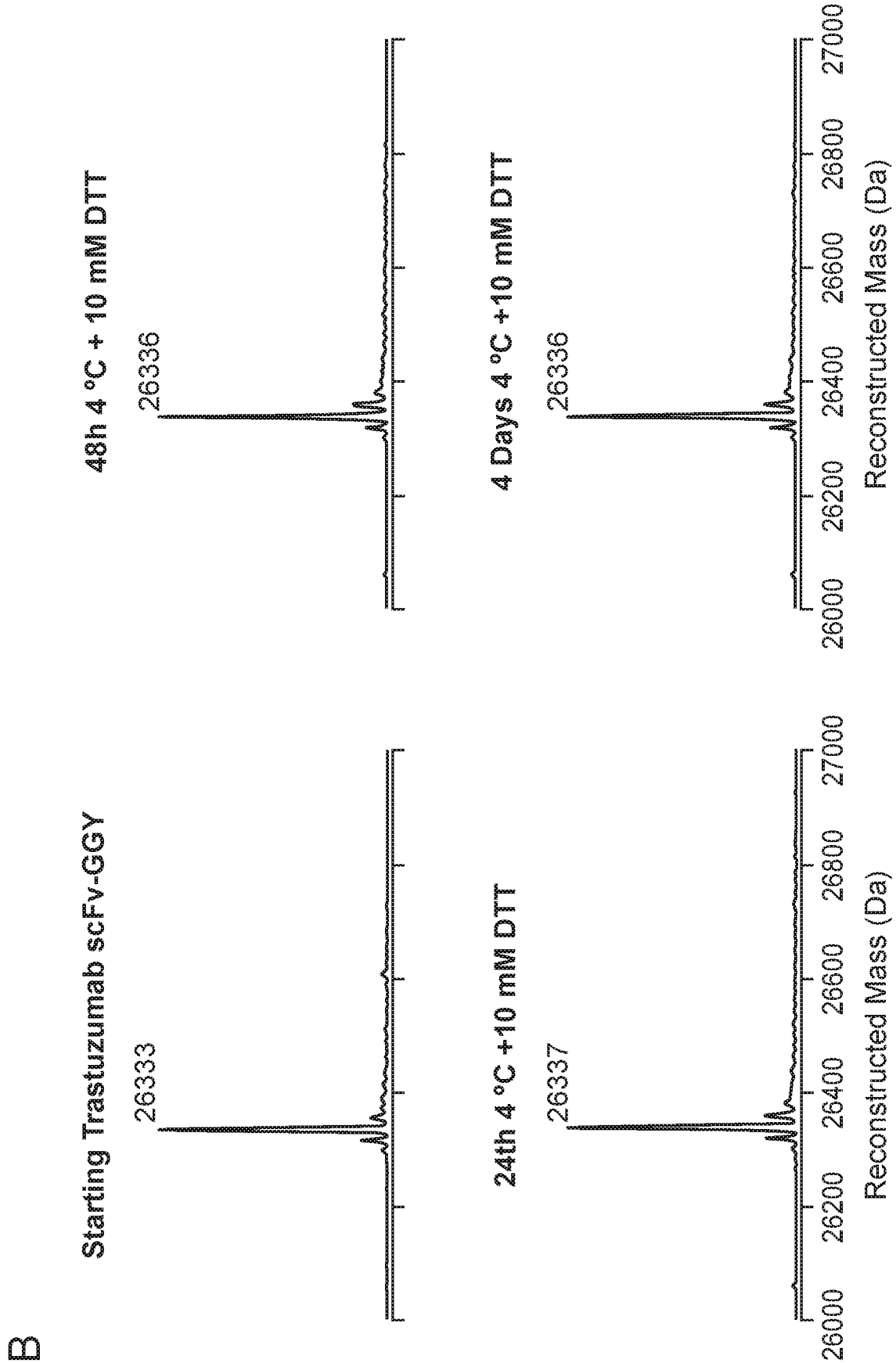

Starting Trastuzumab scFv-GGY
26333
48h 4 °C + 10 mM DTT
26336
24th 4 °C +10 mM DTT
26337
4 Days 4 °C +10 mM DTT
26336
26000
26200
26400
26600
26800
27000
Reconstructed Mass (Da)

FIG. 30

A

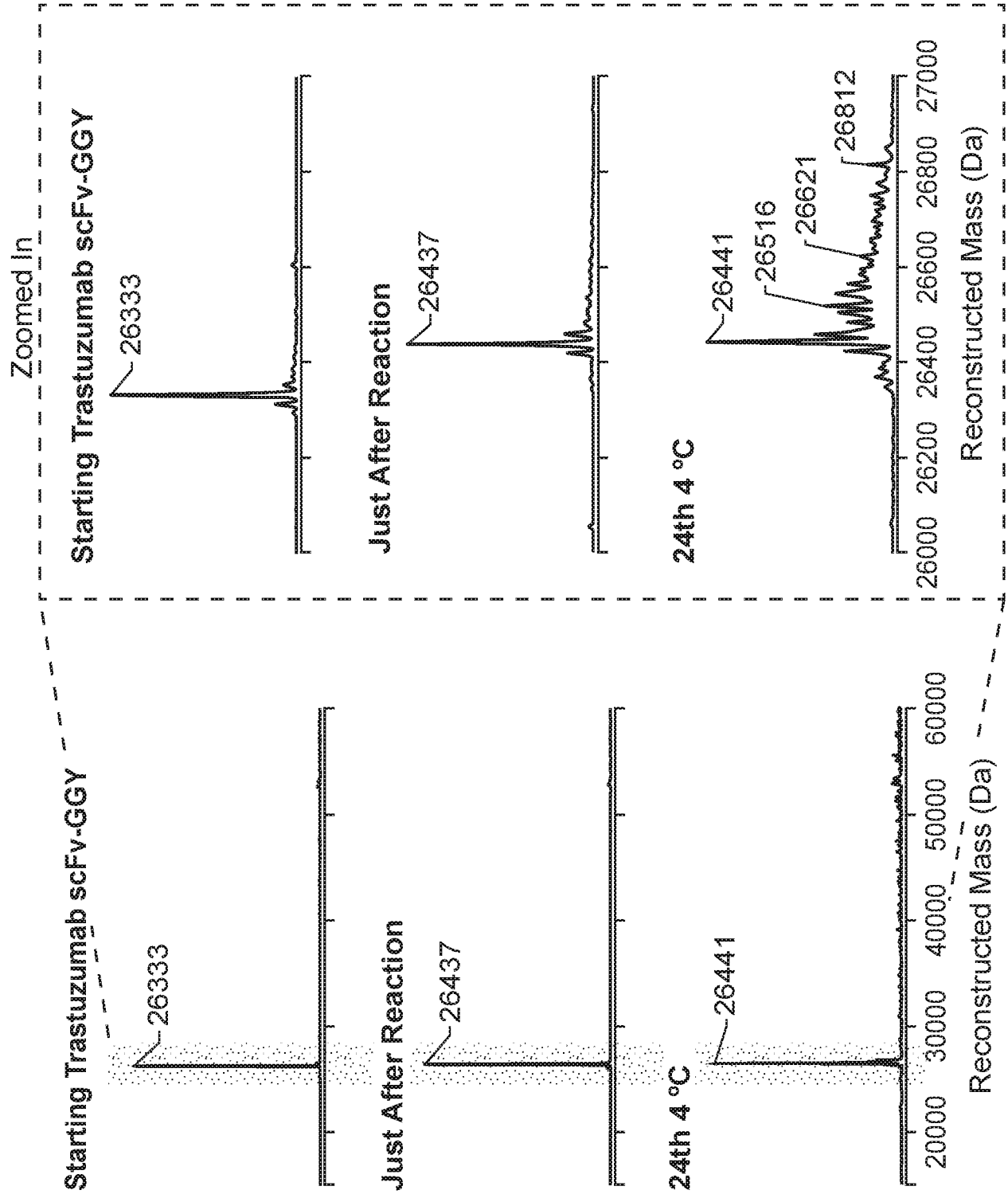

Zoomed In
Starting Trastuzumab scFv-GGY
26333
Just After Reaction
26437
24th 4 °C
26441
26516
26621
26812
26000 26200 26400 26600 26800 27000
Reconstructed Mass (Da)
Starting Trastuzumab scFv-GGY
26333
Just After Reaction
26437
24th 4 °C
26441
20000 30000 40000 50000 60000
Reconstructed Mass (Da)

FIG. 30 (Cont.)
A (Cont.)

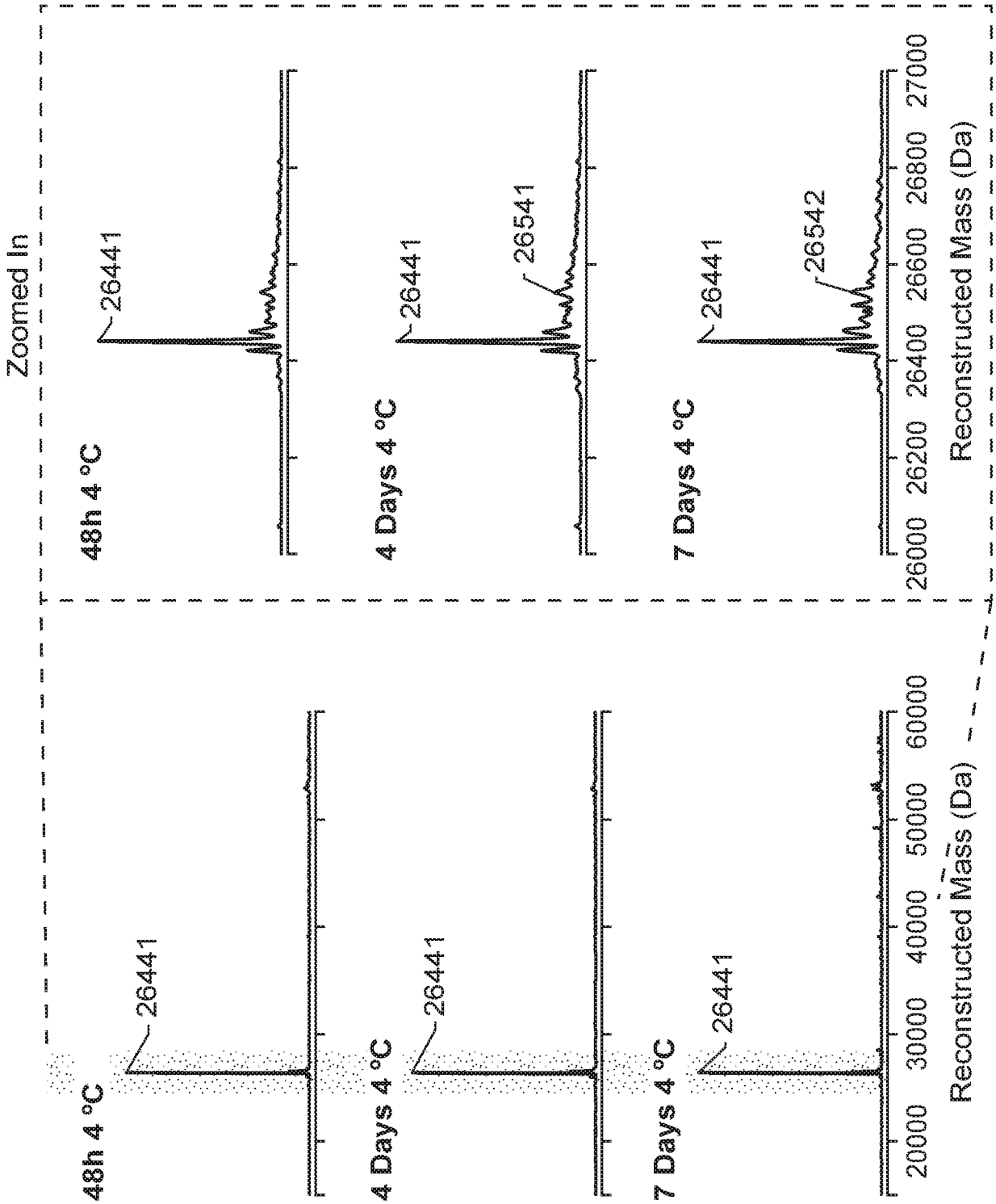


FIG. 30 (Cont.)

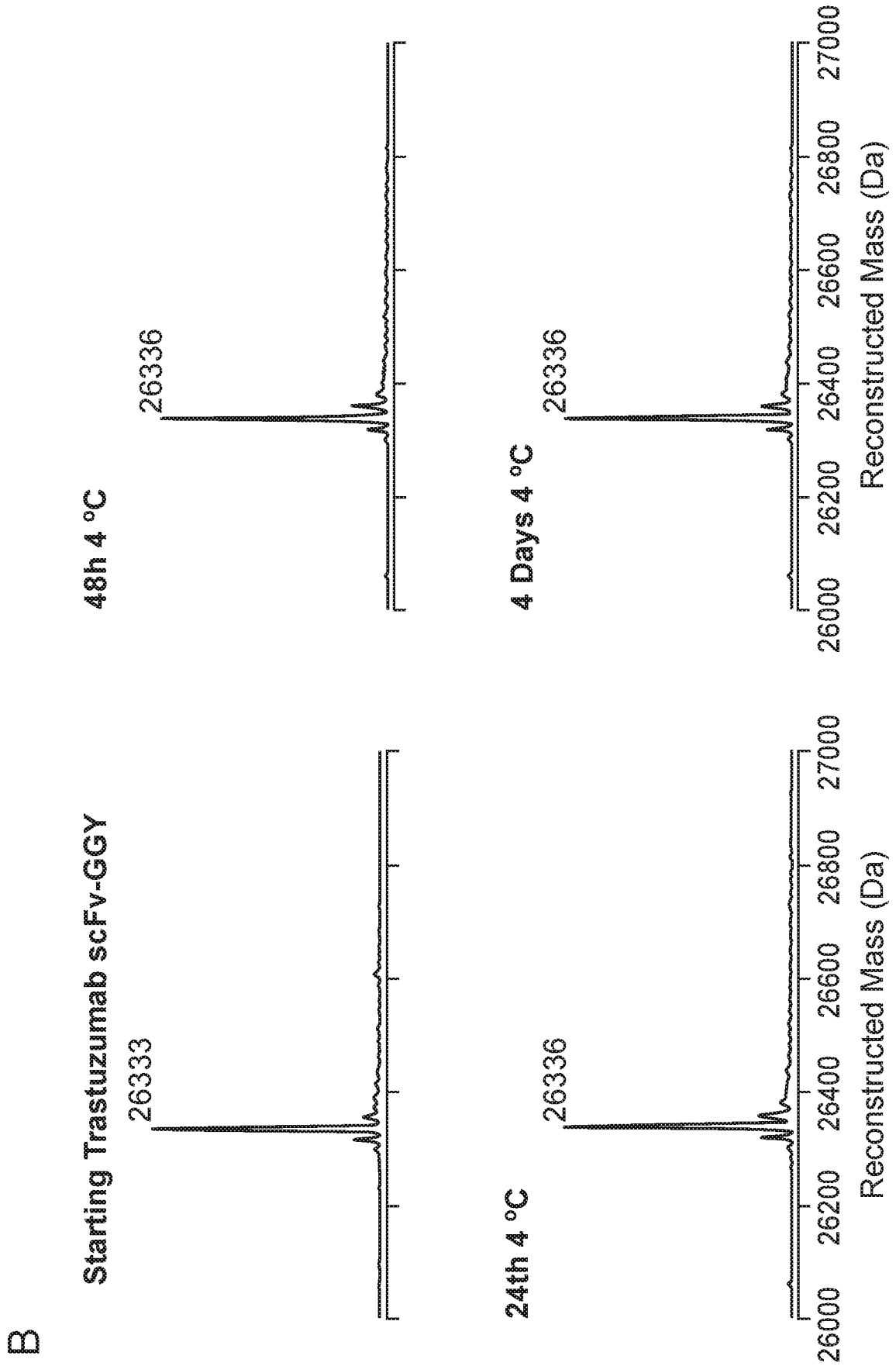

B
Starting Trastuzumab scFv-GGY
26333
48h 4 °C
26336
24th 4 °C
26336
4 Days 4 °C
26336
26000
26200
26400
26600
26800
27000
Reconstructed Mass (Da)

FIG. 31

A

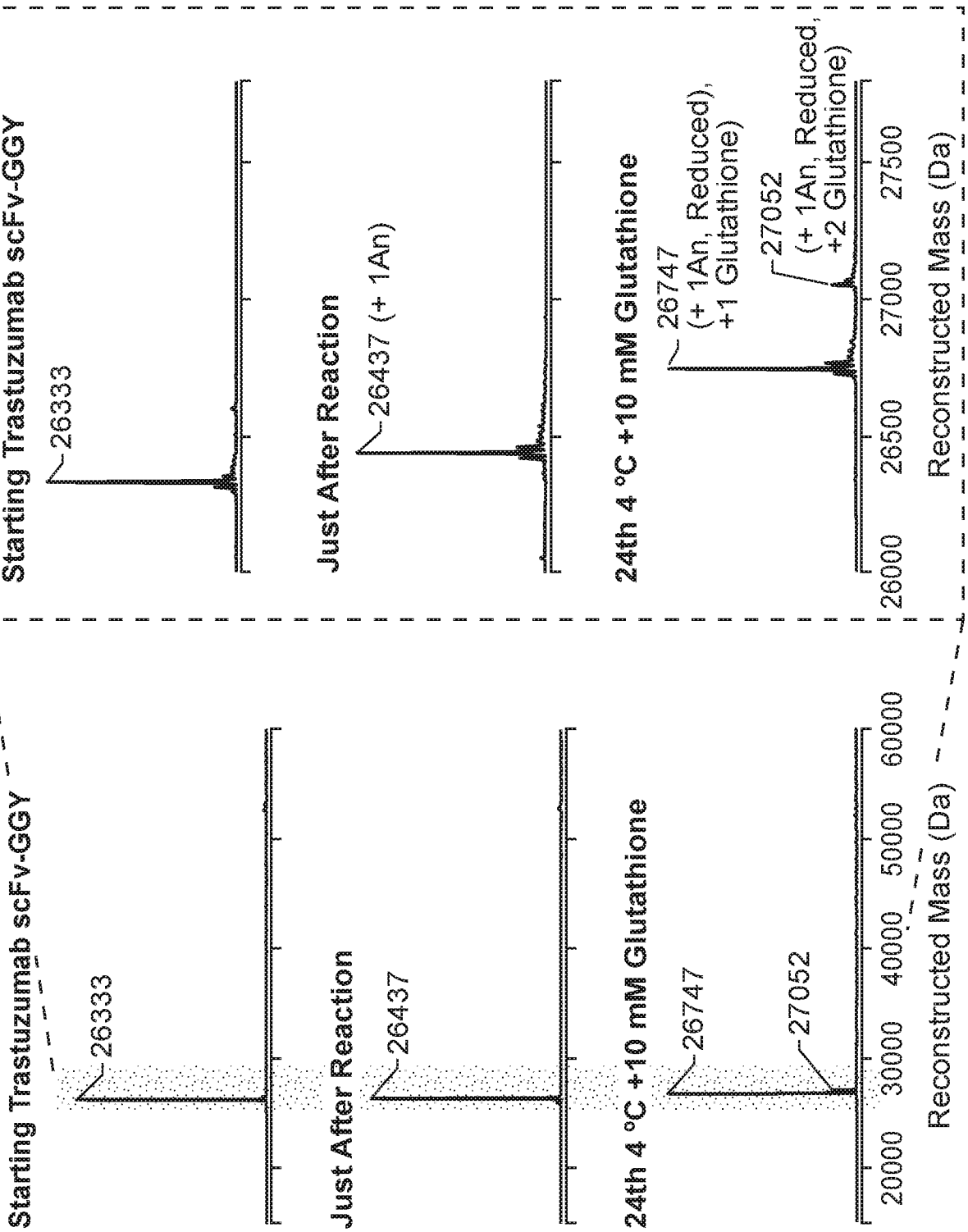

Zoomed In
Starting Trastuzumab scFv-GGY
26333
Just After Reaction
26437 (+ 1An)
24th 4 °C +10 mM Glutathione
26747
(+ 1An, Reduced),
+1 Glutathione)
27052
(+ 1An, Reduced,
+2 Glutathione)
26000
26500
27000
27500
Reconstructed Mass (Da)
Starting Trastuzumab scFv-GGY
26333
Just After Reaction
26437
24th 4 °C +10 mM Glutathione
26747
27052
20000
30000
40000
50000
60000
Reconstructed Mass (Da)

FIG. 31 (Cont.)
A (Cont.)

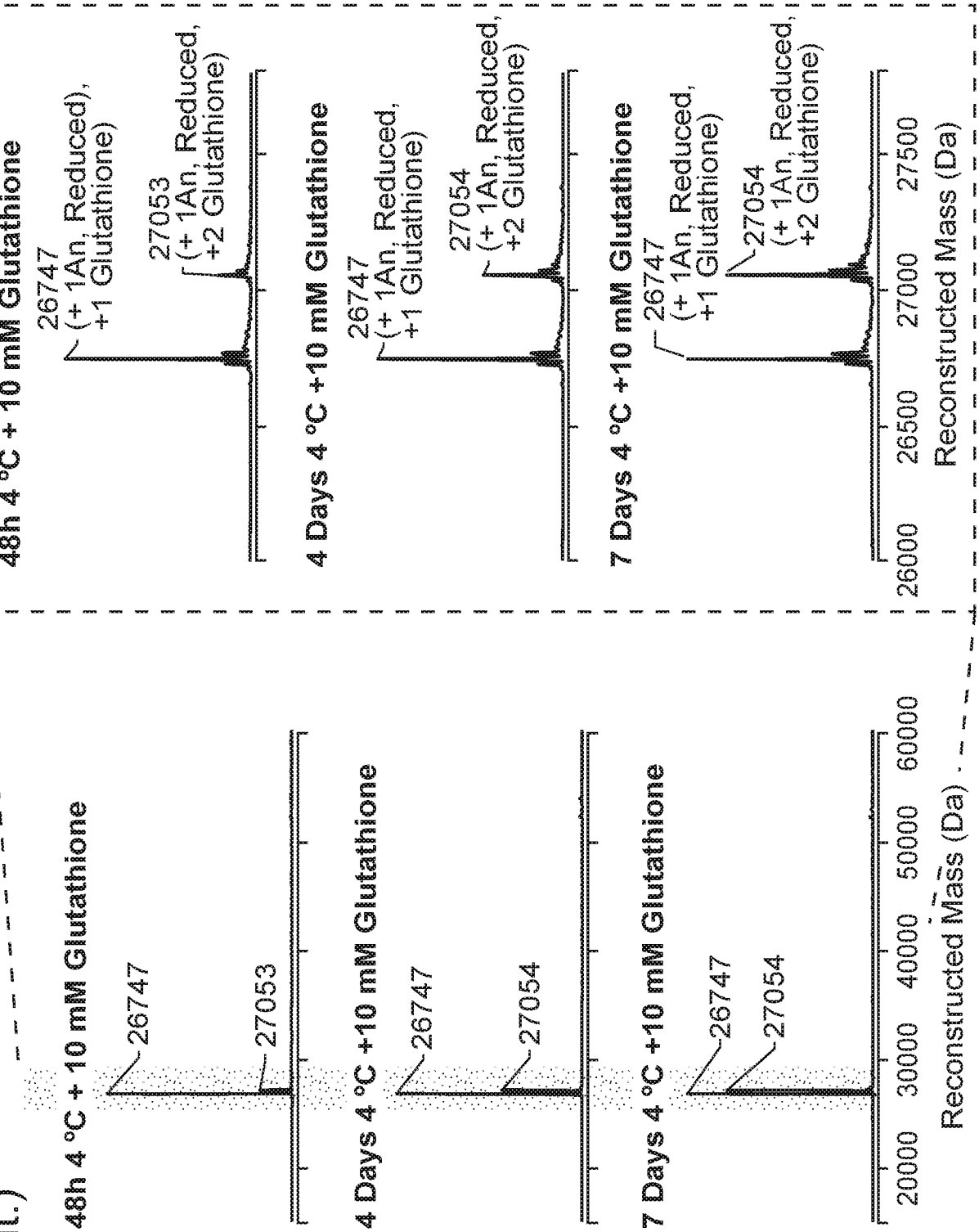


FIG. 31 (Cont.)

B

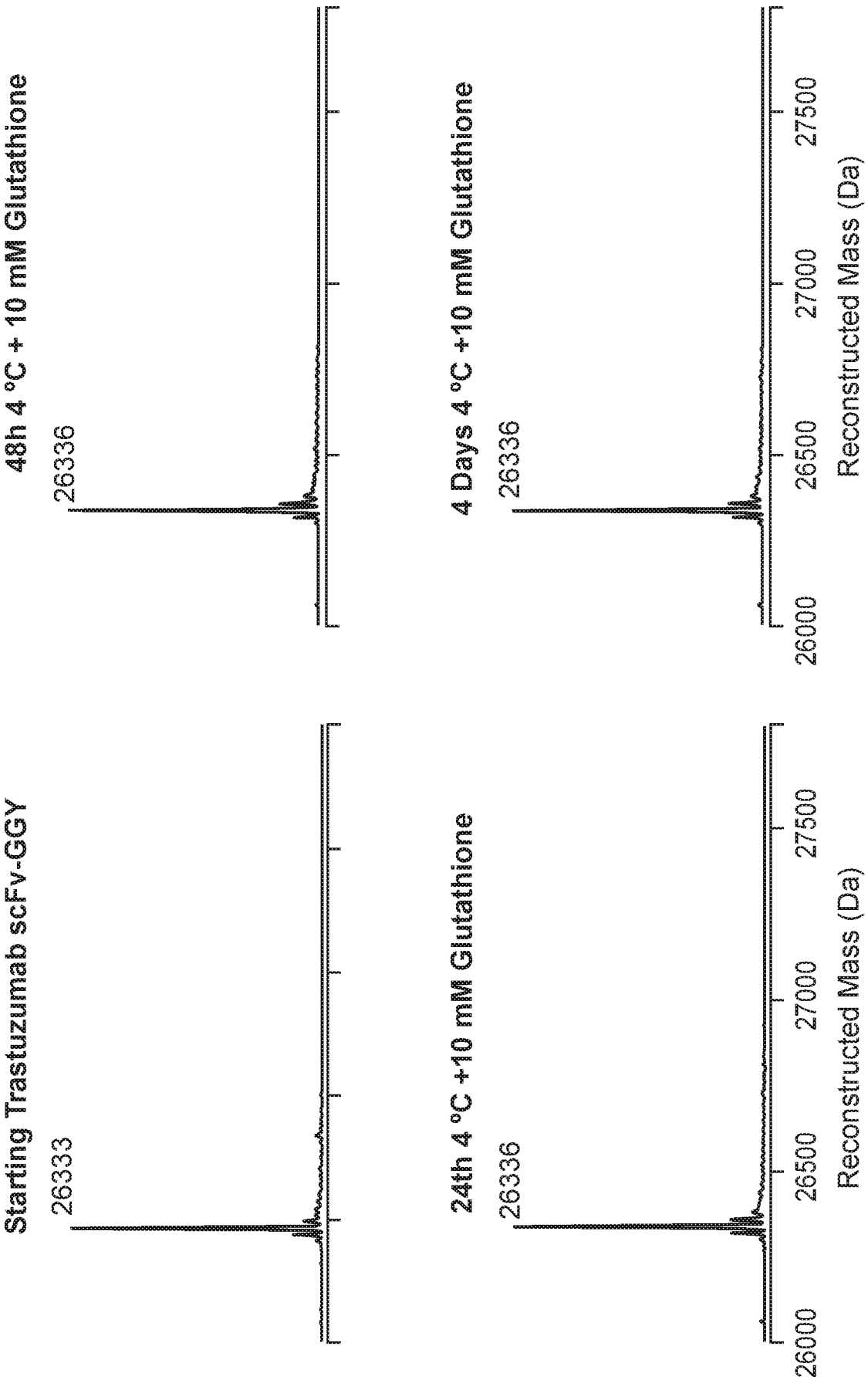

Starting Trastuzumab scFv-GGY
26333
48h 4 °C + 10 mM Glutathione
26336
24th 4 °C +10 mM Glutathione
26336
4 Days 4 °C +10 mM Glutathione
26336
26000
26500
27000
27500
Reconstructed Mass (Da)

FIG. 32

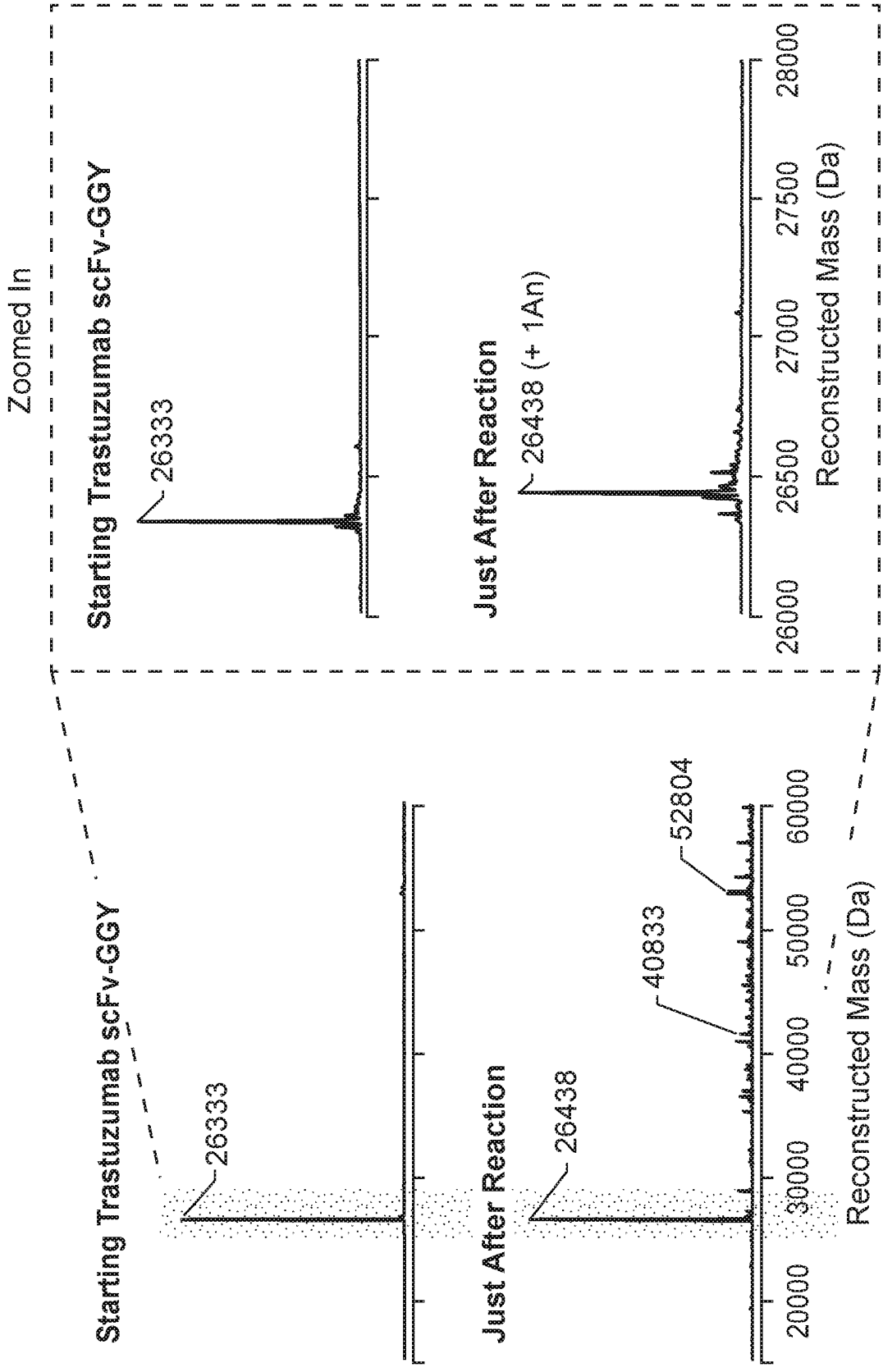

Zoomed In
Starting Trastuzumab scFv-GGY
26333
Just After Reaction
26438 (+ 1An)
26000
26500
27000
27500
28000
Reconstructed Mass (Da)
Starting Trastuzumab scFv-GGY
26333
Just After Reaction
26438
40833
52804
20000
30000
40000
50000
60000
Reconstructed Mass (Da)

FIG. 32 (Cont.)

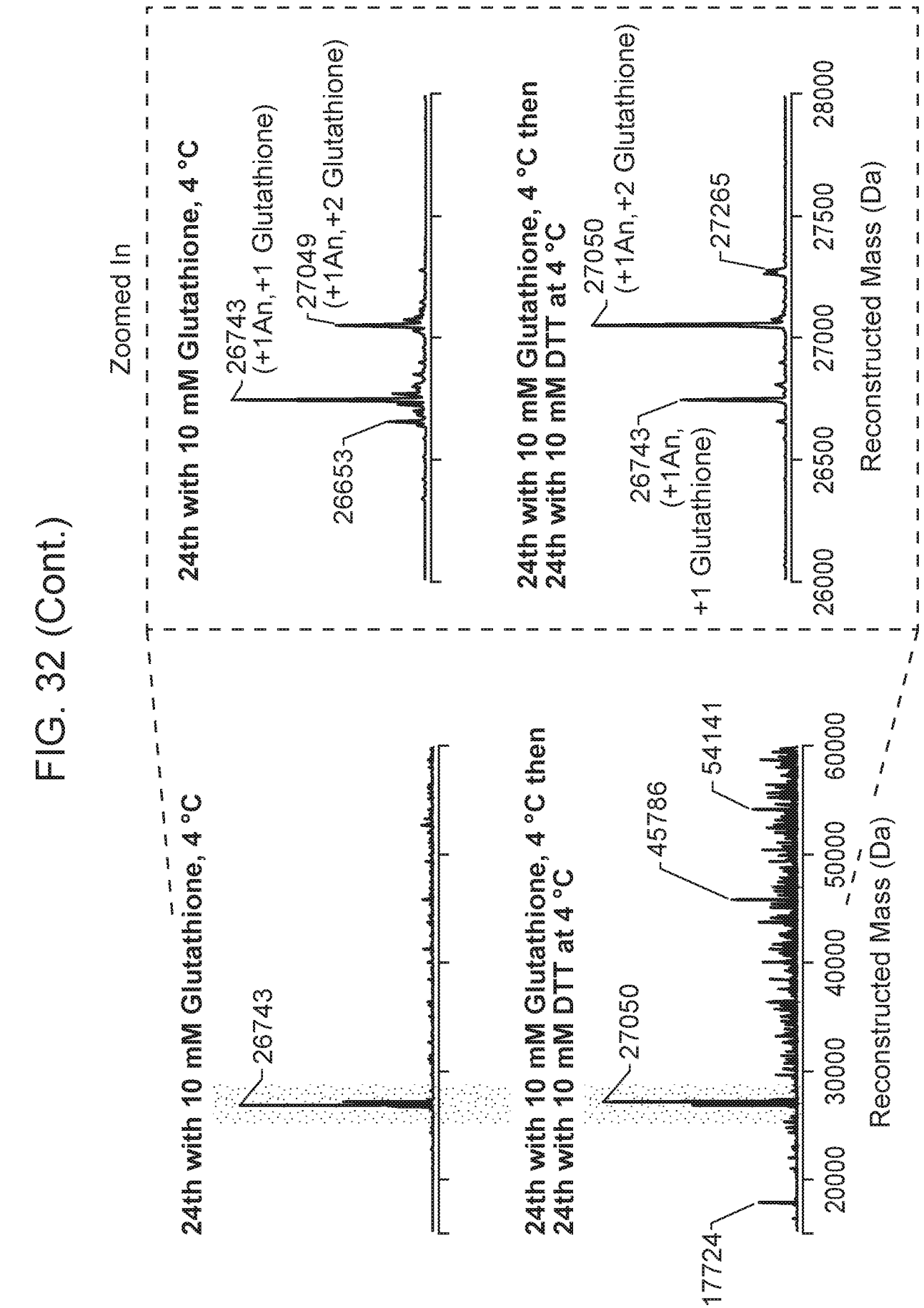

24th with 10 mM Glutathione, 4 °C
26743
24th with 10 mM Glutathione, 4 °C then
24th with 10 mM DTT at 4 °C
27050
45786
54141
17724
20000
30000
40000
50000
60000
Reconstructed Mass (Da)
Zoomed In
24th with 10 mM Glutathione, 4 °C
26743
(+1An,+1 Glutathione)
27049
(+1An,+2 Glutathione)
26653
24th with 10 mM Glutathione, 4 °C then
24th with 10 mM DTT at 4 °C
27050
(+1An,+2 Glutathione)
26743
(+1An,
+1 Glutathione)
27265
26000
26500
27000
27500
28000
Reconstructed Mass (Da)

FIG. 33

Protein	C-Terminus	Average Mass (Da) Expressed Protein	Aniline Adduct
Trastuzumab scFv	No Extension	26,055.83	
	GGY	26,333.11	26,438.20
His6-sfGFP	No Extension	27,609.03	27,714.12
	GGGGSGGY	28,201.59	28,306.68
	(GGGGS)2 GGY	28,516.88	28,621.97
	(AP)4 GGY	28,559.09	28,664.18
	AN20 GGY	30,239.46	30,344.55
His6-(GGS)2-Flag-Maltose Binding Protein	No Extension	42,559.98	
	GGY	42,837.25	42,942.34
	SSGGGGY	43,125.51	43,230.60
Protein L	No Extension	41,417.52	
	GGY	41,694.80	41,799.89
	(GGGGS)2 GGY	42,325.37	42,430.46
	(GGGGS)3 GGY	42,640.66	42,745.75
	AEAAAKEAAAKAGGY	42,778.01	42,883.10
	(AP)3 GGY	42,199.39	42,304.48
	AN20 GGY	44,047.95	44,153.04
	EIKRTGGY	42,322.54	42,427.63
	Domain4-GGY	34,439.87	34,544.96
	Domain4-GGGGSGGY	34,668.08	34,773.17
Ubiquitin			

FIG. 34A

His_6-Super folder GFP:

MHHHHHHRKGEELFTGVVPILVELDGDVNGHKFSVRGEGEGDATNGKLTLKFICTTGKLPVPWPTLVTTL
TYGVQCFARYPDHMKQHDFFKSAMPEGYVQERTISFKDDGTYKTRAEVKFEGDTLVNRIELKGIDFKED
GNILGHKLEYNFNSHNVYITADKQKNGIKANFKIRHNVEDGSVQLADHYQQNTPIGDGPVLLPDNHYLSTQ
SVLSKDPNEKRDHMVLLEFVTAAGITHGMDELYK*

FIG. 34B

His_6-$(GGS)_2$-Flag-Maltose Binding Protein:

MHHHHHHGGSGGSDYKDDDDKKIEEGKLVIWINGDKGYNGLAEVGKKFEKDTGIKVTVEHPDKLEEKFP
QVAATGDGPDIIFWAHDRFGGYAQSGLLAEITPDKAFQDKLYPFTWDAVRYNGKLIAYPIAVEALSLIYNK
DLLPNPPKTWEEIPALDKELKAKGKSALMFNLQEPYFTWPLIAADGGYAFKYENGKYDIKDVGVDNAGAK
AGLTFLVDLIKNKHMNADTDYSIAEAAFNKGETAMTINGPWAWSNIDTSKVNYGVTVLPTFKGQPSKPFV
GVLSAGINAASPNKELAKEFLENYLLTDEGLEAVNKDKPLGAVALKSYEEELAKDPRIAATMENAQKGEIM
PNIPQMSAFWYAVRTAVINAASGRQTVDEALKDAQT*
SSGGGGY

FIG. 34C

PelB-Trastuzumab scFv:

MKYLLPTAAAGLLLLAAQPAMAEVQLVESGGGLVQPGGSLRLSCAASGFNIKDTYIHWVRQAPGKGLEW
VARIYPTNGYTRYADSVKGRFTISADTSKNTAYLQMNSLRAEDTAVYYCSRWGGDGFYAMDYWGQGTL
VTVSSGGGGSGGGGSGGGGSDIQMTQSPSSLSASVGDRVTITCRASQDVNTAVAWYQQKPGKAPKLLI
YSASFLYSGVPSRFSGSRSGTDFTLTISSLQPEDFATYYCQQHYTTPPTFGQGTKLEIKRT*

PelB leader peptide is cleaved *in vivo* after secretion to the periplasmic space. Calculated scFv masses are post PelB leader cleavage.

FIG. 34D

His_6-Protein-L:

MHHHHHHKEETPETPETDSEEEVTIKANLIFANGSTQTAEFKGTFEKATSEAYAYADTLKKDNGEYTVDV
ADKGYTLNIKFAGKEKTPEEPKEEVTIKANLIYADGKTQTAEFKGTFEEATAEAYRYADALKKDNGEYTVD
VADKGYTLNIKFAGKEKTPEEPKEEVTIKANLIYADGKTQTAEFKGTFEEATAEAYRYADLLAKENGKYTV
DVADKGYTLNIKFAGKEKTPEEPKEEVTIKANLIYADGKTQTAEFKGTFAEATAEAYRYADLLAKENGKYT
ADLEDGGYTINIRFAGKKVDEKPEEKEQVTIKENIYFEDGTVQTATFKGTFAEATAEAYRYADLLSKEHGK
YTADLEDGGYTINIRFA*

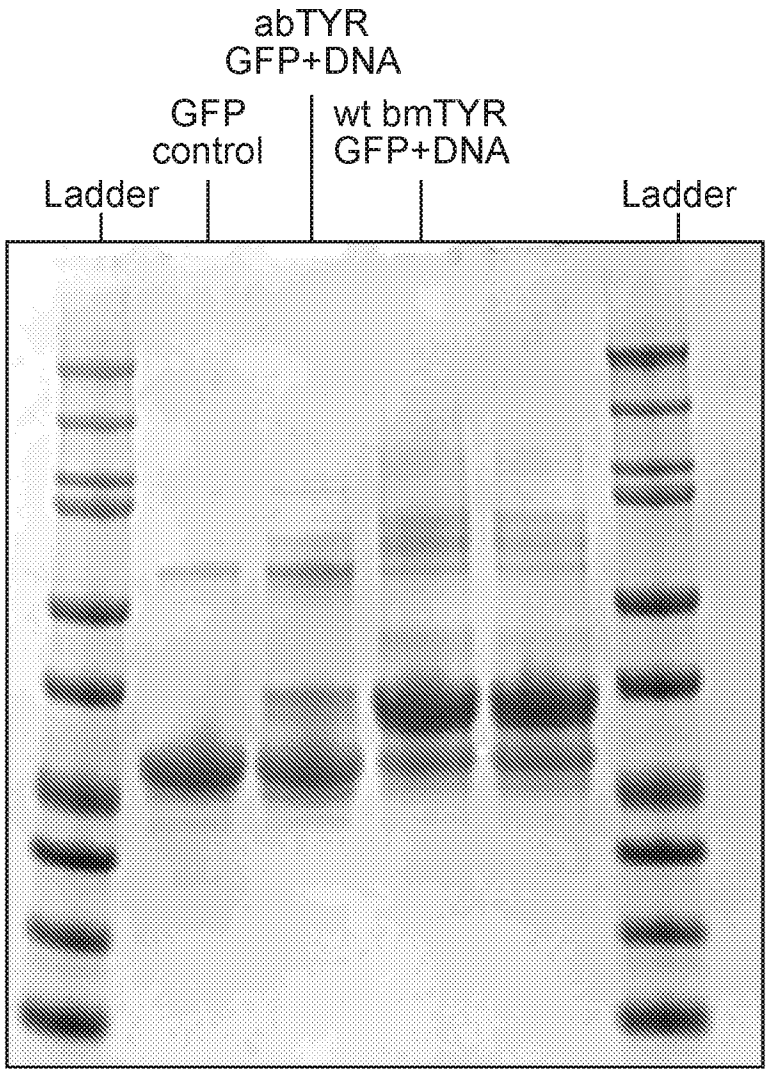
Kappa light chain binding domains are underlined.

FIG. 34E

Bacillus megaterium Tyrosinase – His_6:

MSNKYRVRKNVLHLTDTEKRDFVRTVLILKEKGIYDRYIAWHGAAGKFHTPPGSDRNAAHMSSAFLPWH
REYLLRFERDLQSINPEVTLPYWEWETDAQMQDPSQSQIWSADFMGGNGNPIKDFIVDTGPFAAGRWTT
IDEQGNPSGGLKRNFGATKEAPTLPTRDDVLNALKITQYDTPPWDMTSQNSFRNQLEGFINGPQLHNRV
HRWVGGQMGVVPTAPNDPVFFLHHANVDRIWAVWQIIHRNQNYQPMKNGPFGQNFRDPMYPWNTTPE
DVMNHRKLGYVYDIELRKSKRSSLEHHHHHH

FIG. 35



Rxn Conditions: 50uM GFP, 167nM abTYR (or equivalent activity of bmTYR), 250uM DNA-Phenol, 10mM Phosphate pH 6.5, 30 mins @RT

Mass of GFP: 27550 Da
Mass of DNA: ~8000 Da

FIG. 36A

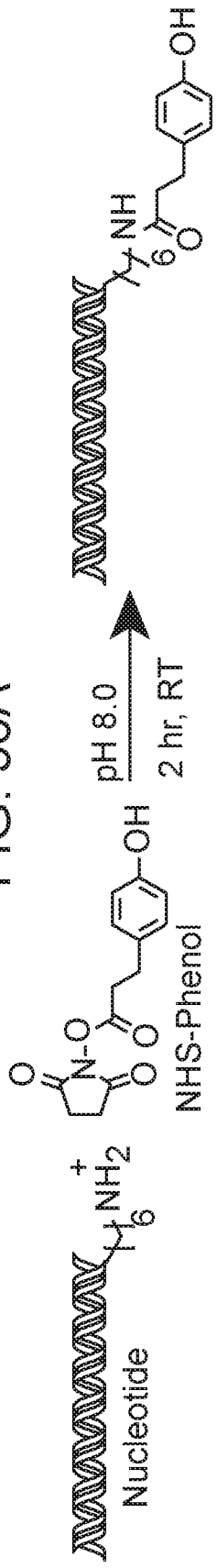


FIG. 36B

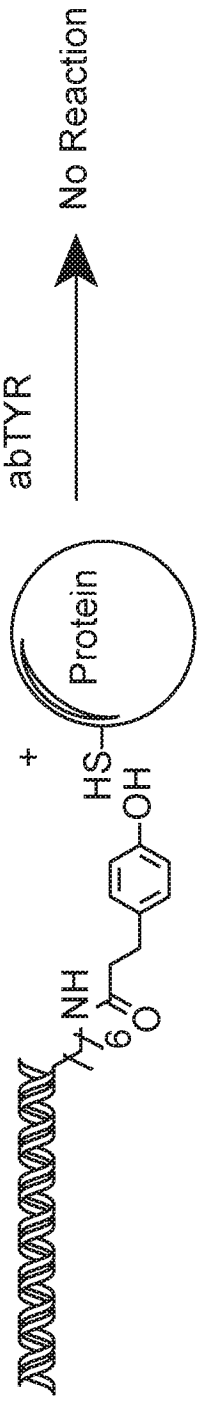


FIG. 36C

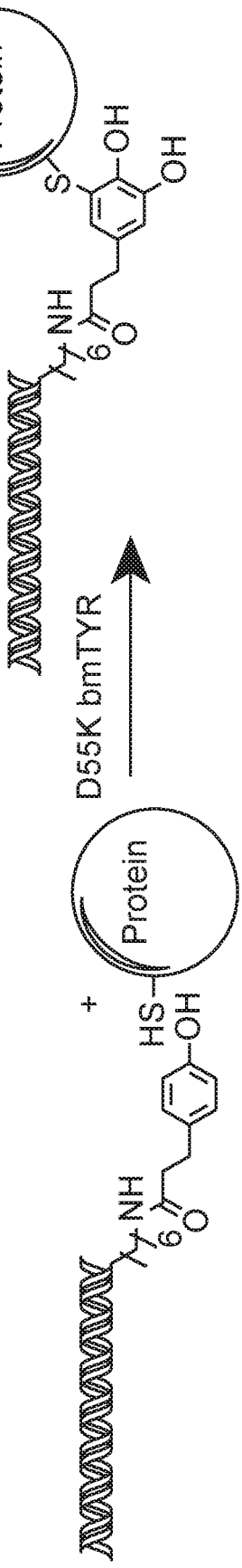


FIG. 37A

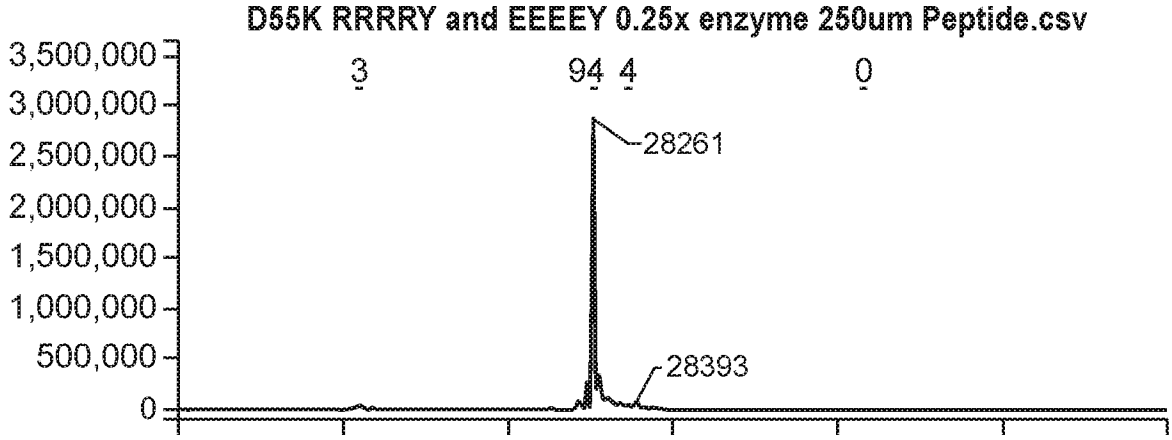


FIG. 37B

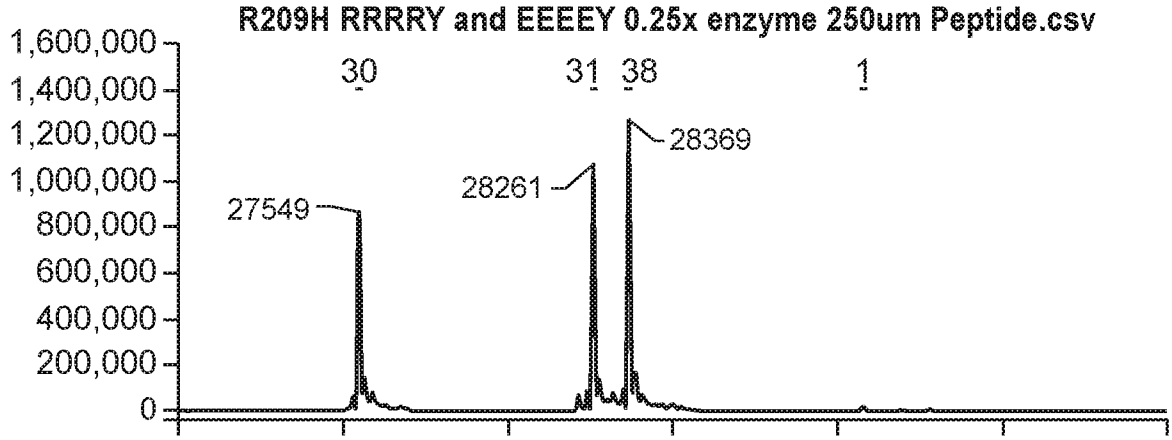


FIG. 37C

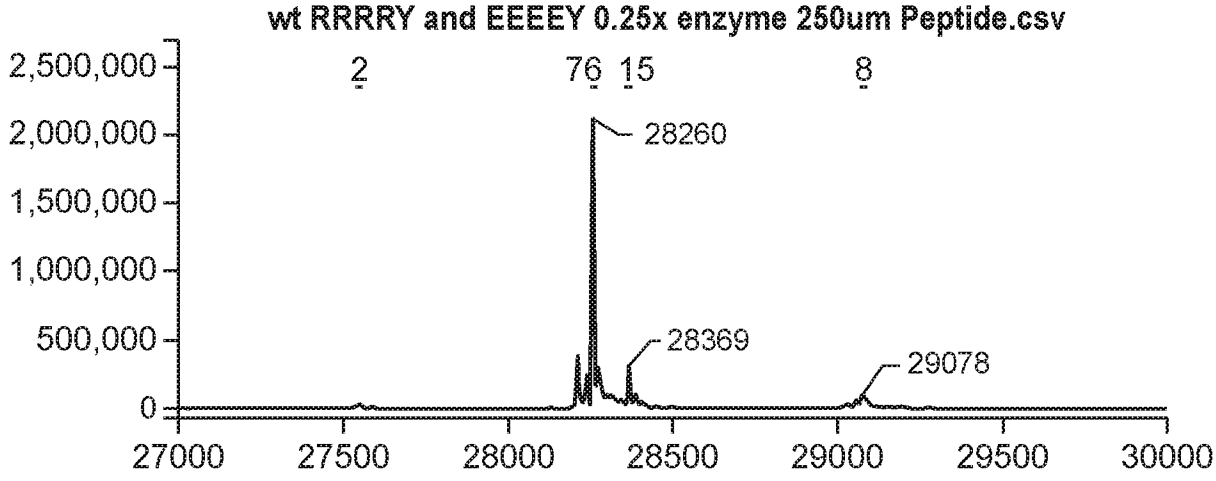


FIG. 38

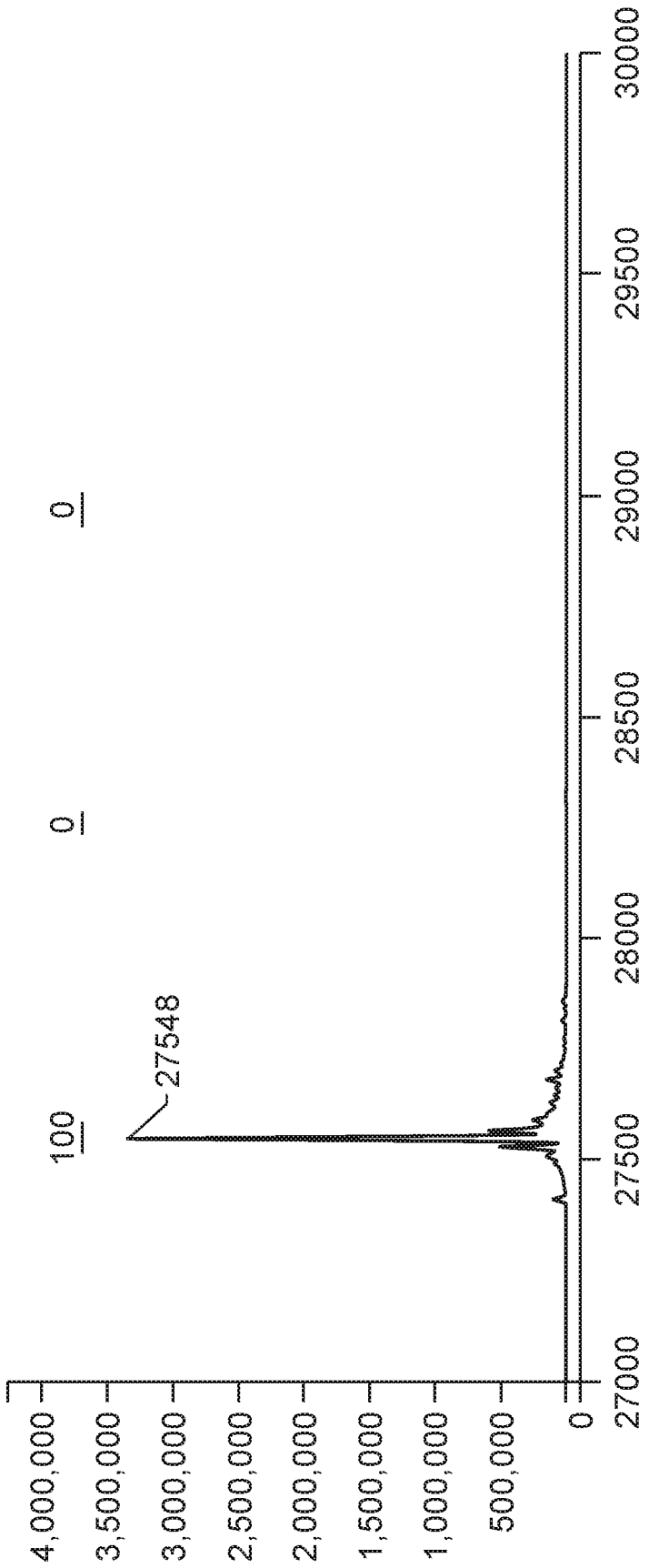

abEEEEY.csv
100
0
0
27548
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
27000
27500
28000
28500
29000
29500
30000

FIG. 39A

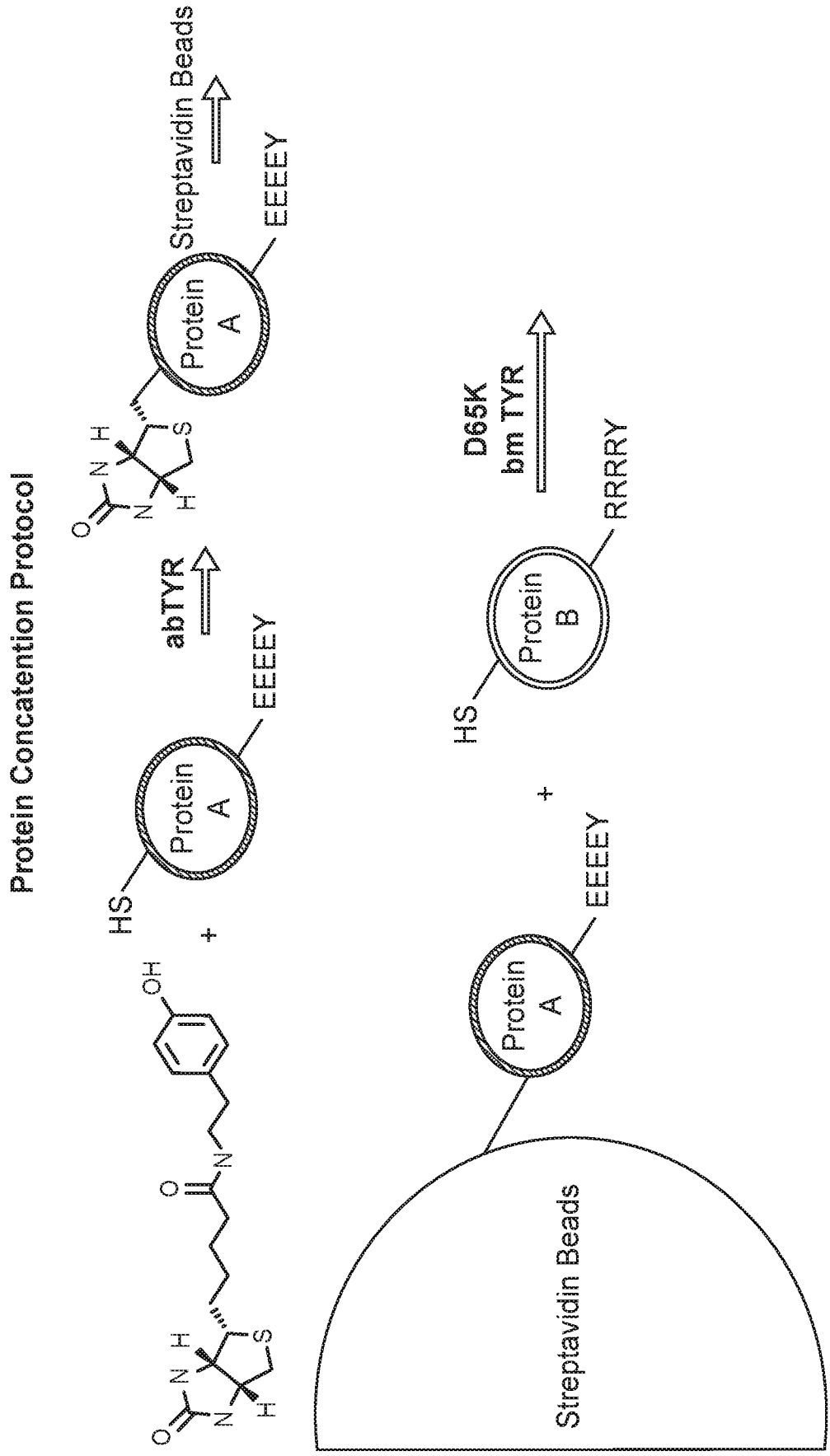

Protein Concatention Protocol
HS
Protein A
EEEEY
abTYR
EEEEY
Protein A
Streptavidin Beads
EEEEY
Protein A
HS
Protein B
D65K
bm TYR
RRRRY
Streptavidin Beads

FIG. 39B

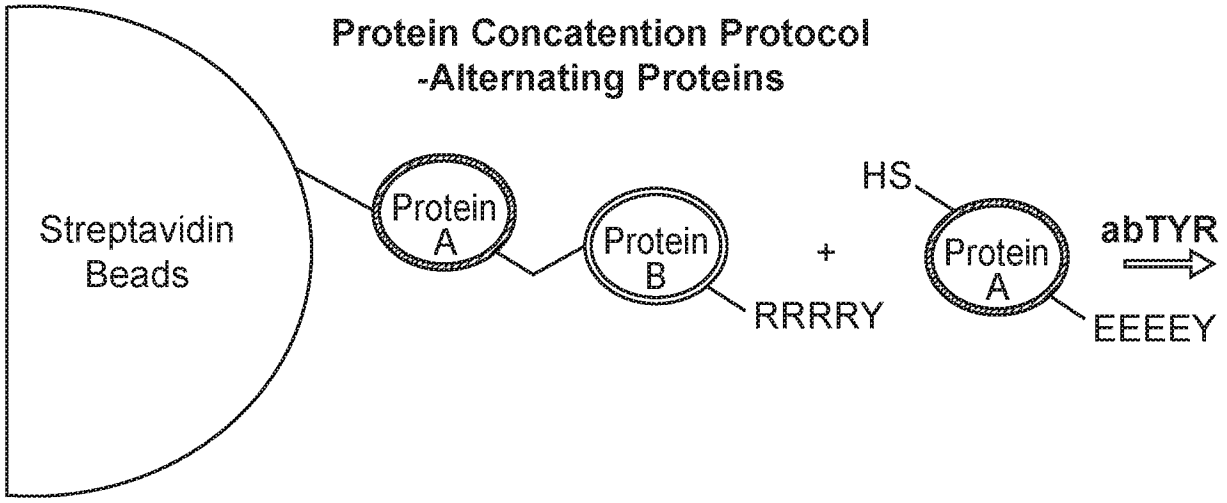


FIG. 39C

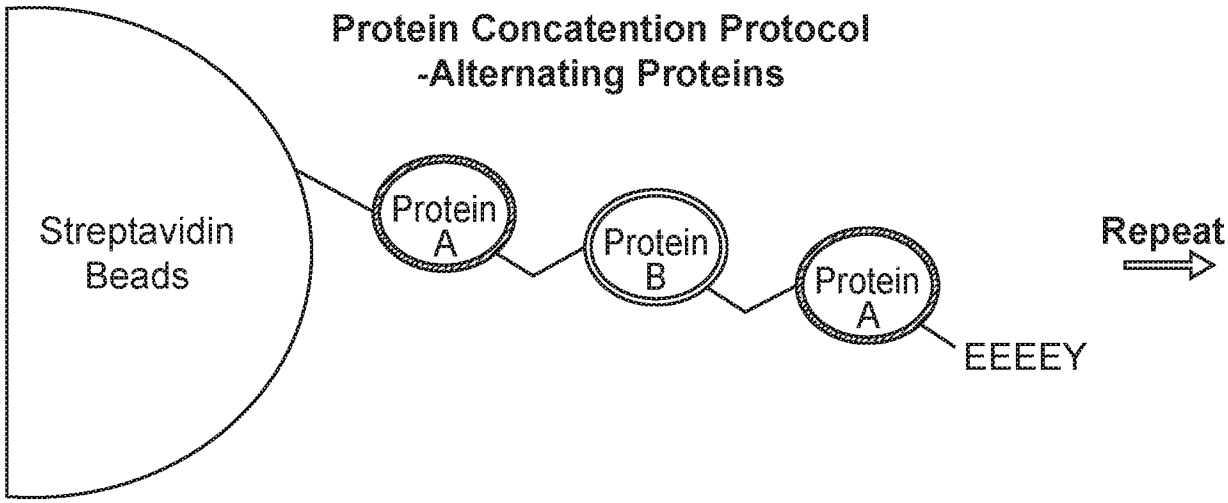


FIG. 39D

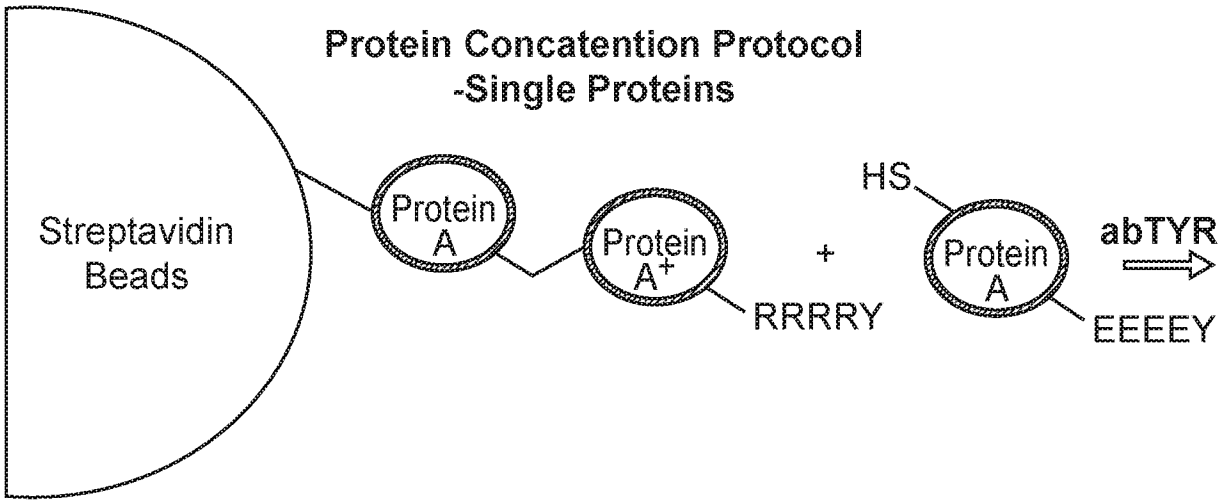


FIG. 39E

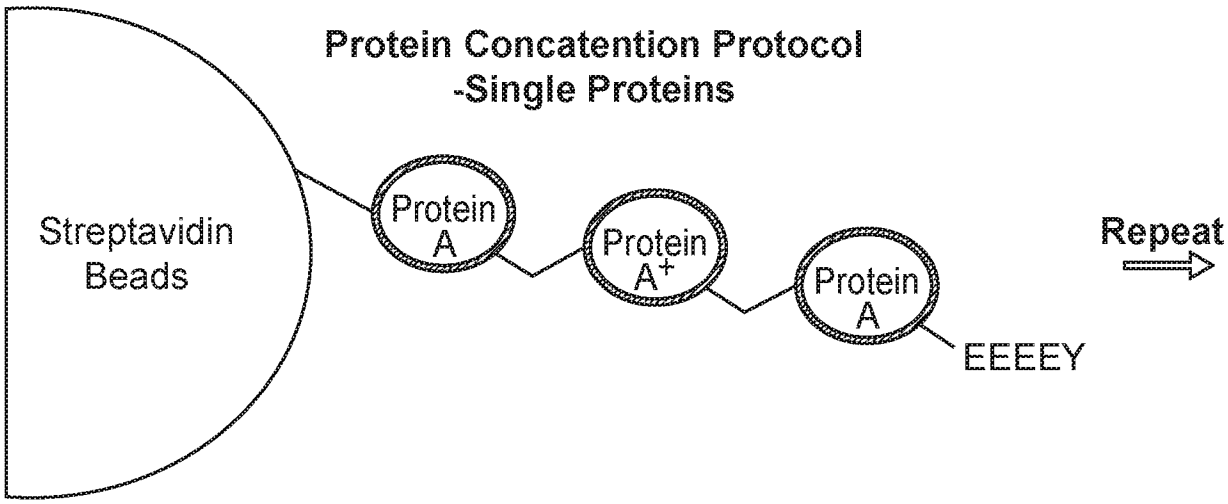


FIG. 39F

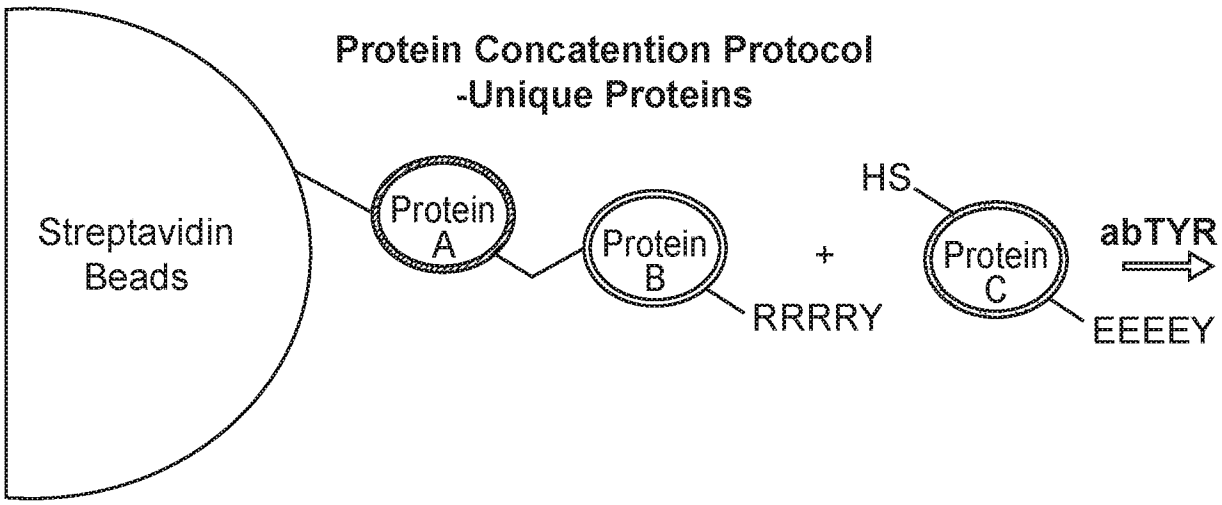


FIG. 39G

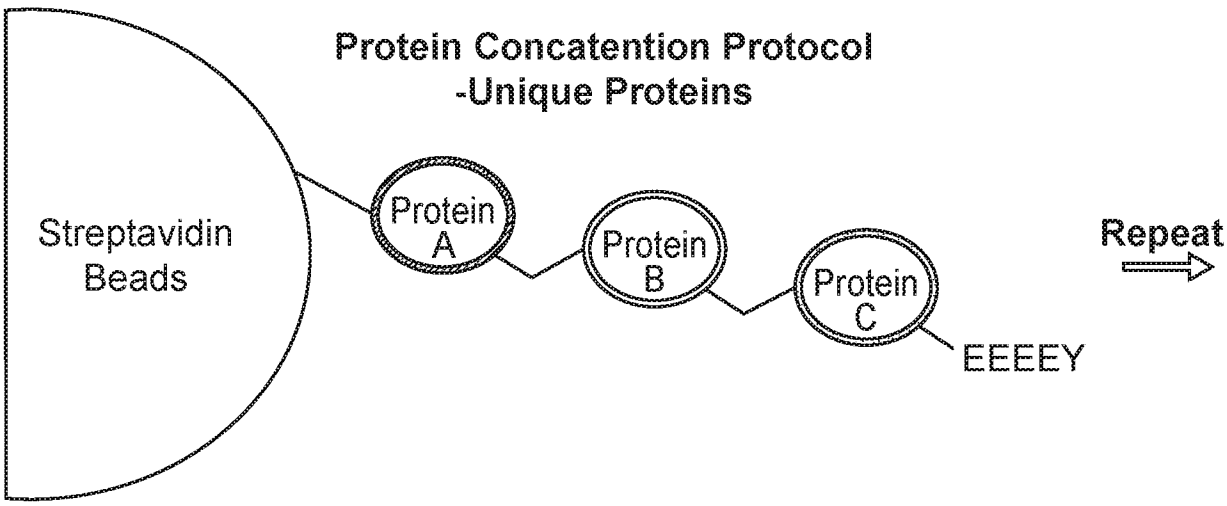


FIG. 40A

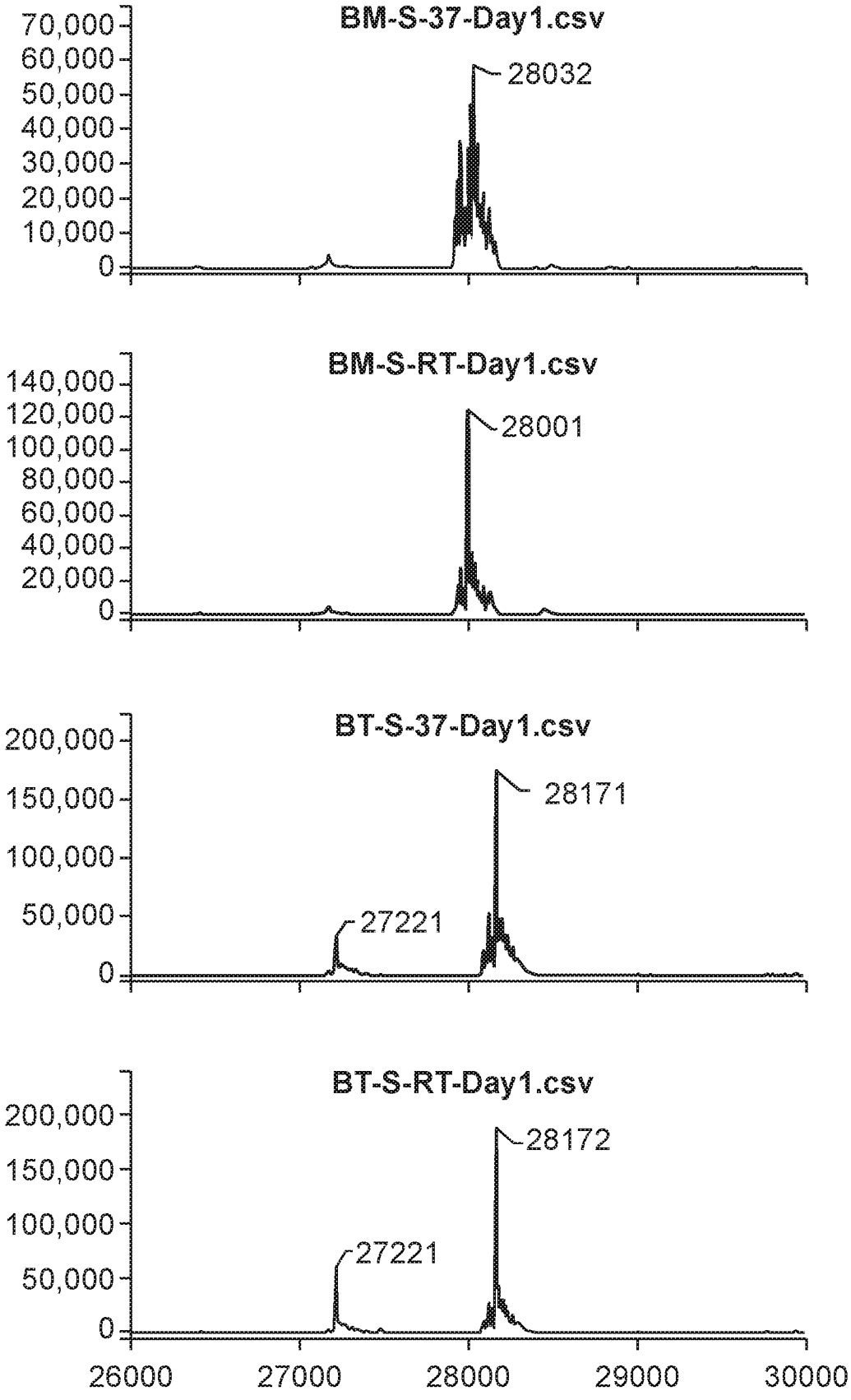

BM-S-37-Day1.csv
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
28032
BM-S-RT-Day1.csv
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
28001
BT-S-37-Day1.csv
200,000
150,000
100,000
50,000
0
28171
27221
BT-S-RT-Day1.csv
200,000
150,000
100,000
50,000
0
28172
27221
26000
27000
28000
29000
30000

FIG. 40B

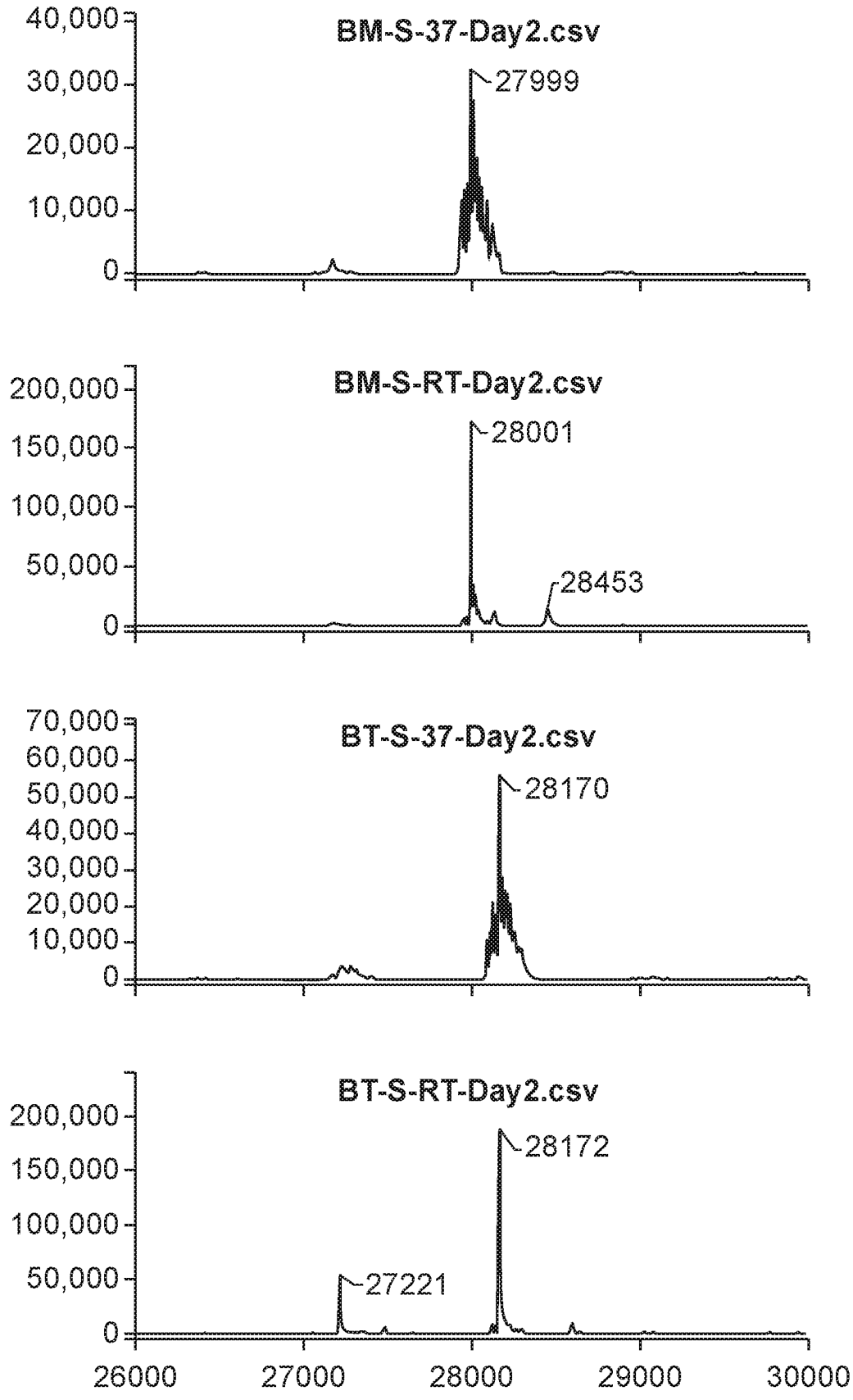

BM-S-37-Day2.csv
27999
40,000
30,000
20,000
10,000
0
BM-S-RT-Day2.csv
28001
28453
200,000
150,000
100,000
50,000
0
BT-S-37-Day2.csv
28170
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
BT-S-RT-Day2.csv
28172
27221
200,000
150,000
100,000
50,000
0
26000
27000
28000
29000
30000

FIG. 40C

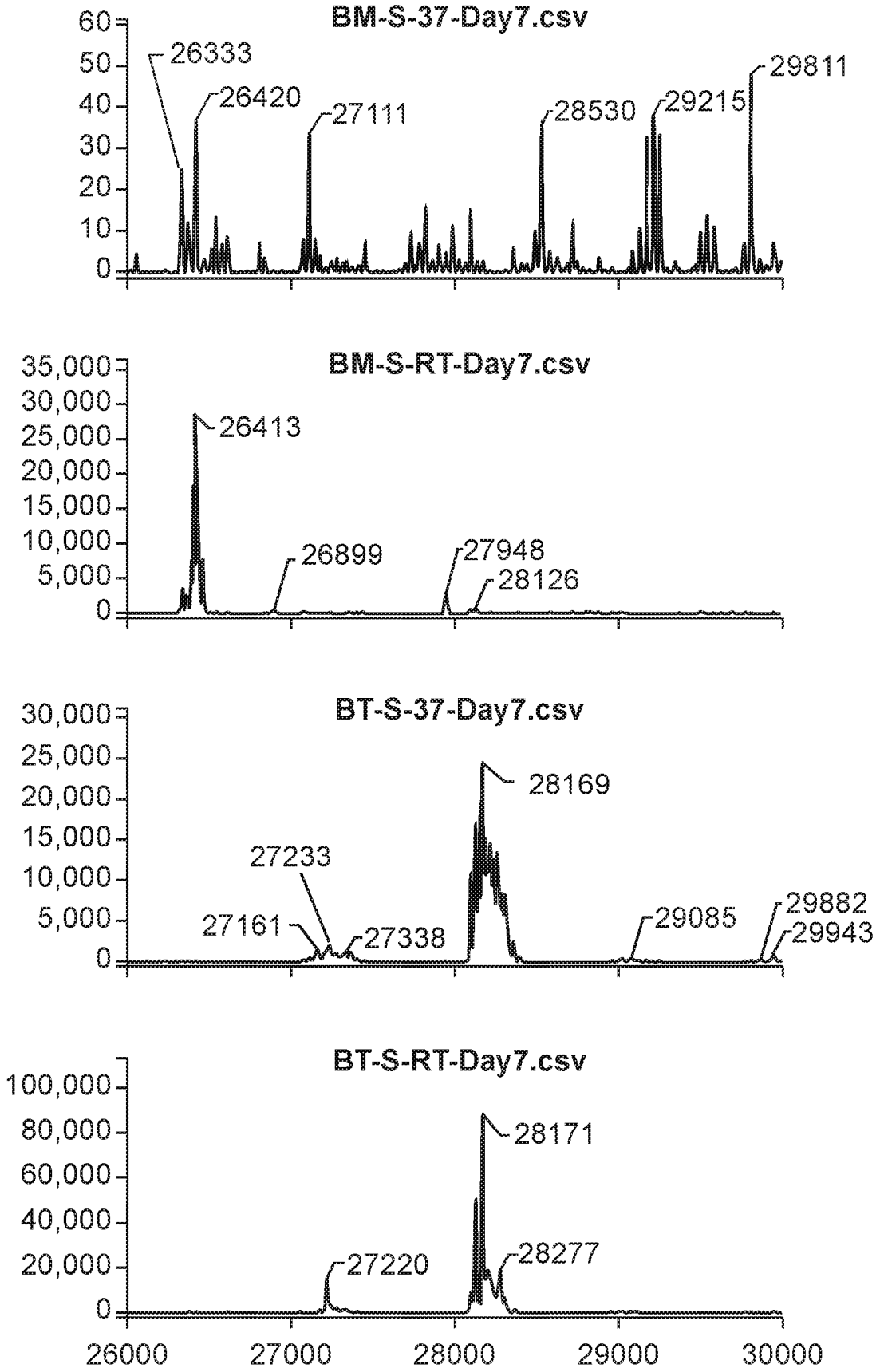

BM-S-37-Day7.csv
60
50
40
30
20
10
0
26333
26420
27111
28530
29215
29811
BM-S-RT-Day7.csv
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
26413
26899
27948
28126
BT-S-37-Day7.csv
30,000
25,000
20,000
15,000
10,000
5,000
0
28169
27233
27161
27338
29085
29882
29943
BT-S-RT-Day7.csv
100,000
80,000
60,000
40,000
20,000
0
28171
27220
28277
26000
27000
28000
29000
30000

FIG. 41

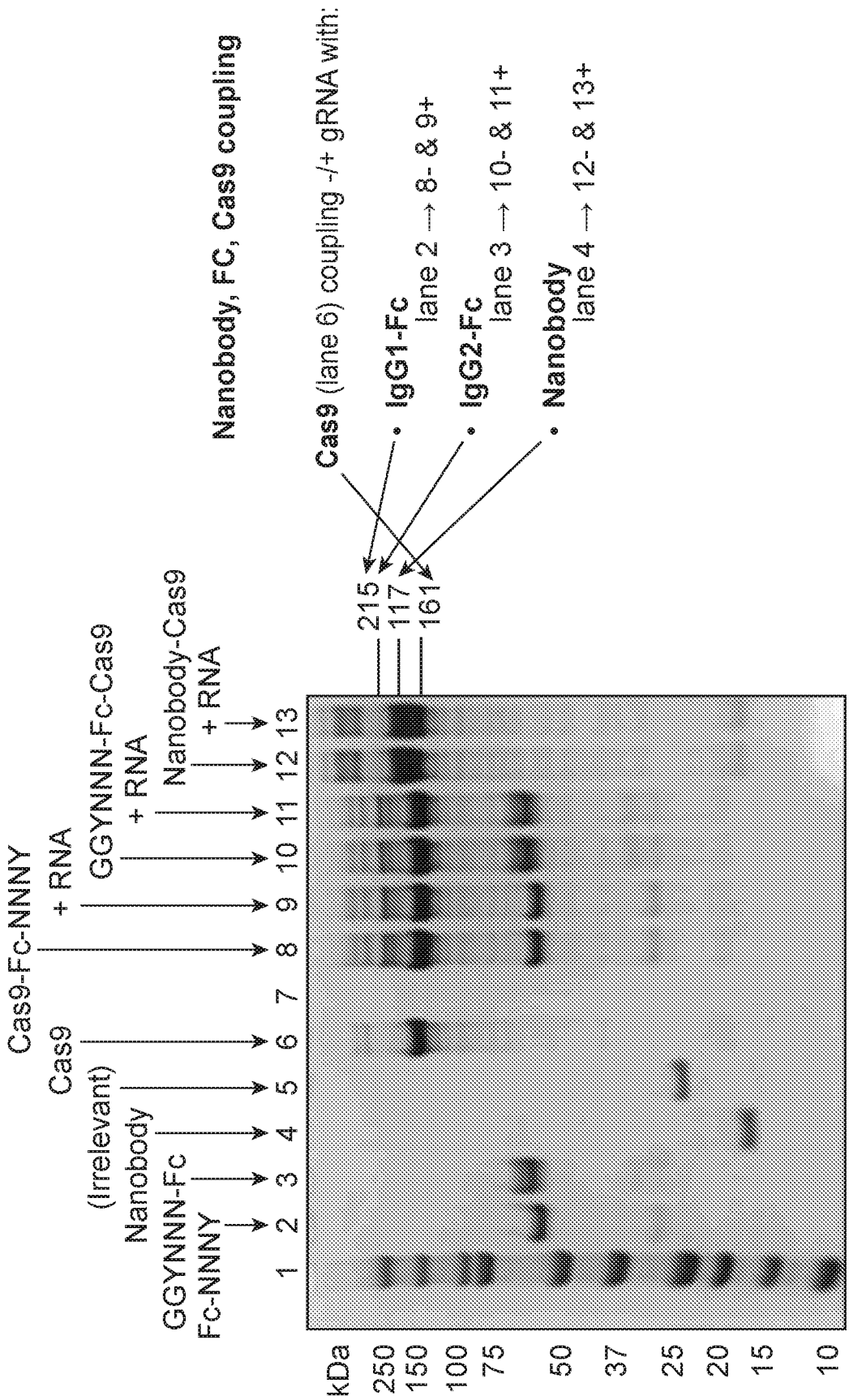
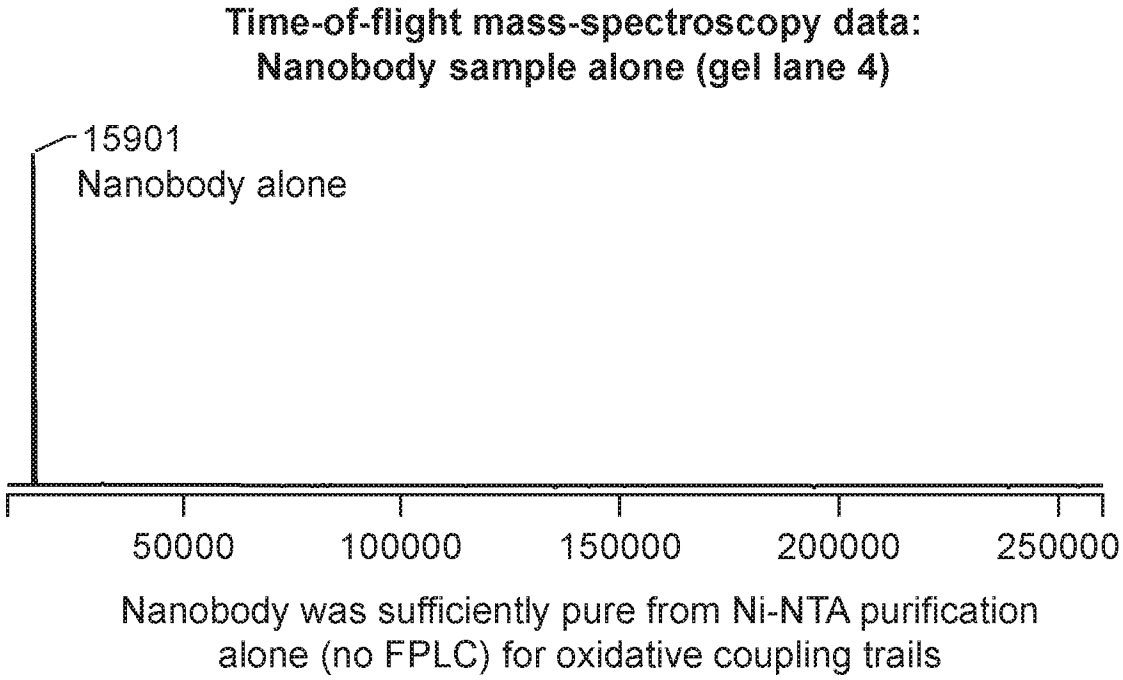

Nanobody, FC, Cas9 coupling
Cas9 (lane 6) coupling -/+ gRNA with:
IgG1-Fc lane 2 → 8- & 9+
IgG2-Fc lane 3 → 10- & 11+
Nanobody lane 4 → 12- & 13+
215
117
161
Cas9-Fc-NNNY
+ RNA
GGYNNN-Fc-Cas9
+ RNA
Nanobody-Cas9
+ RNA
Cas9
(Irrelevant) Nanobody
GGYNNN-Fc
Fc-NNNY
1 2 3 4 5 6 7 8 9 10 11 12 13
kDa
250
150
100
75
50
37
25
20
15
10

FIG. 42


Time-of-flight mass-spectroscopy data:
Nanobody sample alone (gel lane 4)
15901
Nanobody alone
50000
100000
150000
200000
250000
Nanobody was sufficiently pure from Ni-NTA purification
alone (no FPLC) for oxidative coupling trails

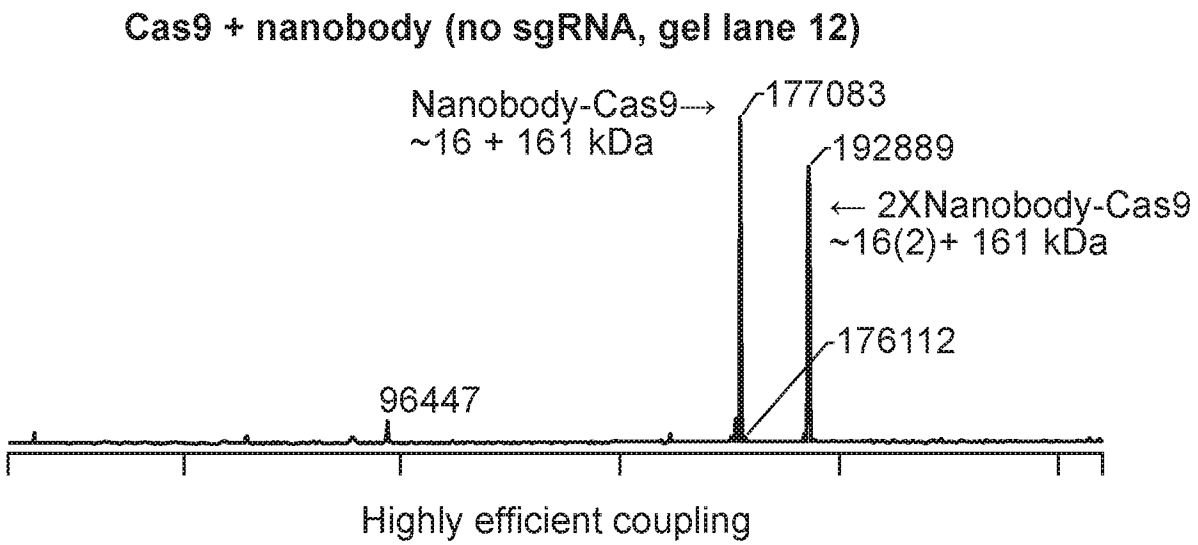

Cas9 + nanobody (no sgRNA, gel lane 12)
Nanobody-Cas9⟶
~16 + 161 kDa
177083
192889
⟵ 2XNanobody-Cas9
~16(2)+ 161 kDa
176112
96447
Highly efficient coupling

FIG. 43A

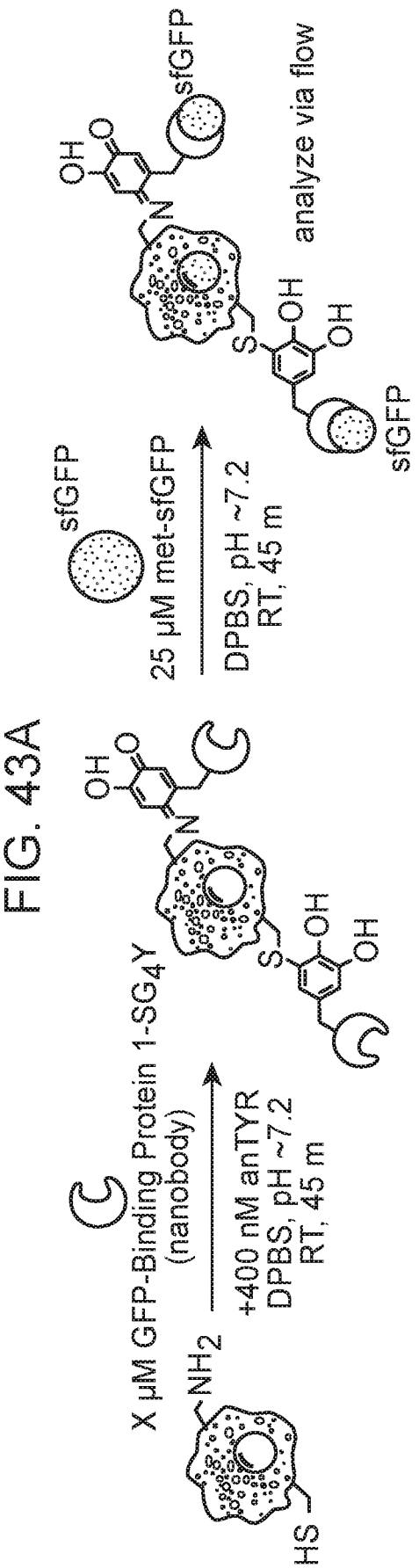


FIG. 43B

Sample	[GBP1]	+/- met-sfGFP	+/- sfGFP-sG4Y
	None	None	None
	None	+	None
	None	None	+
	10 μM	+	None
	20 μM	+	None
	50 μM	+	None
	100 μM	+	None

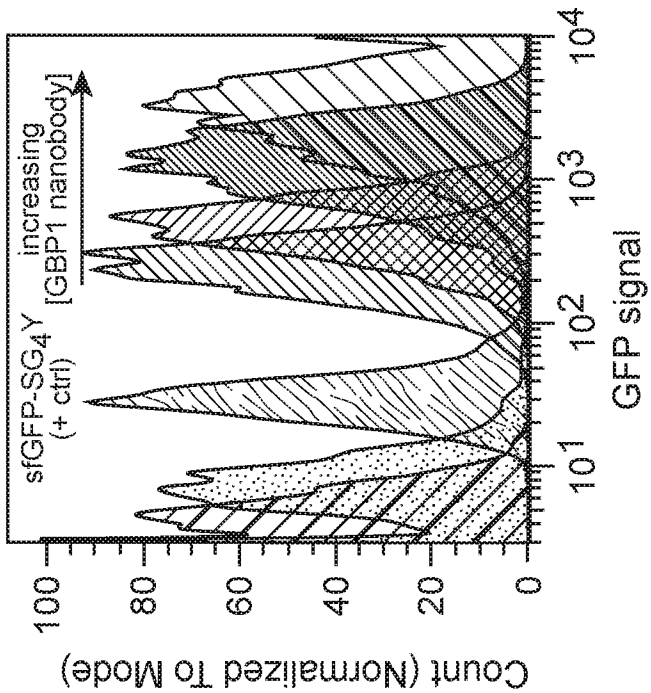


FIG. 44A

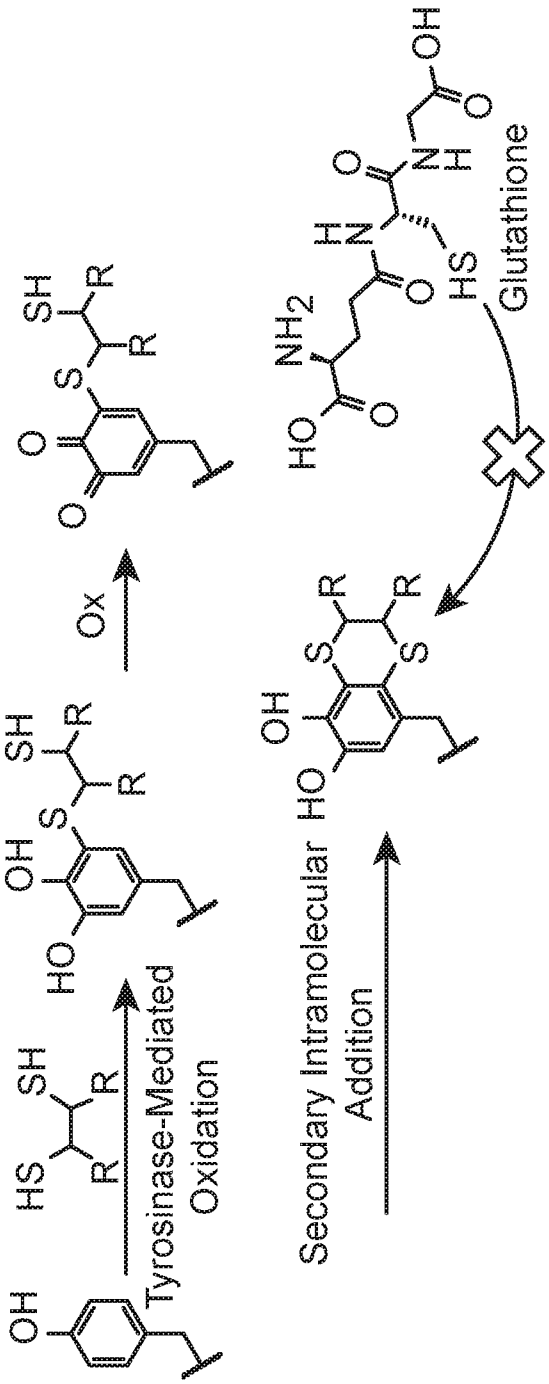
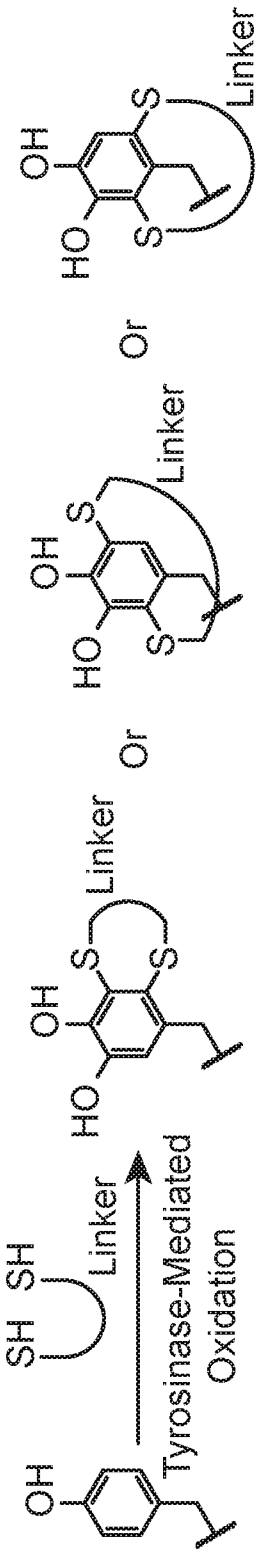


FIG. 44B



SEQUENCE LISTING

<110> University of California - Berkeley
Francis, Matthew B.
Lobba, Marco
Maza, Johnathan Charles
Marmelstein, Alan M.
Doudna, Jennifer A.
Fellmann, Christof

<120> COMPOSITIONS AND METHODS FOR MODIFICATION OF TARGET MOLECULES

<130> BERK-405WO

<150> US 62/910,836
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<160> 1060

<170> PatentIn version 3.5

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<212> PRT
<213> Artificial sequence

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Ile Gly Leu Asp Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile
1 5 10 15

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<213> Artificial sequence

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Ile Val Ile Glu Met Ala Arg Glu
1 5

<210> 3
<211> 27
<212> PRT
<213> Artificial sequence

<220>
<223> Synthetic Sequence

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Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp Ser Ile
1 5 10 15

Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn
20 25

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<212> PRT
<213> Artificial sequence

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His His Ala His Asp Ala Tyr Leu
1 5

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<211> 1368
<212> PRT
<213> Streptococcus pyogenes

<400> 5

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
20 25 30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile

```
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240
```

```
Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
               245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
               325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
               405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
```

```
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640
```

```
His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
               645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
               725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
               805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys
```

```
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser
945                 950                 955                 960

Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020

Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035
```

```
Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050

Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080

Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155

Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170

Phe Glu  Lys Asn Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Lys Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215

Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
```

```
    1220                1225                1230

Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245

Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260

His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275

Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290

Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                1300                1305

Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
    1310                1315                1320

Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1325                1330                1335

Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1340                1345                1350

Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                1360                1365


<210>  6
<211>  1367
<212>  PRT
<213>  Streptococcus pyogenes

<400>  6

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15
```

```
Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Leu
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Arg His Gly Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Val Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Arg Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220
```

```
Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile His Leu
                405                 410                 415
```

```
Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Thr Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620
```

```
Leu Phe Glu Asp Lys Glu Met Ile Glu Glu Arg Leu Lys Lys Tyr Ala
625                 630                 635                 640

Asn Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg His Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Ala Ile Gln Lys Ala Gln Val Ser Gly Gln Gly His Ser Leu
705                 710                 715                 720

His Glu Gln Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Thr Val Lys Ile Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
        755                 760                 765

Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu
    770                 775                 780

Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val
785                 790                 795                 800

Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln
                805                 810                 815
```

```
Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu
            820                 825                 830

Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp
        835                 840                 845

Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly
    850                 855                 860

Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn
865                 870                 875                 880

Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe
                885                 890                 895

Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys
            900                 905                 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925

His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu
    930                 935                 940

Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys
945                 950                 955                 960

Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu
                965                 970                 975

Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val
            980                 985                 990

Gly Thr Ala Leu Ile Lys Lys Tyr  Pro Lys Leu Glu Ser  Glu Phe Val
        995                 1000                1005

Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg Lys Met  Ile Ala Lys
    1010                1015                1020
```

```
Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala Lys Tyr  Phe Phe Tyr
    1025                1030                1035

Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu Ile Thr  Leu Ala Asn
    1040                1045                1050

Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu Thr Asn  Gly Glu Thr
    1055                1060                1065

Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp Phe Ala  Thr Val Arg
    1070                1075                1080

Lys Val  Leu Ser Met Pro Gln  Val Asn Ile Val Lys  Lys Thr Glu
    1085                1090                1095

Val Gln  Thr Gly Gly Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Arg
    1100                1105                1110

Asn Ser  Asp Lys Leu Ile Ala  Arg Lys Lys Asp Trp  Asp Pro Lys
    1115                1120                1125

Lys Tyr  Gly Gly Phe Asp Ser  Pro Thr Val Ala Tyr  Ser Val Leu
    1130                1135                1140

Val Val  Ala Lys Val Glu Lys  Gly Lys Ser Lys Lys  Leu Lys Ser
    1145                1150                1155

Val Lys  Glu Leu Leu Gly Ile  Thr Ile Met Glu Arg  Ser Ser Phe
    1160                1165                1170

Glu Lys  Asn Pro Ile Asp Phe  Leu Glu Ala Lys Gly  Tyr Lys Glu
    1175                1180                1185

Val Arg  Lys Asp Leu Ile Ile  Lys Leu Pro Lys Tyr  Ser Leu Phe
    1190                1195                1200
```

```
Glu Leu  Glu Asn Gly Arg Lys  Arg Met Leu Ala Ser  Ala Gly Glu
    1205                 1210                 1215


Leu Gln  Lys Gly Asn Glu Leu  Ala Leu Pro Ser Lys  Tyr Val Asn
    1220                 1225                 1230


Phe Leu  Tyr Leu Ala Ser His  Tyr Glu Lys Leu Lys  Gly Ser Pro
    1235                 1240                 1245


Glu Asp  Asn Glu Gln Lys Gln  Leu Phe Val Glu Gln  His Lys His
    1250                 1255                 1260


Tyr Leu  Asp Glu Ile Ile Glu  Gln Ile Ser Glu Phe  Ser Lys Arg
    1265                 1270                 1275


Val Ile  Leu Ala Asp Ala Asn  Leu Asp Lys Val Leu  Ser Ala Tyr
    1280                 1285                 1290


Asn Lys  His Arg Asp Lys Pro  Ile Arg Glu Gln Ala  Lys Asn Ile
    1295                 1300                 1305


Ile His  Leu Phe Thr Leu Thr  Asn Leu Gly Ala Pro  Ala Ala Phe
    1310                 1315                 1320


Lys Tyr  Phe Asp Thr Thr Ile  Glu Arg Asn Arg Tyr  Lys Ser Ile
    1325                 1330                 1335


Lys Glu  Val Leu Asp Ala Thr  Leu Ile His Gln Ser  Ile Thr Gly
    1340                 1345                 1350


Leu Tyr  Glu Ile Arg Ile Asp  Leu Ser Gln Leu Gly  Gly Asp
    1355                 1360                 1365
```

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<211> 1056
<212> PRT
<213> Pasteurella multocida

<400> 7

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Met Gln Thr Thr Asn Leu Ser Tyr Ile Leu Gly Leu Asp Leu Gly Ile
1               5                  10                  15

Ala Ser Val Gly Trp Ala Val Val Glu Ile Asn Glu Asn Glu Asp Pro
            20                  25                  30

Ile Gly Leu Ile Asp Val Gly Val Arg Ile Phe Glu Arg Ala Glu Val
        35                  40                  45

Pro Lys Thr Gly Glu Ser Leu Ala Leu Ser Arg Arg Leu Ala Arg Ser
    50                  55                  60

Thr Arg Arg Leu Ile Arg Arg Arg Ala His Arg Leu Leu Leu Ala Lys
65                  70                  75                  80

Arg Phe Leu Lys Arg Glu Gly Ile Leu Ser Thr Ile Asp Leu Glu Lys
                85                  90                  95

Gly Leu Pro Asn Gln Ala Trp Glu Leu Arg Val Ala Gly Leu Glu Arg
            100                 105                 110

Arg Leu Ser Ala Ile Glu Trp Gly Ala Val Leu Leu His Leu Ile Lys
        115                 120                 125

His Arg Gly Tyr Leu Ser Lys Arg Lys Asn Glu Ser Gln Thr Asn Asn
    130                 135                 140

Lys Glu Leu Gly Ala Leu Leu Ser Gly Val Ala Gln Asn His Gln Leu
145                 150                 155                 160

Leu Gln Ser Asp Asp Tyr Arg Thr Pro Ala Glu Leu Ala Leu Lys Lys
                165                 170                 175

Phe Ala Lys Glu Glu Gly His Ile Arg Asn Gln Arg Gly Ala Tyr Thr
            180                 185                 190

His Thr Phe Asn Arg Leu Asp Leu Leu Ala Glu Leu Asn Leu Leu Phe
```

```
        195                 200                 205

Ala Gln Gln His Gln Phe Gly Asn Pro His Cys Lys Glu His Ile Gln
    210                 215                 220

Gln Tyr Met Thr Glu Leu Leu Met Trp Gln Lys Pro Ala Leu Ser Gly
225                 230                 235                 240

Glu Ala Ile Leu Lys Met Leu Gly Lys Cys Thr His Glu Lys Asn Glu
                245                 250                 255

Phe Lys Ala Ala Lys His Thr Tyr Ser Ala Glu Arg Phe Val Trp Leu
            260                 265                 270

Thr Lys Leu Asn Asn Leu Arg Ile Leu Glu Asp Gly Ala Glu Arg Ala
        275                 280                 285

Leu Asn Glu Glu Glu Arg Gln Leu Leu Ile Asn His Pro Tyr Glu Lys
    290                 295                 300

Ser Lys Leu Thr Tyr Ala Gln Val Arg Lys Leu Leu Gly Leu Ser Glu
305                 310                 315                 320

Gln Ala Ile Phe Lys His Leu Arg Tyr Ser Lys Glu Asn Ala Glu Ser
                325                 330                 335

Ala Thr Phe Met Glu Leu Lys Ala Trp His Ala Ile Arg Lys Ala Leu
            340                 345                 350

Glu Asn Gln Gly Leu Lys Asp Thr Trp Gln Asp Leu Ala Lys Lys Pro
        355                 360                 365

Asp Leu Leu Asp Glu Ile Gly Thr Ala Phe Ser Leu Tyr Lys Thr Asp
    370                 375                 380

Glu Asp Ile Gln Gln Tyr Leu Thr Asn Lys Val Pro Asn Ser Val Ile
385                 390                 395                 400
```

```
Asn Ala Leu Leu Val Ser Leu Asn Phe Asp Lys Phe Ile Glu Leu Ser
               405                 410                 415

Leu Lys Ser Leu Arg Lys Ile Leu Pro Leu Met Glu Gln Gly Lys Arg
            420                 425                 430

Tyr Asp Gln Ala Cys Arg Glu Ile Tyr Gly His His Tyr Gly Glu Ala
        435                 440                 445

Asn Gln Lys Thr Ser Gln Leu Leu Pro Ala Ile Pro Ala Gln Glu Ile
    450                 455                 460

Arg Asn Pro Val Val Leu Arg Thr Leu Ser Gln Ala Arg Lys Val Ile
465                 470                 475                 480

Asn Ala Ile Ile Arg Gln Tyr Gly Ser Pro Ala Arg Val His Ile Glu
               485                 490                 495

Thr Gly Arg Glu Leu Gly Lys Ser Phe Lys Glu Arg Arg Glu Ile Gln
            500                 505                 510

Lys Gln Gln Glu Asp Asn Arg Thr Lys Arg Glu Ser Ala Val Gln Lys
        515                 520                 525

Phe Lys Glu Leu Phe Ser Asp Phe Ser Ser Glu Pro Lys Ser Lys Asp
    530                 535                 540

Ile Leu Lys Phe Arg Leu Tyr Glu Gln Gln His Gly Lys Cys Leu Tyr
545                 550                 555                 560

Ser Gly Lys Glu Ile Asn Ile His Arg Leu Asn Glu Lys Gly Tyr Val
               565                 570                 575

Glu Ile Asp His Ala Leu Pro Phe Ser Arg Thr Trp Asp Asp Ser Phe
            580                 585                 590

Asn Asn Lys Val Leu Val Leu Ala Ser Glu Asn Gln Asn Lys Gly Asn
```

```
        595                 600                 605

Gln Thr Pro Tyr Glu Trp Leu Gln Gly Lys Ile Asn Ser Glu Arg Trp
    610                 615                 620

Lys Asn Phe Val Ala Leu Val Leu Gly Ser Gln Cys Ser Ala Ala Lys
625                 630                 635                 640

Lys Gln Arg Leu Leu Thr Gln Val Ile Asp Asp Asn Lys Phe Ile Asp
                645                 650                 655

Arg Asn Leu Asn Asp Thr Arg Tyr Ile Ala Arg Phe Leu Ser Asn Tyr
            660                 665                 670

Ile Gln Glu Asn Leu Leu Leu Val Gly Lys Asn Lys Lys Asn Val Phe
        675                 680                 685

Thr Pro Asn Gly Gln Ile Thr Ala Leu Leu Arg Ser Arg Trp Gly Leu
    690                 695                 700

Ile Lys Ala Arg Glu Asn Asn Asn Arg His His Ala Leu Asp Ala Ile
705                 710                 715                 720

Val Val Ala Cys Ala Thr Pro Ser Met Gln Gln Lys Ile Thr Arg Phe
                725                 730                 735

Ile Arg Phe Lys Glu Val His Pro Tyr Lys Ile Glu Asn Arg Tyr Glu
            740                 745                 750

Met Val Asp Gln Glu Ser Gly Glu Ile Ile Ser Pro His Phe Pro Glu
        755                 760                 765

Pro Trp Ala Tyr Phe Arg Gln Glu Val Asn Ile Arg Val Phe Asp Asn
    770                 775                 780

His Pro Asp Thr Val Leu Lys Glu Met Leu Pro Asp Arg Pro Gln Ala
785                 790                 795                 800
```

```
Asn His Gln Phe Val Gln Pro Leu Phe Val Ser Arg Ala Pro Thr Arg
               805                 810                 815

Lys Met Ser Gly Gln Gly His Met Glu Thr Ile Lys Ser Ala Lys Arg
            820                 825                 830

Leu Ala Glu Gly Ile Ser Val Leu Arg Ile Pro Leu Thr Gln Leu Lys
        835                 840                 845

Pro Asn Leu Leu Glu Asn Met Val Asn Lys Glu Arg Glu Pro Ala Leu
    850                 855                 860

Tyr Ala Gly Leu Lys Ala Arg Leu Ala Glu Phe Asn Gln Asp Pro Ala
865                 870                 875                 880

Lys Ala Phe Ala Thr Pro Phe Tyr Lys Gln Gly Gly Gln Gln Val Lys
               885                 890                 895

Ala Ile Arg Val Glu Gln Val Gln Lys Ser Gly Val Leu Val Arg Glu
            900                 905                 910

Asn Asn Gly Val Ala Asp Asn Ala Ser Ile Val Arg Thr Asp Val Phe
        915                 920                 925

Ile Lys Asn Asn Lys Phe Phe Leu Val Pro Ile Tyr Thr Trp Gln Val
    930                 935                 940

Ala Lys Gly Ile Leu Pro Asn Lys Ala Ile Val Ala His Lys Asn Glu
945                 950                 955                 960

Asp Glu Trp Glu Glu Met Asp Glu Gly Ala Lys Phe Lys Phe Ser Leu
               965                 970                 975

Phe Pro Asn Asp Leu Val Glu Leu Lys Thr Lys Lys Glu Tyr Phe Phe
            980                 985                 990

Gly Tyr Tyr Ile Gly Leu Asp Arg  Ala Thr Gly Asn Ile  Ser Leu Lys
```

995 1000 1005

Glu His Asp Gly Glu Ile Ser Lys Gly Lys Asp Gly Val Tyr Arg
1010 1015 1020

Val Gly Val Lys Leu Ala Leu Ser Phe Glu Lys Tyr Gln Val Asp
1025 1030 1035

Glu Leu Gly Lys Asn Arg Gln Ile Cys Arg Pro Gln Gln Arg Gln
1040 1045 1050

Pro Val Arg
1055

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<212> PRT
<213> Streptococcus pyogenes

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Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Leu
20 25 30

Lys Gly Leu Gly Asn Thr Asp Arg His Gly Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
85 90 95

```
Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Val Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Arg Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Thr Leu Leu Ser Asp
    290                 295                 300
```

```
Ile Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495
```

```
Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700
```

```
Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

Glu Glu Gly Ile Lys Glu Leu Gly Ser Asp Ile Leu Lys Glu Tyr Pro
785                 790                 795                 800

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895
```

```
Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Val Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Arg Val Ile Thr Leu Lys Ser
945                 950                 955                 960

Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020

Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050

Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080

Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095
```

```
Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155

Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170

Phe Glu  Lys Asp Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Arg Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215

Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230

Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245

Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260

His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275
```

```
Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290


Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                1300                1305


Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
    1310                1315                1320


Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1325                1330                1335


Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1340                1345                1350


Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                1360                1365
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<211> 1334
<212> PRT
<213> Listeria innocua

<400> 9

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Met Lys Lys Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Leu Thr Asp Gln Tyr Asp Leu Val Lys Arg Lys Met
            20                  25                  30


Lys Ile Ala Gly Asp Ser Glu Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Ala Asp Arg Arg Met
    50                  55                  60


Ala Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80
```

```
Tyr Leu Gln Gly Ile Phe Ala Glu Glu Met Ser Lys Thr Asp Ala Asn
                85                  90                  95

Phe Phe Cys Arg Leu Ser Asp Ser Phe Tyr Val Asp Asn Glu Lys Arg
            100                 105                 110

Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Glu Tyr
        115                 120                 125

His Lys Asn Tyr Pro Thr Ile Tyr His Leu Arg Glu Glu Leu Val Asn
    130                 135                 140

Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175

Gln Asn Thr Ser Val Asp Gly Ile Tyr Lys Gln Phe Ile Gln Thr Tyr
            180                 185                 190

Asn Gln Val Phe Ala Ser Gly Ile Glu Asp Gly Ser Leu Lys Lys Leu
        195                 200                 205

Glu Asp Asn Lys Asp Val Ala Lys Ile Leu Val Glu Lys Val Thr Arg
    210                 215                 220

Lys Glu Lys Leu Glu Arg Ile Leu Lys Leu Tyr Pro Gly Glu Lys Ser
225                 230                 235                 240

Ala Gly Met Phe Ala Gln Phe Ile Ser Leu Ile Val Gly Ser Lys Gly
                245                 250                 255

Asn Phe Gln Lys Pro Phe Asp Leu Ile Glu Lys Ser Asp Ile Glu Cys
            260                 265                 270

Ala Lys Asp Ser Tyr Glu Glu Asp Leu Glu Ser Leu Leu Ala Leu Ile
```

```
        275                 280                 285

Gly Asp Glu Tyr Ala Glu Leu Phe Val Ala Ala Lys Asn Ala Tyr Ser
    290                 295                 300

Ala Val Val Leu Ser Ser Ile Ile Thr Val Ala Glu Thr Glu Thr Asn
305                 310                 315                 320

Ala Lys Leu Ser Ala Ser Met Ile Glu Arg Phe Asp Thr His Glu Glu
                325                 330                 335

Asp Leu Gly Glu Leu Lys Ala Phe Ile Lys Leu His Leu Pro Lys His
            340                 345                 350

Tyr Glu Glu Ile Phe Ser Asn Thr Glu Lys His Gly Tyr Ala Gly Tyr
        355                 360                 365

Ile Asp Gly Lys Thr Lys Gln Ala Asp Phe Tyr Lys Tyr Met Lys Met
    370                 375                 380

Thr Leu Glu Asn Ile Glu Gly Ala Asp Tyr Phe Ile Ala Lys Ile Glu
385                 390                 395                 400

Lys Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ala Ile
                405                 410                 415

Pro His Gln Leu His Leu Glu Glu Leu Glu Ala Ile Leu His Gln Gln
            420                 425                 430

Ala Lys Tyr Tyr Pro Phe Leu Lys Glu Asn Tyr Asp Lys Ile Lys Ser
        435                 440                 445

Leu Val Thr Phe Arg Ile Pro Tyr Phe Val Gly Pro Leu Ala Asn Gly
    450                 455                 460

Gln Ser Glu Phe Ala Trp Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg
465                 470                 475                 480
```

```
Pro Trp Asn Ile Glu Glu Lys Val Asp Phe Gly Lys Ser Ala Val Asp
               485                 490                 495

Phe Ile Glu Lys Met Thr Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn
            500                 505                 510

Val Leu Pro Lys His Ser Leu Cys Tyr Gln Lys Tyr Leu Val Tyr Asn
        515                 520                 525

Glu Leu Thr Lys Val Arg Tyr Ile Asn Asp Gln Gly Lys Thr Ser Tyr
    530                 535                 540

Phe Ser Gly Gln Glu Lys Glu Gln Ile Phe Asn Asp Leu Phe Lys Gln
545                 550                 555                 560

Lys Arg Lys Val Lys Lys Lys Asp Leu Glu Leu Phe Leu Arg Asn Met
               565                 570                 575

Ser His Val Glu Ser Pro Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn
            580                 585                 590

Ser Ser Tyr Ser Thr Tyr His Asp Leu Leu Lys Val Gly Ile Lys Gln
        595                 600                 605

Glu Ile Leu Asp Asn Pro Val Asn Thr Glu Met Leu Glu Asn Ile Val
    610                 615                 620

Lys Ile Leu Thr Val Phe Glu Asp Lys Arg Met Ile Lys Glu Gln Leu
625                 630                 635                 640

Gln Gln Phe Ser Asp Val Leu Asp Gly Val Val Leu Lys Lys Leu Glu
               645                 650                 655

Arg Arg His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu Met
            660                 665                 670

Gly Ile Arg Asp Lys Gln Ser His Leu Thr Ile Leu Asp Tyr Leu Met
```

```
        675                 680                 685

Asn Asp Asp Gly Leu Asn Arg Asn Leu Met Gln Leu Ile Asn Asp Ser
    690                 695                 700

Asn Leu Ser Phe Lys Ser Ile Ile Glu Lys Glu Gln Val Thr Thr Ala
705                 710                 715                 720

Asp Lys Asp Ile Gln Ser Ile Val Ala Asp Leu Ala Gly Ser Pro Ala
                725                 730                 735

Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val
            740                 745                 750

Ser Val Met Gly Tyr Pro Pro Gln Thr Ile Val Val Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Gly Lys Gly Lys Asn Asn Ser Arg Pro Arg Tyr
    770                 775                 780

Lys Ser Leu Glu Lys Ala Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys
785                 790                 795                 800

Glu His Pro Thr Asp Asn Gln Glu Leu Arg Asn Asn Arg Leu Tyr Leu
                805                 810                 815

Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Gln Asp Leu Asp
            820                 825                 830

Ile His Asn Leu Ser Asn Tyr Asp Ile Asp His Ile Val Pro Gln Ser
        835                 840                 845

Phe Ile Thr Asp Asn Ser Ile Asp Asn Leu Val Leu Thr Ser Ser Ala
    850                 855                 860

Gly Asn Arg Glu Lys Gly Asp Asp Val Pro Pro Leu Glu Ile Val Arg
865                 870                 875                 880
```

```
Lys Arg Lys Val Phe Trp Glu Lys Leu Tyr Gln Gly Asn Leu Met Ser
               885                 890                 895


Lys Arg Lys Phe Asp Tyr Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr
            900                 905                 910


Glu Ala Asp Lys Ala Arg Phe Ile His Arg Gln Leu Val Glu Thr Arg
        915                 920                 925


Gln Ile Thr Lys Asn Val Ala Asn Ile Leu His Gln Arg Phe Asn Tyr
    930                 935                 940


Glu Lys Asp Asp His Gly Asn Thr Met Lys Gln Val Arg Ile Val Thr
945                 950                 955                 960


Leu Lys Ser Ala Leu Val Ser Gln Phe Arg Lys Gln Phe Gln Leu Tyr
               965                 970                 975


Lys Val Arg Asp Val Asn Asp Tyr His His Ala His Asp Ala Tyr Leu
            980                 985                 990


Asn Gly Val Val Ala Asn Thr Leu  Leu Lys Val Tyr Pro  Gln Leu Glu
        995                 1000                1005


Pro Glu  Phe Val Tyr Gly Asp  Tyr His Gln Phe Asp  Trp Phe Lys
    1010                1015                1020


Ala Asn  Lys Ala Thr Ala Lys  Lys Gln Phe Tyr Thr  Asn Ile Met
    1025                1030                1035


Leu Phe  Phe Ala Gln Lys Asp  Arg Ile Ile Asp Glu  Asn Gly Glu
    1040                1045                1050


Ile Leu  Trp Asp Lys Lys Tyr  Leu Asp Thr Val Lys  Lys Val Met
    1055                1060                1065


Ser Tyr  Arg Gln Met Asn Ile  Val Lys Lys Thr Glu  Ile Gln Lys
```

```
    1070                1075                1080

Gly Glu  Phe Ser Lys Ala Thr  Ile Lys Pro Lys Gly  Asn Ser Ser
    1085                1090                1095

Lys Leu  Ile Pro Arg Lys Thr  Asn Trp Asp Pro Met  Lys Tyr Gly
    1100                1105                1110

Gly Leu  Asp Ser Pro Asn Met  Ala Tyr Ala Val Val  Ile Glu Tyr
    1115                1120                1125

Ala Lys  Gly Lys Asn Lys Leu  Val Phe Glu Lys Lys  Ile Ile Arg
    1130                1135                1140

Val Thr  Ile Met Glu Arg Lys  Ala Phe Glu Lys Asp  Glu Lys Ala
    1145                1150                1155

Phe Leu  Glu Glu Gln Gly Tyr  Arg Gln Pro Lys Val  Leu Ala Lys
    1160                1165                1170

Leu Pro  Lys Tyr Thr Leu Tyr  Glu Cys Glu Glu Gly  Arg Arg Arg
    1175                1180                1185

Met Leu  Ala Ser Ala Asn Glu  Ala Gln Lys Gly Asn  Gln Gln Val
    1190                1195                1200

Leu Pro  Asn His Leu Val Thr  Leu Leu His His Ala  Ala Asn Cys
    1205                1210                1215

Glu Val  Ser Asp Gly Lys Ser  Leu Asp Tyr Ile Glu  Ser Asn Arg
    1220                1225                1230

Glu Met  Phe Ala Glu Leu Leu  Ala His Val Ser Glu  Phe Ala Lys
    1235                1240                1245

Arg Tyr  Thr Leu Ala Glu Ala  Asn Leu Asn Lys Ile  Asn Gln Leu
    1250                1255                1260
```

```
Phe Glu  Gln Asn Lys Glu Gly  Asp Ile Lys Ala Ile  Ala Gln Ser
    1265                1270                1275


Phe Val  Asp Leu Met Ala Phe  Asn Ala Met Gly Ala  Pro Ala Ser
    1280                1285                1290


Phe Lys  Phe Phe Glu Thr Thr  Ile Glu Arg Lys Arg  Tyr Asn Asn
    1295                1300                1305


Leu Lys  Glu Leu Leu Asn Ser  Thr Ile Ile Tyr Gln  Ser Ile Thr
    1310                1315                1320


Gly Leu  Tyr Glu Ser Arg Lys  Arg Leu Asp Asp
    1325                1330


<210>  10
<211>  1368
<212>  PRT
<213>  Streptococcus pyogenes

<400>  10

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Leu
            20                  25                  30


Lys Gly Leu Gly Asn Thr Asp Arg His Gly Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95
```

```
Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Val Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Arg Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285
```

```
Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Thr Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495
```

```
Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685
```

```
Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

Glu Glu Gly Ile Lys Glu Leu Gly Ser Asp Ile Leu Lys Glu Tyr Pro
785                 790                 795                 800

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895
```

```
Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Val Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Arg Val Ile Thr Leu Lys Ser
945                 950                 955                 960

Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020

Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050

Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080
```

```
Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155

Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170

Phe Glu  Lys Asp Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Arg Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215

Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230

Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245

Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260

His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275
```

```
Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290


Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                1300                1305


Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
    1310                1315                1320


Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1325                1330                1335


Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1340                1345                1350


Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                1360                1365
```

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<211> 1370
<212> PRT
<213> Streptococcus agalactiae

<400> 11

```
Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
```

```
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270
```

```
Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
```

```
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670
```

```
Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asp Leu Asn Gly Asn Ile
785                 790                 795                 800

Leu Lys Glu Tyr Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu
                805                 810                 815

Phe Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala
            820                 825                 830

Leu Asp Ile Asp Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro
        835                 840                 845

Gln Ala Phe Ile Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser
    850                 855                 860

Ser Ala Lys Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile
```

```
865                 870                 875                 880

Val Lys Asp Cys Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu
                885                 890                 895

Met Ser Gln Arg Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly
            900                 905                 910

Leu Thr Ser Asp Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu
        915                 920                 925

Thr Arg Gln Ile Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe
    930                 935                 940

Asn Asn Glu Leu Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile
945                 950                 955                 960

Val Thr Leu Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly
                965                 970                 975

Phe Tyr Lys Ile Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala
            980                 985                 990

Tyr Leu Asn Ala Val Val Ala Lys  Ala Ile Leu Thr Lys  Tyr Pro Gln
        995                 1000                1005

Leu Glu  Pro Glu Phe Val Tyr  Gly Asp Tyr Pro Lys  Tyr Asn Ser
    1010                1015                1020

Tyr Lys  Thr Arg Lys Ser Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser
    1025                1030                1035

Asn Ile  Met Asn Phe Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly
    1040                1045                1050

Thr Val  Val Val Lys Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly
    1055                1060                1065
```

```
Glu Ile  Val Trp Asp Lys Lys  Lys His Phe Ala Thr  Val Arg Lys
    1070                1075                1080

Val Leu  Ser Tyr Pro Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile
    1085                1090                1095

Gln Thr  Gly Gly Phe Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn
    1100                1105                1110

Ser Asp  Lys Leu Ile Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp
    1115                1120                1125

Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser
    1130                1135                1140

Val Leu  Val Val Ala Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu
    1145                1150                1155

Lys Thr  Val Thr Glu Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser
    1160                1165                1170

Arg Phe  Glu Lys Asn Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr
    1175                1180                1185

Leu Asn  Ile Arg Ala Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser
    1190                1195                1200

Leu Phe  Glu Leu Glu Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala
    1205                1210                1215

Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe
    1220                1225                1230

Met Lys  Phe Leu Tyr Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly
    1235                1240                1245

Lys Pro  Glu Glu Ile Glu Lys  Lys Gln Glu Phe Val  Asn Gln His
```

```
    1250                1255                1260

Val Ser  Tyr Phe Asp Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser
    1265                1270                1275

Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys
    1280                1285                1290

Leu Tyr  Gln Asp Asn Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala
    1295                1300                1305

Asn Asn  Ile Ile Asn Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro
    1310                1315                1320

Ala Ala  Phe Lys Phe Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr
    1325                1330                1335

Thr Ser  Thr Lys Glu Val Leu  Asn Ser Thr Leu Ile  His Gln Ser
    1340                1345                1350

Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly
    1355                1360                1365

Glu Asp
    1370
```

<210> 12
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<212> PRT
<213> Streptococcus mutans

<400> 12

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30
```

```
Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240
```

```
Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
               245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Gly Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
               325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
               405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430
```

```
Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Leu Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640
```

```
Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830
```

```
Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035
```

```
Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215
```

```
Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                 1225                 1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                 1240                 1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                 1255                 1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                 1270                 1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                 1285                 1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                 1300                 1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                 1315                 1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                 1330                 1335


Leu Asn  Lys Leu Gly Gly Asp
    1340                 1345


<210>  13
<211>  1377
<212>  PRT
<213>  Streptococcus agalactiae

<400>  13

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30
```

```
Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Tyr Tyr
        115                 120                 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Arg Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn His Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
```

```
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Val Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His His Glu Asp Leu Lys His Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Asn Tyr Arg Glu Val Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Leu Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Arg Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430
```

```
Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Phe Leu Ala Glu Gly Phe Lys Asp Phe Gln Phe Leu Asn Arg Lys
    530                 535                 540

Gln Lys Glu Thr Ile Phe Asn Ser Leu Phe Lys Glu Lys Arg Lys Val
545                 550                 555                 560

Thr Glu Lys Asp Ile Ile Ser Phe Leu Asn Lys Val Asp Gly Tyr Glu
                565                 570                 575

Gly Ile Ala Ile Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser
            580                 585                 590

Thr Tyr His Asp Leu Lys Lys Ile Leu Gly Lys Asp Phe Leu Asp Asn
        595                 600                 605

Thr Asp Asn Glu Leu Ile Leu Glu Asp Ile Val Gln Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Lys Lys Cys Leu Asp Ile Tyr Lys Asp
```

625 630 635 640

Phe Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg His Tyr Thr
645 650 655

Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asn Lys
660 665 670

Glu Asn Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Ser Ala
675 680 685

Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Asp Leu Ser Phe Lys
690 695 700

Pro Ile Ile Asp Lys Ala Arg Thr Gly Ser His Ser Asp Asn Leu Lys
705 710 715 720

Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
725 730 735

Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val Met Gly Tyr
740 745 750

Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr
755 760 765

Ala Lys Gly Leu Ser Arg Ser Arg Gln Arg Leu Thr Thr Leu Arg Glu
770 775 780

Ser Leu Ala Asn Leu Lys Ser Asn Ile Leu Glu Glu Lys Lys Pro Lys
785 790 795 800

Tyr Val Lys Asp Gln Val Glu Asn His His Leu Ser Asp Asp Arg Leu
805 810 815

Phe Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Lys Lys Ala
820 825 830

```
Leu Asp Ile Asp Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro
        835                 840                 845

Gln Ala Phe Ile Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser
    850                 855                 860

Ser Ala Lys Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Ile Glu Ile
865                 870                 875                 880

Val Lys Ala Arg Lys Met Phe Trp Lys Asn Leu Leu Asp Ala Lys Leu
                885                 890                 895

Met Ser Gln Arg Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly
            900                 905                 910

Leu Thr Ser Asp Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu
        915                 920                 925

Thr Arg Gln Ile Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe
    930                 935                 940

Asn Asn Glu Val Asp Asn Gly Lys Lys Ile Cys Lys Val Lys Ile Val
945                 950                 955                 960

Thr Leu Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe
                965                 970                 975

Tyr Lys Ile Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala Tyr
            980                 985                 990

Leu Asn Ala Val Val Ala Lys Ala  Ile Leu Thr Lys Tyr  Pro Gln Leu
        995                 1000                1005

Glu Pro  Glu Phe Val Tyr Gly  Met Tyr Arg Gln Lys  Lys Leu Ser
    1010                1015                1020

Lys Ile  Val His Glu Asp Lys  Glu Glu Lys Tyr Ser  Glu Ala Thr
```

```
    1025                1030                1035

Arg Lys  Met Phe Phe Tyr Ser  Asn Leu Met Asn Met  Phe Lys Arg
    1040                1045                1050

Val Val  Arg Leu Ala Asp Gly  Ser Ile Val Val Arg  Pro Val Ile
    1055                1060                1065

Glu Thr  Gly Arg Tyr Met Arg  Lys Thr Ala Trp Asp  Lys Lys Lys
    1070                1075                1080

His Phe  Ala Thr Val Arg Lys  Val Leu Ser Tyr Pro  Gln Asn Asn
    1085                1090                1095

Ile Val  Lys Lys Thr Glu Ile  Gln Thr Gly Gly Phe  Ser Lys Glu
    1100                1105                1110

Ser Ile  Leu Ala His Gly Asn  Ser Asp Lys Leu Ile  Pro Arg Lys
    1115                1120                1125

Thr Lys  Asp Ile Tyr Leu Asp  Pro Lys Lys Tyr Gly  Gly Phe Asp
    1130                1135                1140

Ser Pro  Ile Val Ala Tyr Ser  Val Leu Val Val Ala  Asp Ile Lys
    1145                1150                1155

Lys Gly  Lys Ala Gln Lys Leu  Lys Thr Val Thr Glu  Leu Leu Gly
    1160                1165                1170

Ile Thr  Ile Met Glu Arg Ser  Arg Phe Glu Lys Asn  Pro Ser Ala
    1175                1180                1185

Phe Leu  Glu Ser Lys Gly Tyr  Leu Asn Ile Arg Asp  Asp Lys Leu
    1190                1195                1200

Met Ile  Leu Pro Lys Tyr Ser  Leu Phe Glu Leu Glu  Asn Gly Arg
    1205                1210                1215
```

```
Arg Arg  Leu Leu Ala Ser Ala  Gly Glu Leu Gln Lys  Gly Asn Glu
    1220                1225                1230

Leu Ala  Leu Pro Thr Gln Phe  Met Lys Phe Leu Tyr  Leu Ala Ser
    1235                1240                1245

Arg Tyr  Asn Glu Ser Lys Gly  Lys Pro Glu Glu Ile  Glu Lys Lys
    1250                1255                1260

Gln Glu  Phe Val Asn Gln His  Val Ser Tyr Phe Asp  Asp Ile Leu
    1265                1270                1275

Gln Leu  Ile Asn Asp Phe Ser  Lys Arg Val Ile Leu  Ala Asp Ala
    1280                1285                1290

Asn Leu  Glu Lys Ile Asn Lys  Leu Tyr Gln Asp Asn  Lys Glu Asn
    1295                1300                1305

Ile Pro  Val Asp Glu Leu Ala  Asn Asn Ile Ile Asn  Leu Phe Thr
    1310                1315                1320

Phe Thr  Ser Leu Gly Ala Pro  Ala Ala Phe Lys Phe  Phe Asp Lys
    1325                1330                1335

Ile Val  Asp Arg Lys Arg Tyr  Thr Ser Thr Lys Glu  Val Leu Asn
    1340                1345                1350

Ser Thr  Leu Ile His Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg
    1355                1360                1365

Ile Asp  Leu Gly Lys Leu Gly  Glu Asp
    1370                1375
```

<210> 14
<211> 131
<212> PRT
<213> Helicobacter hepaticus

<400> 14

Met Arg Ile Leu Gly Phe Asp Ile Gly Ile Thr Ser Ile Gly Trp Ala
1 5 10 15

Tyr Val Glu Ser Asn Glu Leu Lys Asp Cys Gly Val Arg Ile Phe Thr
20 25 30

Lys Ala Glu Asn Pro Lys Asn Gly Asp Ser Leu Ala Ala Pro Arg Arg
35 40 45

Glu Ala Arg Gly Ala Arg Arg Arg Leu Ala Arg Arg Lys Ala Arg Leu
50 55 60

Asn Ala Ile Lys Arg Leu Leu Cys Lys Glu Phe Glu Leu Asn Leu Asn
65 70 75 80

Asp Tyr Leu Ala Asn Asp Gly Glu Leu Pro Lys Ala Tyr Gln Thr Ser
85 90 95

Lys Asp Thr Lys Ser Pro Tyr Glu Leu Tyr Thr Ala Phe His Trp Ile
100 105 110

Ile Phe Ala Phe Cys Ser Ile Ala Ser Ser Leu Ser Asn Arg Gln Met
115 120 125

Leu Pro Ile
130

<210> 15
<211> 1059
<212> PRT
<213> Wolinella succinogenes

<400> 15

Met Ile Glu Arg Ile Leu Gly Val Asp Leu Gly Ile Ser Ser Leu Gly
1 5 10 15

Trp Ala Ile Val Glu Tyr Asp Lys Asp Asp Glu Ala Ala Asn Arg Ile

```
            20                  25                  30

Ile Asp Cys Gly Val Arg Leu Phe Thr Ala Ala Glu Thr Pro Lys Lys
        35                  40                  45

Lys Glu Ser Pro Asn Lys Ala Arg Arg Glu Ala Arg Gly Ile Arg Arg
    50                  55                  60

Val Leu Asn Arg Arg Arg Val Arg Met Asn Met Ile Lys Lys Leu Phe
65                  70                  75                  80

Leu Arg Ala Gly Leu Ile Gln Asp Val Asp Leu Asp Gly Glu Gly Gly
                85                  90                  95

Met Phe Tyr Ser Lys Ala Asn Arg Ala Asp Val Trp Glu Leu Arg His
            100                 105                 110

Asp Gly Leu Tyr Arg Leu Leu Lys Gly Asp Glu Leu Ala Arg Val Leu
        115                 120                 125

Ile His Ile Ala Lys His Arg Gly Tyr Lys Phe Ile Gly Asp Asp Glu
    130                 135                 140

Ala Asp Glu Glu Ser Gly Lys Val Lys Lys Ala Gly Val Val Leu Arg
145                 150                 155                 160

Gln Asn Phe Glu Ala Ala Gly Cys Arg Thr Val Gly Glu Trp Leu Trp
                165                 170                 175

Arg Glu Arg Gly Ala Asn Gly Lys Lys Arg Asn Lys His Gly Asp Tyr
            180                 185                 190

Glu Ile Ser Ile His Arg Asp Leu Leu Val Glu Glu Val Glu Ala Ile
        195                 200                 205

Phe Val Ala Gln Gln Glu Met Arg Ser Thr Ile Ala Thr Asp Ala Leu
    210                 215                 220
```

```
Lys Ala Ala Tyr Arg Glu Ile Ala Phe Phe Val Arg Pro Met Gln Arg
225                 230                 235                 240

Ile Glu Lys Met Val Gly His Cys Thr Tyr Phe Pro Glu Glu Arg Arg
                245                 250                 255

Ala Pro Lys Ser Ala Pro Thr Ala Glu Lys Phe Ile Ala Ile Ser Lys
            260                 265                 270

Phe Phe Ser Thr Val Ile Ile Asp Asn Glu Gly Trp Glu Gln Lys Ile
        275                 280                 285

Ile Glu Arg Lys Thr Leu Glu Glu Leu Leu Asp Phe Ala Val Ser Arg
    290                 295                 300

Glu Lys Val Glu Phe Arg His Leu Arg Lys Phe Leu Asp Leu Ser Asp
305                 310                 315                 320

Asn Glu Ile Phe Lys Gly Leu His Tyr Lys Gly Lys Pro Lys Thr Ala
                325                 330                 335

Lys Lys Arg Glu Ala Thr Leu Phe Asp Pro Asn Glu Pro Thr Glu Leu
            340                 345                 350

Glu Phe Asp Lys Val Glu Ala Glu Lys Lys Ala Trp Ile Ser Leu Arg
        355                 360                 365

Gly Ala Ala Lys Leu Arg Glu Ala Leu Gly Asn Glu Phe Tyr Gly Arg
    370                 375                 380

Phe Val Ala Leu Gly Lys His Ala Asp Glu Ala Thr Lys Ile Leu Thr
385                 390                 395                 400

Tyr Tyr Lys Asp Glu Gly Gln Lys Arg Arg Glu Leu Thr Lys Leu Pro
                405                 410                 415

Leu Glu Ala Glu Met Val Glu Arg Leu Val Lys Ile Gly Phe Ser Asp
```

```
            420                 425                 430

Phe Leu Lys Leu Ser Leu Lys Ala Ile Arg Asp Ile Leu Pro Ala Met
        435                 440                 445

Glu Ser Gly Ala Arg Tyr Asp Glu Ala Val Leu Met Leu Gly Val Pro
    450                 455                 460

His Lys Glu Lys Ser Ala Ile Leu Pro Pro Leu Asn Lys Thr Asp Ile
465                 470                 475                 480

Asp Ile Leu Asn Pro Thr Val Ile Arg Ala Phe Ala Gln Phe Arg Lys
                485                 490                 495

Val Ala Asn Ala Leu Val Arg Lys Tyr Gly Ala Phe Asp Arg Val His
            500                 505                 510

Phe Glu Leu Ala Arg Glu Ile Asn Thr Lys Gly Glu Ile Glu Asp Ile
        515                 520                 525

Lys Glu Ser Gln Arg Lys Asn Glu Lys Glu Arg Lys Glu Ala Ala Asp
    530                 535                 540

Trp Ile Ala Glu Thr Ser Phe Gln Val Pro Leu Thr Arg Lys Asn Ile
545                 550                 555                 560

Leu Lys Lys Arg Leu Tyr Ile Gln Gln Asp Gly Arg Cys Ala Tyr Thr
                565                 570                 575

Gly Asp Val Ile Glu Leu Glu Arg Leu Phe Asp Glu Gly Tyr Cys Glu
            580                 585                 590

Ile Asp His Ile Leu Pro Arg Ser Arg Ser Ala Asp Asp Ser Phe Ala
        595                 600                 605

Asn Lys Val Leu Cys Leu Ala Arg Ala Asn Gln Gln Lys Thr Asp Arg
    610                 615                 620
```

```
Thr Pro Tyr Glu Trp Phe Gly His Asp Ala Ala Arg Trp Asn Ala Phe
625                 630                 635                 640

Glu Thr Arg Thr Ser Ala Pro Ser Asn Arg Val Arg Thr Gly Lys Gly
                645                 650                 655

Lys Ile Asp Arg Leu Leu Lys Lys Asn Phe Asp Glu Asn Ser Glu Met
            660                 665                 670

Ala Phe Lys Asp Arg Asn Leu Asn Asp Thr Arg Tyr Met Ala Arg Ala
        675                 680                 685

Ile Lys Thr Tyr Cys Glu Gln Tyr Trp Val Phe Lys Asn Ser His Thr
    690                 695                 700

Lys Ala Pro Val Gln Val Arg Ser Gly Lys Leu Thr Ser Val Leu Arg
705                 710                 715                 720

Tyr Gln Trp Gly Leu Glu Ser Lys Asp Arg Glu Ser His Thr His His
                725                 730                 735

Ala Val Asp Ala Ile Ile Ile Ala Phe Ser Thr Gln Gly Met Val Gln
            740                 745                 750

Lys Leu Ser Glu Tyr Tyr Arg Phe Lys Glu Thr His Arg Glu Lys Glu
        755                 760                 765

Arg Pro Lys Leu Ala Val Pro Leu Ala Asn Phe Arg Asp Ala Val Glu
    770                 775                 780

Glu Ala Thr Arg Ile Glu Asn Thr Glu Thr Val Lys Glu Gly Val Glu
785                 790                 795                 800

Val Lys Arg Leu Leu Ile Ser Arg Pro Pro Arg Ala Arg Val Thr Gly
                805                 810                 815

Gln Ala His Glu Gln Thr Ala Lys Pro Tyr Pro Arg Ile Lys Gln Val
```

```
            820                 825                 830

Lys Asn Lys Lys Lys Trp Arg Leu Ala Pro Ile Asp Glu Glu Lys Phe
        835                 840                 845

Glu Ser Phe Lys Ala Asp Arg Val Ala Ser Ala Asn Gln Lys Asn Phe
    850                 855                 860

Tyr Glu Thr Ser Thr Ile Pro Arg Val Asp Val Tyr His Lys Lys Gly
865                 870                 875                 880

Lys Phe His Leu Val Pro Ile Tyr Leu His Glu Met Val Leu Asn Glu
                885                 890                 895

Leu Pro Asn Leu Ser Leu Gly Thr Asn Pro Glu Ala Met Asp Glu Asn
            900                 905                 910

Phe Phe Lys Phe Ser Ile Phe Lys Asp Asp Leu Ile Ser Ile Gln Thr
        915                 920                 925

Gln Gly Thr Pro Lys Lys Pro Ala Lys Ile Ile Met Gly Tyr Phe Lys
    930                 935                 940

Asn Met His Gly Ala Asn Met Val Leu Ser Ser Ile Asn Asn Ser Pro
945                 950                 955                 960

Cys Glu Gly Phe Thr Cys Thr Pro Val Ser Met Asp Lys Lys His Lys
                965                 970                 975

Asp Lys Cys Lys Leu Cys Pro Glu Glu Asn Arg Ile Ala Gly Arg Cys
            980                 985                 990

Leu Gln Gly Phe Leu Asp Tyr Trp  Ser Gln Glu Gly Leu  Arg Pro Pro
        995                 1000                1005

Arg Lys  Glu Phe Glu Cys Asp  Gln Gly Val Lys Phe  Ala Leu Asp
    1010                1015                1020
```

```
Val Lys  Lys Tyr Gln Ile Asp  Pro Leu Gly Tyr Tyr  Tyr Glu Val
    1025                1030                1035


Lys Gln  Glu Lys Arg Leu Gly  Thr Ile Pro Gln Met  Arg Ser Ala
    1040                1045                1050


Lys Lys  Leu Val Lys Lys
    1055
```

<210> 16
<211> 1409
<212> PRT
<213> Wolinella succinogenes

<400> 16

```
Met Leu Val Ser Pro Ile Ser Val Asp Leu Gly Gly Lys Asn Thr Gly
1               5                  10                  15


Phe Phe Ser Phe Thr Asp Ser Leu Asp Asn Ser Gln Ser Gly Thr Val
            20                  25                  30


Ile Tyr Asp Glu Ser Phe Val Leu Ser Gln Val Gly Arg Arg Ser Lys
        35                  40                  45


Arg His Ser Lys Arg Asn Asn Leu Arg Asn Lys Leu Val Lys Arg Leu
    50                  55                  60


Phe Leu Leu Ile Leu Gln Glu His His Gly Leu Ser Ile Asp Val Leu
65                  70                  75                  80


Pro Asp Glu Ile Arg Gly Leu Phe Asn Lys Arg Gly Tyr Thr Tyr Ala
                85                  90                  95


Gly Phe Glu Leu Asp Glu Lys Lys Lys Asp Ala Leu Glu Ser Asp Thr
            100                 105                 110


Leu Lys Glu Phe Leu Ser Glu Lys Leu Gln Ser Ile Asp Arg Asp Ser
        115                 120                 125
```

```
Asp Val Glu Asp Phe Leu Asn Gln Ile Ala Ser Asn Ala Glu Ser Phe
    130                 135                 140

Lys Asp Tyr Lys Lys Gly Phe Glu Ala Val Phe Ala Ser Ala Thr His
145                 150                 155                 160

Ser Pro Asn Lys Lys Leu Glu Leu Lys Asp Glu Leu Lys Ser Glu Tyr
                165                 170                 175

Gly Glu Asn Ala Lys Glu Leu Leu Ala Gly Leu Arg Val Thr Lys Glu
            180                 185                 190

Ile Leu Asp Glu Phe Asp Lys Gln Glu Asn Gln Gly Asn Leu Pro Arg
        195                 200                 205

Ala Lys Tyr Phe Glu Glu Leu Gly Glu Tyr Ile Ala Thr Asn Glu Lys
    210                 215                 220

Val Lys Ser Phe Phe Asp Ser Asn Ser Leu Lys Leu Thr Asp Met Thr
225                 230                 235                 240

Lys Leu Ile Gly Asn Ile Ser Asn Tyr Gln Leu Lys Glu Leu Arg Arg
                245                 250                 255

Tyr Phe Asn Asp Lys Glu Met Glu Lys Gly Asp Ile Trp Ile Pro Asn
            260                 265                 270

Lys Leu His Lys Ile Thr Glu Arg Phe Val Arg Ser Trp His Pro Lys
        275                 280                 285

Asn Asp Ala Asp Arg Gln Arg Arg Ala Glu Leu Met Lys Asp Leu Lys
    290                 295                 300

Ser Lys Glu Ile Met Glu Leu Leu Thr Thr Thr Glu Pro Val Met Thr
305                 310                 315                 320
```

```
Ile Pro Pro Tyr Asp Asp Met Asn Asn Arg Gly Ala Val Lys Cys Gln
                325                 330                 335

Thr Leu Arg Leu Asn Glu Glu Tyr Leu Asp Lys His Leu Pro Asn Trp
            340                 345                 350

Arg Asp Ile Ala Lys Arg Leu Asn His Gly Lys Phe Asn Asp Asp Leu
        355                 360                 365

Ala Asp Ser Thr Val Lys Gly Tyr Ser Glu Asp Ser Thr Leu Leu His
    370                 375                 380

Arg Leu Leu Asp Thr Ser Lys Glu Ile Asp Ile Tyr Glu Leu Arg Gly
385                 390                 395                 400

Lys Lys Pro Asn Glu Leu Leu Val Lys Thr Leu Gly Gln Ser Asp Ala
                405                 410                 415

Asn Arg Leu Tyr Gly Phe Ala Gln Asn Tyr Tyr Glu Leu Ile Arg Gln
            420                 425                 430

Lys Val Arg Ala Gly Ile Trp Val Pro Val Lys Asn Lys Asp Asp Ser
        435                 440                 445

Leu Asn Leu Glu Asp Asn Ser Asn Met Leu Lys Arg Cys Asn His Asn
    450                 455                 460

Pro Pro His Lys Lys Asn Gln Ile His Asn Leu Val Ala Gly Ile Leu
465                 470                 475                 480

Gly Val Lys Leu Asp Glu Ala Lys Phe Ala Glu Phe Glu Lys Glu Leu
                485                 490                 495

Trp Ser Ala Lys Val Gly Asn Lys Lys Leu Ser Ala Tyr Cys Lys Asn
            500                 505                 510

Ile Glu Glu Leu Arg Lys Thr His Gly Asn Thr Phe Lys Ile Asp Ile
        515                 520                 525
```

```
Glu Glu Leu Arg Lys Lys Asp Pro Ala Glu Leu Ser Lys Glu Glu Lys
    530                 535                 540

Ala Lys Leu Arg Leu Thr Asp Asp Val Ile Leu Asn Glu Trp Ser Gln
545                 550                 555                 560

Lys Ile Ala Asn Phe Phe Asp Ile Asp Asp Lys His Arg Gln Arg Phe
                565                 570                 575

Asn Asn Leu Phe Ser Met Ala Gln Leu His Thr Val Ile Asp Thr Pro
            580                 585                 590

Arg Ser Gly Phe Ser Ser Thr Cys Lys Arg Cys Thr Ala Glu Asn Arg
        595                 600                 605

Phe Arg Ser Glu Thr Ala Phe Tyr Asn Asp Glu Thr Gly Glu Phe His
    610                 615                 620

Lys Lys Ala Thr Ala Thr Cys Gln Arg Leu Pro Ala Asp Thr Gln Arg
625                 630                 635                 640

Pro Phe Ser Gly Lys Ile Glu Arg Tyr Ile Asp Lys Leu Gly Tyr Glu
                645                 650                 655

Leu Ala Lys Ile Lys Ala Lys Glu Leu Glu Gly Met Glu Ala Lys Glu
            660                 665                 670

Ile Lys Val Pro Ile Ile Leu Glu Gln Asn Ala Phe Glu Tyr Glu Glu
        675                 680                 685

Ser Leu Arg Lys Ser Lys Thr Gly Ser Asn Asp Arg Val Ile Asn Ser
    690                 695                 700

Lys Lys Asp Arg Asp Gly Lys Lys Leu Ala Lys Ala Lys Glu Asn Ala
705                 710                 715                 720
```

```
Glu Asp Arg Leu Lys Asp Lys Asp Lys Arg Ile Lys Ala Phe Ser Ser
                725                 730                 735

Gly Ile Cys Pro Tyr Cys Gly Asp Thr Ile Gly Asp Asp Gly Glu Ile
            740                 745                 750

Asp His Ile Leu Pro Arg Ser His Thr Leu Lys Ile Tyr Gly Thr Val
        755                 760                 765

Phe Asn Pro Glu Gly Asn Leu Ile Tyr Val His Gln Lys Cys Asn Gln
    770                 775                 780

Ala Lys Ala Asp Ser Ile Tyr Lys Leu Ser Asp Ile Lys Ala Gly Val
785                 790                 795                 800

Ser Ala Gln Trp Ile Glu Glu Gln Val Ala Asn Ile Lys Gly Tyr Lys
                805                 810                 815

Thr Phe Ser Val Leu Ser Ala Glu Gln Gln Lys Ala Phe Arg Tyr Ala
            820                 825                 830

Leu Phe Leu Gln Asn Asp Asn Glu Ala Tyr Lys Lys Val Val Asp Trp
        835                 840                 845

Leu Arg Thr Asp Gln Ser Ala Arg Val Asn Gly Thr Gln Lys Tyr Leu
    850                 855                 860

Ala Lys Lys Ile Gln Glu Lys Leu Thr Lys Met Leu Pro Asn Lys His
865                 870                 875                 880

Leu Ser Phe Glu Phe Ile Leu Ala Asp Ala Thr Glu Val Ser Glu Leu
                885                 890                 895

Arg Arg Gln Tyr Ala Arg Gln Asn Pro Leu Leu Ala Lys Ala Glu Lys
            900                 905                 910

Gln Ala Pro Ser Ser His Ala Ile Asp Ala Val Met Ala Phe Val Ala
        915                 920                 925
```

```
Arg Tyr Gln Lys Val Phe Lys Asp Gly Thr Pro Pro Asn Ala Asp Glu
    930                 935                 940

Val Ala Lys Leu Ala Met Leu Asp Ser Trp Asn Pro Ala Ser Asn Glu
945                 950                 955                 960

Pro Leu Thr Lys Gly Leu Ser Thr Asn Gln Lys Ile Glu Lys Met Ile
                965                 970                 975

Lys Ser Gly Asp Tyr Gly Gln Lys Asn Met Arg Glu Val Phe Gly Lys
            980                 985                 990

Ser Ile Phe Gly Glu Asn Ala Ile  Gly Glu Arg Tyr Lys  Pro Ile Val
        995                 1000                1005

Val Gln  Glu Gly Gly Tyr Tyr  Ile Gly Tyr Pro Ala  Thr Val Lys
    1010                1015                1020

Lys Gly  Tyr Glu Leu Lys Asn  Cys Lys Val Val Thr  Ser Lys Asn
    1025                1030                1035

Asp Ile  Ala Lys Leu Glu Lys  Ile Ile Lys Asn Gln  Asp Leu Ile
    1040                1045                1050

Ser Leu  Lys Glu Asn Gln Tyr  Ile Lys Ile Phe Ser  Ile Asn Lys
    1055                1060                1065

Gln Thr  Ile Ser Glu Leu Ser  Asn Arg Tyr Phe Asn  Met Asn Tyr
    1070                1075                1080

Lys Asn  Leu Val Glu Arg Asp  Lys Glu Ile Val Gly  Leu Leu Glu
    1085                1090                1095

Phe Ile  Val Glu Asn Cys Arg  Tyr Tyr Thr Lys Lys  Val Asp Val
    1100                1105                1110
```

```
Lys Phe  Ala Pro Lys Tyr Ile  His Glu Thr Lys Tyr  Pro Phe Tyr
    1115                1120                1125

Asp Asp  Trp Arg Arg Phe Asp  Glu Ala Trp Arg Tyr  Leu Gln Glu
    1130                1135                1140

Asn Gln  Asn Lys Thr Ser Ser  Lys Asp Arg Phe Val  Ile Asp Lys
    1145                1150                1155

Ser Ser  Leu Asn Glu Tyr Tyr  Gln Pro Asp Lys Asn  Glu Tyr Lys
    1160                1165                1170

Leu Asp  Val Asp Thr Gln Pro  Ile Trp Asp Asp Phe  Cys Arg Trp
    1175                1180                1185

Tyr Phe  Leu Asp Arg Tyr Lys  Thr Ala Asn Asp Lys  Lys Ser Ile
    1190                1195                1200

Arg Ile  Lys Ala Arg Lys Thr  Phe Ser Leu Leu Ala  Glu Ser Gly
    1205                1210                1215

Val Gln  Gly Lys Val Phe Arg  Ala Lys Arg Lys Ile  Pro Thr Gly
    1220                1225                1230

Tyr Ala  Tyr Gln Ala Leu Pro  Met Asp Asn Asn Val  Ile Ala Gly
    1235                1240                1245

Asp Tyr  Ala Asn Ile Leu Leu  Glu Ala Asn Ser Lys  Thr Leu Ser
    1250                1255                1260

Leu Val  Pro Lys Ser Gly Ile  Ser Ile Glu Lys Gln  Leu Asp Lys
    1265                1270                1275

Lys Leu  Asp Val Ile Lys Lys  Thr Asp Val Arg Gly  Leu Ala Ile
    1280                1285                1290

Asp Asn  Asn Ser Phe Phe Asn  Ala Asp Phe Asp Thr  His Gly Ile
    1295                1300                1305
```

```
Arg Leu  Ile Val Glu Asn Thr  Ser Val Lys Val Gly  Asn Phe Pro
    1310                1315                1320


Ile Ser  Ala Ile Asp Lys Ser  Ala Lys Arg Met Ile  Phe Arg Ala
    1325                1330                1335


Leu Phe  Glu Lys Glu Lys Gly  Lys Arg Lys Lys Lys  Thr Thr Ile
    1340                1345                1350


Ser Phe  Lys Glu Ser Gly Pro  Val Gln Asp Tyr Leu  Lys Val Phe
    1355                1360                1365


Leu Lys  Lys Ile Val Lys Ile  Gln Leu Arg Thr Asp  Gly Ser Ile
    1370                1375                1380


Ser Asn  Ile Val Val Arg Lys  Asn Ala Ala Asp Phe  Thr Leu Ser
    1385                1390                1395


Phe Arg  Ser Glu His Ile Gln  Lys Leu Leu Lys
    1400                1405
```

<210> 17
<211> 1374
<212> PRT
<213> Fusobacterium nucleatum

<400> 17

```
Met Lys Lys Gln Lys Phe Ser Asp Tyr Tyr Leu Gly Phe Asp Ile Gly
1               5                  10                  15


Thr Asn Ser Val Gly Trp Cys Val Thr Asp Leu Asp Tyr Asn Val Leu
            20                  25                  30


Arg Phe Asn Lys Lys Asp Met Trp Gly Ser Arg Leu Phe Asp Glu Ala
        35                  40                  45


Lys Thr Ala Ala Glu Arg Arg Val Gln Arg Asn Ser Arg Arg Arg Leu
```

```
    50                  55                  60

Lys Arg Arg Lys Trp Arg Leu Asn Leu Leu Glu Glu Ile Phe Ser Asp
65                  70                  75                  80

Glu Ile Met Lys Ile Asp Ser Asn Phe Phe Arg Arg Leu Lys Glu Ser
                85                  90                  95

Ser Leu Trp Leu Glu Asp Lys Asn Ser Lys Glu Lys Phe Thr Leu Phe
            100                 105                 110

Asn Asp Asp Asn Tyr Lys Asp Tyr Asp Phe Tyr Lys Gln Tyr Pro Thr
        115                 120                 125

Ile Phe His Leu Arg Asp Glu Leu Ile Lys Asn Pro Glu Lys Lys Asp
    130                 135                 140

Ile Arg Leu Ile Tyr Leu Ala Leu His Ser Ile Phe Lys Ser Arg Gly
145                 150                 155                 160

His Phe Leu Phe Glu Gly Gln Asn Leu Lys Glu Ile Lys Asn Phe Glu
                165                 170                 175

Thr Leu Tyr Asn Asn Leu Ile Ser Phe Leu Glu Asp Asn Gly Ile Asn
            180                 185                 190

Lys Ser Ile Asp Lys Asp Asn Ile Glu Lys Leu Glu Lys Ile Ile Cys
        195                 200                 205

Asp Ser Gly Lys Gly Leu Lys Asp Lys Glu Lys Glu Phe Lys Gly Ile
    210                 215                 220

Phe Asn Ser Asp Lys Gln Leu Val Ala Ile Phe Lys Leu Ser Val Gly
225                 230                 235                 240

Ser Ser Val Ser Leu Asn Asp Leu Phe Asp Thr Asp Glu Tyr Lys Lys
                245                 250                 255
```

```
Glu Glu Val Glu Lys Glu Lys Ile Ser Phe Arg Glu Gln Ile Tyr Glu
            260                 265                 270

Asp Asp Lys Pro Ile Tyr Tyr Ser Ile Leu Gly Glu Lys Ile Glu Leu
        275                 280                 285

Leu Asp Ile Ala Lys Ser Phe Tyr Asp Phe Met Val Leu Asn Asn Ile
    290                 295                 300

Leu Ser Asp Ser Asn Tyr Ile Ser Glu Ala Lys Val Lys Leu Tyr Glu
305                 310                 315                 320

Glu His Lys Lys Asp Leu Lys Asn Leu Lys Tyr Ile Ile Arg Lys Tyr
                325                 330                 335

Asn Lys Glu Asn Tyr Asp Lys Leu Phe Lys Asp Lys Asn Glu Asn Asn
            340                 345                 350

Tyr Pro Ala Tyr Ile Gly Leu Asn Lys Glu Lys Asp Lys Lys Glu Val
        355                 360                 365

Val Glu Lys Ser Arg Leu Lys Ile Asp Asp Leu Ile Lys Val Ile Lys
    370                 375                 380

Gly Tyr Leu Pro Lys Pro Glu Arg Ile Glu Glu Lys Asp Lys Thr Ile
385                 390                 395                 400

Phe Asn Glu Ile Leu Asn Lys Ile Glu Leu Lys Thr Ile Leu Pro Lys
                405                 410                 415

Gln Arg Ile Ser Asp Asn Gly Thr Leu Pro Tyr Gln Ile His Glu Val
            420                 425                 430

Glu Leu Glu Lys Ile Leu Glu Asn Gln Ser Lys Tyr Tyr Asp Phe Leu
        435                 440                 445

Asn Tyr Glu Glu Asn Gly Val Ser Thr Lys Asp Lys Leu Leu Lys Thr
```

```
    450                 455                 460

Phe Lys Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Asn Ser Tyr His
465                 470                 475                 480

Lys Asp Lys Gly Gly Asn Ser Trp Ile Val Arg Lys Glu Glu Gly Lys
                485                 490                 495

Ile Leu Pro Trp Asn Phe Glu Gln Lys Val Asp Ile Glu Lys Ser Ala
            500                 505                 510

Glu Glu Phe Ile Lys Arg Met Thr Asn Lys Cys Thr Tyr Leu Asn Gly
        515                 520                 525

Glu Asp Val Ile Pro Lys Asp Ser Phe Leu Tyr Ser Glu Tyr Ile Ile
    530                 535                 540

Leu Asn Glu Leu Asn Lys Val Gln Val Asn Asp Glu Phe Leu Asn Glu
545                 550                 555                 560

Glu Asn Lys Arg Lys Ile Ile Asp Glu Leu Phe Lys Glu Asn Lys Lys
                565                 570                 575

Val Ser Glu Lys Lys Phe Lys Glu Tyr Leu Leu Val Asn Gln Ile Ala
            580                 585                 590

Asn Arg Thr Val Glu Leu Lys Gly Ile Lys Asp Ser Phe Asn Ser Asn
        595                 600                 605

Tyr Val Ser Tyr Ile Lys Phe Lys Asp Ile Phe Gly Glu Lys Leu Asn
    610                 615                 620

Leu Asp Ile Tyr Lys Glu Ile Ser Glu Lys Ser Ile Leu Trp Lys Cys
625                 630                 635                 640

Leu Tyr Gly Asp Asp Lys Lys Ile Phe Glu Lys Lys Ile Lys Asn Glu
                645                 650                 655
```

```
Tyr Gly Asp Ile Leu Asn Lys Asp Glu Ile Lys Lys Ile Asn Ser Phe
            660                 665                 670

Lys Phe Asn Thr Trp Gly Arg Leu Ser Glu Lys Leu Leu Thr Gly Ile
        675                 680                 685

Glu Phe Ile Asn Leu Glu Thr Gly Glu Cys Tyr Ser Ser Val Met Glu
    690                 695                 700

Ala Leu Arg Arg Thr Asn Tyr Asn Leu Met Glu Leu Leu Ser Ser Lys
705                 710                 715                 720

Phe Thr Leu Gln Glu Ser Ile Asp Asn Glu Asn Lys Glu Met Asn Glu
                725                 730                 735

Val Ser Tyr Arg Asp Leu Ile Glu Glu Ser Tyr Val Ser Pro Ser Leu
            740                 745                 750

Lys Arg Ala Ile Leu Gln Thr Leu Lys Ile Tyr Glu Glu Ile Lys Lys
        755                 760                 765

Ile Thr Gly Arg Val Pro Lys Lys Val Phe Ile Glu Met Ala Arg Gly
    770                 775                 780

Gly Asp Glu Ser Met Lys Asn Lys Lys Ile Pro Ala Arg Gln Glu Gln
785                 790                 795                 800

Leu Lys Lys Leu Tyr Asp Ser Cys Gly Asn Asp Ile Ala Asn Phe Ser
                805                 810                 815

Ile Asp Ile Lys Glu Met Lys Asn Ser Leu Ser Ser Tyr Asp Asn Asn
            820                 825                 830

Ser Leu Arg Gln Lys Lys Leu Tyr Leu Tyr Tyr Leu Gln Phe Gly Lys
        835                 840                 845

Cys Met Tyr Thr Gly Arg Glu Ile Asp Leu Asp Arg Leu Leu Gln Asn
```

```
    850                 855                 860

Asn Asp Thr Tyr Asp Ile Asp His Ile Tyr Pro Arg Ser Lys Val Ile
865                 870                 875                 880

Lys Asp Asp Ser Phe Asp Asn Leu Val Leu Val Leu Lys Asn Glu Asn
                885                 890                 895

Ala Glu Lys Ser Asn Glu Tyr Pro Val Lys Lys Glu Ile Gln Glu Lys
            900                 905                 910

Met Lys Ser Phe Trp Arg Phe Leu Lys Glu Lys Asn Phe Ile Ser Asp
        915                 920                 925

Glu Lys Tyr Lys Arg Leu Thr Gly Lys Asp Asp Phe Glu Leu Arg Gly
    930                 935                 940

Phe Met Ala Arg Gln Leu Val Asn Val Arg Gln Thr Thr Lys Glu Val
945                 950                 955                 960

Gly Lys Ile Leu Gln Gln Ile Glu Pro Glu Ile Lys Ile Val Tyr Ser
                965                 970                 975

Lys Ala Glu Ile Ala Ser Ser Phe Arg Glu Met Phe Asp Phe Ile Lys
            980                 985                 990

Val Arg Glu Leu Asn Asp Thr His  His Ala Lys Asp Ala  Tyr Leu Asn
        995                 1000                1005

Ile Val  Ala Gly Asn Val Tyr  Asn Thr Lys Phe Thr  Glu Lys Pro
    1010                1015                1020

Tyr Arg  Tyr Leu Gln Glu Ile  Lys Glu Asn Tyr Asp  Val Lys Lys
    1025                1030                1035

Ile Tyr  Asn Tyr Asp Ile Lys  Asn Ala Trp Asp Lys  Glu Asn Ser
    1040                1045                1050
```

```
Leu Glu  Ile Val Lys Lys Asn  Met Glu Lys Asn Thr  Val Asn Ile
    1055                1060                1065

Thr Arg  Phe Ile Lys Glu Glu  Lys Gly Glu Leu Phe  Asn Leu Asn
    1070                1075                1080

Pro Ile  Lys Lys Gly Glu Thr  Ser Asn Glu Ile Ile  Ser Ile Lys
    1085                1090                1095

Pro Lys  Leu Tyr Asp Gly Lys  Asp Asn Lys Leu Asn  Glu Lys Tyr
    1100                1105                1110

Gly Tyr  Tyr Thr Ser Leu Lys  Ala Ala Tyr Phe Ile  Tyr Val Glu
    1115                1120                1125

His Glu  Lys Lys Asn Lys Lys  Val Lys Thr Phe Glu  Arg Ile Thr
    1130                1135                1140

Arg Ile  Asp Ser Thr Leu Ile  Lys Asn Glu Lys Asn  Leu Ile Lys
    1145                1150                1155

Tyr Leu  Val Ser Gln Lys Lys  Leu Leu Asn Pro Lys  Ile Ile Lys
    1160                1165                1170

Lys Ile  Tyr Lys Glu Gln Thr  Leu Ile Ile Asp Ser  Tyr Pro Tyr
    1175                1180                1185

Thr Phe  Thr Gly Val Asp Ser  Asn Lys Lys Val Glu  Leu Lys Asn
    1190                1195                1200

Lys Lys  Gln Leu Tyr Leu Glu  Lys Lys Tyr Glu Gln  Ile Leu Lys
    1205                1210                1215

Asn Ala  Leu Lys Phe Val Glu  Asp Asn Gln Gly Glu  Thr Glu Glu
    1220                1225                1230

Asn Tyr  Lys Phe Ile Tyr Leu  Lys Lys Arg Asn Asn  Asn Glu Lys
```

```
    1235                1240                1245

Asn Glu  Thr Ile Asp Ala Val  Lys Glu Arg Tyr Asn  Ile Glu Phe
    1250                1255                1260

Asn Glu  Met Tyr Asp Lys Phe  Leu Glu Lys Leu Ser  Ser Lys Asp
    1265                1270                1275

Tyr Lys  Asn Tyr Ile Asn Asn  Lys Leu Tyr Thr Asn  Phe Leu Asn
    1280                1285                1290

Ser Lys  Glu Lys Phe Lys Lys  Leu Lys Leu Trp Glu  Lys Ser Leu
    1295                1300                1305

Ile Leu  Arg Glu Phe Leu Lys  Ile Phe Asn Lys Asn  Thr Tyr Gly
    1310                1315                1320

Lys Tyr  Glu Ile Lys Asp Ser  Gln Thr Lys Glu Lys  Leu Phe Ser
    1325                1330                1335

Phe Pro  Glu Asp Thr Gly Arg  Ile Arg Leu Gly Gln  Ser Ser Leu
    1340                1345                1350

Gly Asn  Asn Lys Glu Leu Leu  Glu Glu Ser Val Thr  Gly Leu Phe
    1355                1360                1365

Val Lys  Lys Ile Lys Leu
    1370
```

<210> 18
<211> 1084
<212> PRT
<213> Corynebacterium diphtheriae

<400> 18

```
Met Lys Tyr His Val Gly Ile Asp Val Gly Thr Phe Ser Val Gly Leu
1               5                   10                  15
```

```
Ala Ala Ile Glu Val Asp Asp Ala Gly Met Pro Ile Lys Thr Leu Ser
            20                  25                  30

Leu Val Ser His Ile His Asp Ser Gly Leu Asp Pro Asp Glu Ile Lys
        35                  40                  45

Ser Ala Val Thr Arg Leu Ala Ser Ser Gly Ile Ala Arg Arg Thr Arg
    50                  55                  60

Arg Leu Tyr Arg Arg Lys Arg Arg Arg Leu Gln Gln Leu Asp Lys Phe
65                  70                  75                  80

Ile Gln Arg Gln Gly Trp Pro Val Ile Glu Leu Glu Asp Tyr Ser Asp
                85                  90                  95

Pro Leu Tyr Pro Trp Lys Val Arg Ala Glu Leu Ala Ala Ser Tyr Ile
            100                 105                 110

Ala Asp Glu Lys Glu Arg Gly Glu Lys Leu Ser Val Ala Leu Arg His
        115                 120                 125

Ile Ala Arg His Arg Gly Trp Arg Asn Pro Tyr Ala Lys Val Ser Ser
    130                 135                 140

Leu Tyr Leu Pro Asp Gly Pro Ser Asp Ala Phe Lys Ala Ile Arg Glu
145                 150                 155                 160

Glu Ile Lys Arg Ala Ser Gly Gln Pro Val Pro Glu Thr Ala Thr Val
                165                 170                 175

Gly Gln Met Val Thr Leu Cys Glu Leu Gly Thr Leu Lys Leu Arg Gly
            180                 185                 190

Glu Gly Gly Val Leu Ser Ala Arg Leu Gln Gln Ser Asp Tyr Ala Arg
        195                 200                 205

Glu Ile Gln Glu Ile Cys Arg Met Gln Glu Ile Gly Gln Glu Leu Tyr
    210                 215                 220
```

```
Arg Lys Ile Ile Asp Val Val Phe Ala Ala Glu Ser Pro Lys Gly Ser
225                 230                 235                 240

Ala Ser Ser Arg Val Gly Lys Asp Pro Leu Gln Pro Gly Lys Asn Arg
                245                 250                 255

Ala Leu Lys Ala Ser Asp Ala Phe Gln Arg Tyr Arg Ile Ala Ala Leu
            260                 265                 270

Ile Gly Asn Leu Arg Val Arg Val Asp Gly Glu Lys Arg Ile Leu Ser
        275                 280                 285

Val Glu Glu Lys Asn Leu Val Phe Asp His Leu Val Asn Leu Thr Pro
    290                 295                 300

Lys Lys Glu Pro Glu Trp Val Thr Ile Ala Glu Ile Leu Gly Ile Asp
305                 310                 315                 320

Arg Gly Gln Leu Ile Gly Thr Ala Thr Met Thr Asp Asp Gly Glu Arg
                325                 330                 335

Ala Gly Ala Arg Pro Pro Thr His Asp Thr Asn Arg Ser Ile Val Asn
            340                 345                 350

Ser Arg Ile Ala Pro Leu Val Asp Trp Trp Lys Thr Ala Ser Ala Leu
        355                 360                 365

Glu Gln His Ala Met Val Lys Ala Leu Ser Asn Ala Glu Val Asp Asp
    370                 375                 380

Phe Asp Ser Pro Glu Gly Ala Lys Val Gln Ala Phe Phe Ala Asp Leu
385                 390                 395                 400

Asp Asp Asp Val His Ala Lys Leu Asp Ser Leu His Leu Pro Val Gly
                405                 410                 415
```

```
Arg Ala Ala Tyr Ser Glu Asp Thr Leu Val Arg Leu Thr Arg Arg Met
            420                 425                 430

Leu Ser Asp Gly Val Asp Leu Tyr Thr Ala Arg Leu Gln Glu Phe Gly
        435                 440                 445

Ile Glu Pro Ser Trp Thr Pro Pro Thr Pro Arg Ile Gly Glu Pro Val
    450                 455                 460

Gly Asn Pro Ala Val Asp Arg Val Leu Lys Thr Val Ser Arg Trp Leu
465                 470                 475                 480

Glu Ser Ala Thr Lys Thr Trp Gly Ala Pro Glu Arg Val Ile Ile Glu
                485                 490                 495

His Val Arg Glu Gly Phe Val Thr Glu Lys Arg Ala Arg Glu Met Asp
            500                 505                 510

Gly Asp Met Arg Arg Arg Ala Ala Arg Asn Ala Lys Leu Phe Gln Glu
        515                 520                 525

Met Gln Glu Lys Leu Asn Val Gln Gly Lys Pro Ser Arg Ala Asp Leu
    530                 535                 540

Trp Arg Tyr Gln Ser Val Gln Arg Gln Asn Cys Gln Cys Ala Tyr Cys
545                 550                 555                 560

Gly Ser Pro Ile Thr Phe Ser Asn Ser Glu Met Asp His Ile Val Pro
                565                 570                 575

Arg Ala Gly Gln Gly Ser Thr Asn Thr Arg Glu Asn Leu Val Ala Val
            580                 585                 590

Cys His Arg Cys Asn Gln Ser Lys Gly Asn Thr Pro Phe Ala Ile Trp
        595                 600                 605

Ala Lys Asn Thr Ser Ile Glu Gly Val Ser Val Lys Glu Ala Val Glu
    610                 615                 620
```

```
Arg Thr Arg His Trp Val Thr Asp Thr Gly Met Arg Ser Thr Asp Phe
625                 630                 635                 640

Lys Lys Phe Thr Lys Ala Val Val Glu Arg Phe Gln Arg Ala Thr Met
                645                 650                 655

Asp Glu Glu Ile Asp Ala Arg Ser Met Glu Ser Val Ala Trp Met Ala
            660                 665                 670

Asn Glu Leu Arg Ser Arg Val Ala Gln His Phe Ala Ser His Gly Thr
        675                 680                 685

Thr Val Arg Val Tyr Arg Gly Ser Leu Thr Ala Glu Ala Arg Arg Ala
    690                 695                 700

Ser Gly Ile Ser Gly Lys Leu Lys Phe Phe Asp Gly Val Gly Lys Ser
705                 710                 715                 720

Arg Leu Asp Arg Arg His His Ala Ile Asp Ala Ala Val Ile Ala Phe
                725                 730                 735

Thr Ser Asp Tyr Val Ala Glu Thr Leu Ala Val Arg Ser Asn Leu Lys
            740                 745                 750

Gln Ser Gln Ala His Arg Gln Glu Ala Pro Gln Trp Arg Glu Phe Thr
        755                 760                 765

Gly Lys Asp Ala Glu His Arg Ala Ala Trp Arg Val Trp Cys Gln Lys
    770                 775                 780

Met Glu Lys Leu Ser Ala Leu Leu Thr Glu Asp Leu Arg Asp Asp Arg
785                 790                 795                 800

Val Val Val Met Ser Asn Val Arg Leu Arg Leu Gly Asn Gly Ser Ala
                805                 810                 815
```

```
His Lys Glu Thr Ile Gly Lys Leu Ser Lys Val Lys Leu Ser Ser Gln
            820                 825                 830

Leu Ser Val Ser Asp Ile Asp Lys Ala Ser Ser Glu Ala Leu Trp Cys
        835                 840                 845

Ala Leu Thr Arg Glu Pro Gly Phe Asp Pro Lys Glu Gly Leu Pro Ala
    850                 855                 860

Asn Pro Glu Arg His Ile Arg Val Asn Gly Thr His Val Tyr Ala Gly
865                 870                 875                 880

Asp Asn Ile Gly Leu Phe Pro Val Ser Ala Gly Ser Ile Ala Leu Arg
                885                 890                 895

Gly Gly Tyr Ala Glu Leu Gly Ser Ser Phe His His Ala Arg Val Tyr
            900                 905                 910

Lys Ile Thr Ser Gly Lys Lys Pro Ala Phe Ala Met Leu Arg Val Tyr
        915                 920                 925

Thr Ile Asp Leu Leu Pro Tyr Arg Asn Gln Asp Leu Phe Ser Val Glu
    930                 935                 940

Leu Lys Pro Gln Thr Met Ser Met Arg Gln Ala Glu Lys Lys Leu Arg
945                 950                 955                 960

Asp Ala Leu Ala Thr Gly Asn Ala Glu Tyr Leu Gly Trp Leu Val Val
                965                 970                 975

Asp Asp Glu Leu Val Val Asp Thr Ser Lys Ile Ala Thr Asp Gln Val
            980                 985                 990

Lys Ala Val Glu Ala Glu Leu Gly  Thr Ile Arg Arg Trp  Arg Val Asp
        995                 1000                1005

Gly Phe  Phe Ser Pro Ser Lys  Leu Arg Leu Arg Pro  Leu Gln Met
    1010                1015                1020
```

Ser Lys Glu Gly Ile Lys Lys Glu Ser Ala Pro Glu Leu Ser Lys
    1025   1030   1035

Ile Ile Asp Arg Pro Gly Trp Leu Pro Ala Val Asn Lys Leu Phe
    1040   1045   1050

Ser Asp Gly Asn Val Thr Val Val Arg Arg Asp Ser Leu Gly Arg
    1055   1060   1065

Val Arg Leu Glu Ser Thr Ala His Leu Pro Val Thr Trp Lys Val
    1070   1075   1080

Gln

<210> 19
<211> 1395
<212> PRT
<213> Treponema denticola

<400> 19

Met Lys Lys Glu Ile Lys Asp Tyr Phe Leu Gly Leu Asp Val Gly Thr
1   5   10   15

Gly Ser Val Gly Trp Ala Val Thr Asp Thr Asp Tyr Lys Leu Leu Lys
            20   25   30

Ala Asn Arg Lys Asp Leu Trp Gly Met Arg Cys Phe Glu Thr Ala Glu
        35   40   45

Thr Ala Glu Val Arg Arg Leu His Arg Gly Ala Arg Arg Arg Ile Glu
    50   55   60

Arg Arg Lys Lys Arg Ile Lys Leu Leu Gln Glu Leu Phe Ser Gln Glu
65   70   75   80

Ile Ala Lys Thr Asp Glu Gly Phe Phe Gln Arg Met Lys Glu Ser Pro

```
                85                  90                  95

Phe Tyr Ala Glu Asp Lys Thr Ile Leu Gln Glu Asn Thr Leu Phe Asn
            100                 105                 110

Asp Lys Asp Phe Ala Asp Lys Thr Tyr His Lys Ala Tyr Pro Thr Ile
        115                 120                 125

Asn His Leu Ile Lys Ala Trp Ile Glu Asn Lys Val Lys Pro Asp Pro
    130                 135                 140

Arg Leu Leu Tyr Leu Ala Cys His Asn Ile Ile Lys Lys Arg Gly His
145                 150                 155                 160

Phe Leu Phe Glu Gly Asp Phe Asp Ser Glu Asn Gln Phe Asp Thr Ser
                165                 170                 175

Ile Gln Ala Leu Phe Glu Tyr Leu Arg Glu Asp Met Glu Val Asp Ile
            180                 185                 190

Asp Ala Asp Ser Gln Lys Val Lys Glu Ile Leu Lys Asp Ser Ser Leu
        195                 200                 205

Lys Asn Ser Glu Lys Gln Ser Arg Leu Asn Lys Ile Leu Gly Leu Lys
    210                 215                 220

Pro Ser Asp Lys Gln Lys Lys Ala Ile Thr Asn Leu Ile Ser Gly Asn
225                 230                 235                 240

Lys Ile Asn Phe Ala Asp Leu Tyr Asp Asn Pro Asp Leu Lys Asp Ala
                245                 250                 255

Glu Lys Asn Ser Ile Ser Phe Ser Lys Asp Asp Phe Asp Ala Leu Ser
            260                 265                 270

Asp Asp Leu Ala Ser Ile Leu Gly Asp Ser Phe Glu Leu Leu Leu Lys
        275                 280                 285
```

```
Ala Lys Ala Val Tyr Asn Cys Ser Val Leu Ser Lys Val Ile Gly Asp
    290                 295                 300

Glu Gln Tyr Leu Ser Phe Ala Lys Val Lys Ile Tyr Glu Lys His Lys
305                 310                 315                 320

Thr Asp Leu Thr Lys Leu Lys Asn Val Ile Lys Lys His Phe Pro Lys
                325                 330                 335

Asp Tyr Lys Lys Val Phe Gly Tyr Asn Lys Asn Glu Lys Asn Asn Asn
            340                 345                 350

Asn Tyr Ser Gly Tyr Val Gly Val Cys Lys Thr Lys Ser Lys Lys Leu
        355                 360                 365

Ile Ile Asn Asn Ser Val Asn Gln Glu Asp Phe Tyr Lys Phe Leu Lys
    370                 375                 380

Thr Ile Leu Ser Ala Lys Ser Glu Ile Lys Glu Val Asn Asp Ile Leu
385                 390                 395                 400

Thr Glu Ile Glu Thr Gly Thr Phe Leu Pro Lys Gln Ile Ser Lys Ser
                405                 410                 415

Asn Ala Glu Ile Pro Tyr Gln Leu Arg Lys Met Glu Leu Glu Lys Ile
            420                 425                 430

Leu Ser Asn Ala Glu Lys His Phe Ser Phe Leu Lys Gln Lys Asp Glu
        435                 440                 445

Lys Gly Leu Ser His Ser Glu Lys Ile Ile Met Leu Leu Thr Phe Lys
    450                 455                 460

Ile Pro Tyr Tyr Ile Gly Pro Ile Asn Asp Asn His Lys Lys Phe Phe
465                 470                 475                 480

Pro Asp Arg Cys Trp Val Val Lys Lys Glu Lys Ser Pro Ser Gly Lys
```

```
                485                 490                 495

Thr Thr Pro Trp Asn Phe Phe Asp His Ile Asp Lys Glu Lys Thr Ala
            500                 505                 510

Glu Ala Phe Ile Thr Ser Arg Thr Asn Phe Cys Thr Tyr Leu Val Gly
        515                 520                 525

Glu Ser Val Leu Pro Lys Ser Ser Leu Leu Tyr Ser Glu Tyr Thr Val
    530                 535                 540

Leu Asn Glu Ile Asn Asn Leu Gln Ile Ile Ile Asp Gly Lys Asn Ile
545                 550                 555                 560

Cys Asp Ile Lys Leu Lys Gln Lys Ile Tyr Glu Asp Leu Phe Lys Lys
                565                 570                 575

Tyr Lys Lys Ile Thr Gln Lys Gln Ile Ser Thr Phe Ile Lys His Glu
            580                 585                 590

Gly Ile Cys Asn Lys Thr Asp Glu Val Ile Ile Leu Gly Ile Asp Lys
        595                 600                 605

Glu Cys Thr Ser Ser Leu Lys Ser Tyr Ile Glu Leu Lys Asn Ile Phe
    610                 615                 620

Gly Lys Gln Val Asp Glu Ile Ser Thr Lys Asn Met Leu Glu Glu Ile
625                 630                 635                 640

Ile Arg Trp Ala Thr Ile Tyr Asp Glu Gly Glu Gly Lys Thr Ile Leu
                645                 650                 655

Lys Thr Lys Ile Lys Ala Glu Tyr Gly Lys Tyr Cys Ser Asp Glu Gln
            660                 665                 670

Ile Lys Lys Ile Leu Asn Leu Lys Phe Ser Gly Trp Gly Arg Leu Ser
        675                 680                 685
```

```
Arg Lys Phe Leu Glu Thr Val Thr Ser Glu Met Pro Gly Phe Ser Glu
    690                 695                 700

Pro Val Asn Ile Ile Thr Ala Met Arg Glu Thr Gln Asn Asn Leu Met
705                 710                 715                 720

Glu Leu Leu Ser Ser Glu Phe Thr Phe Thr Glu Asn Ile Lys Lys Ile
                725                 730                 735

Asn Ser Gly Phe Glu Asp Ala Glu Lys Gln Phe Ser Tyr Asp Gly Leu
            740                 745                 750

Val Lys Pro Leu Phe Leu Ser Pro Ser Val Lys Lys Met Leu Trp Gln
        755                 760                 765

Thr Leu Lys Leu Val Lys Glu Ile Ser His Ile Thr Gln Ala Pro Pro
    770                 775                 780

Lys Lys Ile Phe Ile Glu Met Ala Lys Gly Ala Glu Leu Glu Pro Ala
785                 790                 795                 800

Arg Thr Lys Thr Arg Leu Lys Ile Leu Gln Asp Leu Tyr Asn Asn Cys
                805                 810                 815

Lys Asn Asp Ala Asp Ala Phe Ser Ser Glu Ile Lys Asp Leu Ser Gly
            820                 825                 830

Lys Ile Glu Asn Glu Asp Asn Leu Arg Leu Arg Ser Asp Lys Leu Tyr
        835                 840                 845

Leu Tyr Tyr Thr Gln Leu Gly Lys Cys Met Tyr Cys Gly Lys Pro Ile
    850                 855                 860

Glu Ile Gly His Val Phe Asp Thr Ser Asn Tyr Asp Ile Asp His Ile
865                 870                 875                 880

Tyr Pro Gln Ser Lys Ile Lys Asp Asp Ser Ile Ser Asn Arg Val Leu
```

```
               885                 890                 895

Val Cys Ser Ser Cys Asn Lys Asn Lys Glu Asp Lys Tyr Pro Leu Lys
            900                 905                 910

Ser Glu Ile Gln Ser Lys Gln Arg Gly Phe Trp Asn Phe Leu Gln Arg
        915                 920                 925

Asn Asn Phe Ile Ser Leu Glu Lys Leu Asn Arg Leu Thr Arg Ala Thr
    930                 935                 940

Pro Ile Ser Asp Asp Glu Thr Ala Lys Phe Ile Ala Arg Gln Leu Val
945                 950                 955                 960

Glu Thr Arg Gln Ala Thr Lys Val Ala Ala Lys Val Leu Glu Lys Met
               965                 970                 975

Phe Pro Glu Thr Lys Ile Val Tyr Ser Lys Ala Glu Thr Val Ser Met
            980                 985                 990

Phe Arg Asn Lys Phe Asp Ile Val  Lys Cys Arg Glu Ile  Asn Asp Phe
        995                 1000                1005

His His  Ala His Asp Ala Tyr  Leu Asn Ile Val Val  Gly Asn Val
    1010                1015                1020

Tyr Asn  Thr Lys Phe Thr Asn  Asn Pro Trp Asn Phe  Ile Lys Glu
    1025                1030                1035

Lys Arg  Asp Asn Pro Lys Ile  Ala Asp Thr Tyr Asn  Tyr Tyr Lys
    1040                1045                1050

Val Phe  Asp Tyr Asp Val Lys  Arg Asn Asn Ile Thr  Ala Trp Glu
    1055                1060                1065

Lys Gly  Lys Thr Ile Ile Thr  Val Lys Asp Met Leu  Lys Arg Asn
    1070                1075                1080
```

```
Thr Pro  Ile Tyr Thr Arg Gln  Ala Ala Cys Lys Lys  Gly Glu Leu
    1085                1090                1095

Phe Asn  Gln Thr Ile Met Lys  Lys Gly Leu Gly Gln  His Pro Leu
    1100                1105                1110

Lys Lys  Glu Gly Pro Phe Ser  Asn Ile Ser Lys Tyr  Gly Gly Tyr
    1115                1120                1125

Asn Lys  Val Ser Ala Ala Tyr  Tyr Thr Leu Ile Glu  Tyr Glu Glu
    1130                1135                1140

Lys Gly  Asn Lys Ile Arg Ser  Leu Glu Thr Ile Pro  Leu Tyr Leu
    1145                1150                1155

Val Lys  Asp Ile Gln Lys Asp  Gln Asp Val Leu Lys  Ser Tyr Leu
    1160                1165                1170

Thr Asp  Leu Leu Gly Lys Lys  Glu Phe Lys Ile Leu  Val Pro Lys
    1175                1180                1185

Ile Lys  Ile Asn Ser Leu Leu  Lys Ile Asn Gly Phe  Pro Cys His
    1190                1195                1200

Ile Thr  Gly Lys Thr Asn Asp  Ser Phe Leu Leu Arg  Pro Ala Val
    1205                1210                1215

Gln Phe  Cys Cys Ser Asn Asn  Glu Val Leu Tyr Phe  Lys Lys Ile
    1220                1225                1230

Ile Arg  Phe Ser Glu Ile Arg  Ser Gln Arg Glu Lys  Ile Gly Lys
    1235                1240                1245

Thr Ile  Ser Pro Tyr Glu Asp  Leu Ser Phe Arg Ser  Tyr Ile Lys
    1250                1255                1260

Glu Asn  Leu Trp Lys Lys Thr  Lys Asn Asp Glu Ile  Gly Glu Lys
```

```
    1265                1270                1275

Glu Phe  Tyr Asp Leu Leu Gln  Lys Lys Asn Leu Glu  Ile Tyr Asp
    1280                1285                1290

Met Leu  Leu Thr Lys His Lys  Asp Thr Ile Tyr Lys  Lys Arg Pro
    1295                1300                1305

Asn Ser  Ala Thr Ile Asp Ile  Leu Val Lys Gly Lys  Glu Lys Phe
    1310                1315                1320

Lys Ser  Leu Ile Ile Glu Asn  Gln Phe Glu Val Ile  Leu Glu Ile
    1325                1330                1335

Leu Lys  Leu Phe Ser Ala Thr  Arg Asn Val Ser Asp  Leu Gln His
    1340                1345                1350

Ile Gly  Gly Ser Lys Tyr Ser  Gly Val Ala Lys Ile  Gly Asn Lys
    1355                1360                1365

Ile Ser  Ser Leu Asp Asn Cys  Ile Leu Ile Tyr Gln  Ser Ile Thr
    1370                1375                1380

Gly Ile  Phe Glu Lys Arg Ile  Asp Leu Leu Lys Val
    1385                1390                1395


<210>  20
<211>  1334
<212>  PRT
<213>  Listeria monocytogenes

<400>  20

Met Lys Asn Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Leu Thr Asn Gln Tyr Asp Leu Val Lys Arg Lys Met
            20                  25                  30
```

```
Lys Val Ala Gly Asn Ser Asp Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Asp Asp Gly Gln Thr Ala Val Asp Arg Arg Met
    50                  55                  60

Asn Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Val Glu Met Ala Asn Ile Asp Ala Asn
                85                  90                  95

Phe Phe Cys Arg Leu Asn Asp Ser Phe Tyr Val Asp Ser Glu Lys Arg
            100                 105                 110

Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Ala Tyr
        115                 120                 125

His Asp Asn Tyr Arg Thr Ile Tyr His Leu Arg Glu Lys Leu Val Asn
    130                 135                 140

Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175

Lys Asn Thr Ser Val Asp Glu Val Tyr Lys Gln Phe Ile Glu Thr Tyr
            180                 185                 190

Asn Gln Val Phe Met Ser Asn Ile Glu Glu Gly Ala Leu Ala Lys Val
        195                 200                 205

Glu Glu Asn Ile Glu Val Ala Asn Ile Leu Ala Gly Lys Phe Thr Arg
    210                 215                 220

Arg Glu Lys Phe Glu Arg Ile Leu Gln Leu Tyr Pro Gly Glu Lys Ser
225                 230                 235                 240
```

```
Thr Gly Met Phe Ala Gln Phe Ile Ser Leu Ile Val Gly Ser Lys Gly
                245                 250                 255

Asn Phe Gln Lys Val Phe Asp Leu Ile Glu Lys Thr Asp Ile Glu Cys
            260                 265                 270

Ala Lys Asp Ser Tyr Glu Glu Asp Leu Glu Thr Leu Leu Ala Ile Ile
        275                 280                 285

Gly Asp Glu Tyr Ala Glu Leu Phe Val Ala Ala Lys Asn Thr Tyr Asn
    290                 295                 300

Ala Val Val Leu Ser Ser Ile Ile Thr Val Thr Asp Thr Glu Thr Asn
305                 310                 315                 320

Ala Lys Leu Ser Ala Ser Met Ile Glu Arg Phe Asp Ala His Glu Lys
                325                 330                 335

Asp Leu Val Glu Leu Lys Ala Phe Ile Lys Leu Asn Leu Pro Lys Gln
            340                 345                 350

Tyr Glu Glu Ile Phe Ser Asn Ala Ala Ile Asp Gly Tyr Ala Gly Tyr
        355                 360                 365

Ile Asp Gly Lys Thr Lys Gln Val Asp Phe Tyr Lys Tyr Leu Lys Thr
    370                 375                 380

Ile Leu Glu Asn Ile Glu Gly Ser Asp Tyr Phe Ile Ala Lys Ile Glu
385                 390                 395                 400

Glu Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ala Ile
                405                 410                 415

Pro His Gln Leu His Leu Glu Glu Leu Glu Ala Ile Ile His Gln Gln
            420                 425                 430
```

```
Ala Lys Tyr Tyr Pro Phe Leu Lys Glu Asp Tyr Asp Lys Ile Lys Ser
        435                 440                 445

Leu Val Thr Phe Arg Ile Pro Tyr Phe Val Gly Pro Leu Ala Asn Gly
    450                 455                 460

Gln Ser Glu Phe Ala Trp Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg
465                 470                 475                 480

Pro Trp Asn Ile Glu Glu Lys Val Asp Phe Gly Lys Ser Ala Val Asp
                485                 490                 495

Phe Ile Glu Lys Met Thr Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn
            500                 505                 510

Val Leu Pro Lys His Ser Leu Cys Tyr Gln Lys Tyr Met Val Tyr Asn
        515                 520                 525

Glu Leu Thr Lys Ile Arg Tyr Ile Asp Asp Gln Gly Lys Thr Asn Tyr
    530                 535                 540

Phe Ser Gly Arg Glu Lys Gln Gln Val Phe Asn Asp Leu Phe Lys Gln
545                 550                 555                 560

Lys Arg Lys Val Lys Lys Lys Asp Leu Glu Leu Phe Leu Arg Asn Ile
                565                 570                 575

Asn His Ile Glu Ser Pro Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn
            580                 585                 590

Ala Ser Tyr Ala Thr Tyr His Asp Leu Leu Lys Val Gly Met Lys Gln
        595                 600                 605

Glu Ile Leu Asp Asn Pro Leu Asn Thr Glu Met Leu Glu Asp Ile Val
    610                 615                 620

Lys Ile Leu Thr Val Phe Glu Asp Lys Pro Met Ile Lys Glu Gln Leu
625                 630                 635                 640
```

```
Gln Gln Phe Ser Asp Val Leu Asp Gly Gly Val Leu Lys Lys Leu Glu
                645                 650                 655

Arg Arg His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu Val
            660                 665                 670

Gly Ile Arg Glu Lys Gln Ser His Leu Thr Ile Leu Asp Tyr Leu Met
        675                 680                 685

Asn Asp Asp Gly Leu Asn Arg Asn Leu Met Gln Leu Ile Asn Asp Ser
    690                 695                 700

Asn Leu Ser Phe Lys Ser Ile Ile Glu Lys Glu Gln Val Ser Thr Thr
705                 710                 715                 720

Asp Lys Asp Leu Gln Ser Ile Val Ala Glu Leu Ala Gly Ser Pro Ala
                725                 730                 735

Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val
            740                 745                 750

Ser Ile Met Gly Tyr Pro Pro Gln Thr Ile Val Val Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Gly Lys Gly Lys Asn Asn Ser Lys Pro Arg Tyr
    770                 775                 780

Lys Ser Leu Glu Lys Ala Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys
785                 790                 795                 800

Glu His Pro Thr Asp Asn Gln Glu Leu Lys Asn Asn Arg Leu Tyr Leu
                805                 810                 815

Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Gln Glu Leu Asp
            820                 825                 830
```

```
Ile His Asn Leu Ser Asn Tyr Asp Ile Asp His Ile Val Pro Gln Ser
        835                 840                 845

Phe Ile Thr Asp Asn Ser Ile Asp Asn Leu Val Leu Thr Ser Ser Ala
    850                 855                 860

Gly Asn Arg Glu Lys Gly Gly Asp Val Pro Pro Leu Glu Ile Val Arg
865                 870                 875                 880

Lys Arg Lys Val Phe Trp Glu Lys Leu Tyr Gln Gly Asn Leu Met Ser
                885                 890                 895

Lys Arg Lys Phe Asp Tyr Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr
            900                 905                 910

Glu Ala Asp Lys Ala Arg Phe Ile His Arg Gln Leu Val Glu Thr Arg
        915                 920                 925

Gln Ile Thr Lys Asn Val Ala Asn Ile Leu Tyr Gln Arg Phe Asn Lys
    930                 935                 940

Glu Thr Asp Asn His Gly Asn Thr Met Glu Gln Val Arg Ile Val Thr
945                 950                 955                 960

Leu Lys Ser Ala Leu Val Ser Gln Phe Arg Lys Gln Phe Gln Leu Tyr
                965                 970                 975

Lys Val Arg Glu Val Asn Gly Tyr His His Ala His Asp Ala Tyr Leu
            980                 985                 990

Asn Gly Val Val Ala Asn Thr Leu  Leu Lys Val Tyr Pro  Gln Leu Glu
        995                 1000                1005

Pro Glu  Phe Val Tyr Gly Glu  Tyr His Gln Phe Asp  Trp Phe Lys
    1010                1015                1020

Ala Asn  Lys Ala Thr Ala Lys  Lys Gln Phe Tyr Thr  Asn Ile Met
    1025                1030                1035
```

```
Leu Phe  Phe Ala Gln Lys Glu  Arg Ile Ile Asp Glu  Asn Gly Glu
    1040                1045                1050

Ile Leu  Trp Asp Lys Lys Tyr  Leu Glu Thr Ile Lys  Lys Val Leu
    1055                1060                1065

Asp Tyr  Arg Gln Met Asn Ile  Val Lys Lys Thr Glu  Ile Gln Lys
    1070                1075                1080

Gly Glu  Phe Ser Lys Ala Thr  Ile Lys Pro Lys Gly  Asn Ser Ser
    1085                1090                1095

Lys Leu  Ile Pro Arg Lys Glu  Asn Trp Asp Pro Met  Lys Tyr Gly
    1100                1105                1110

Gly Leu  Asp Ser Pro Asn Met  Ala Tyr Ala Val Ile  Ile Glu His
    1115                1120                1125

Ala Lys  Gly Lys Lys Lys Ile  Val Ile Glu Lys Lys  Leu Ile Gln
    1130                1135                1140

Ile Asn  Ile Met Glu Arg Lys  Met Phe Glu Lys Asp  Glu Glu Ala
    1145                1150                1155

Phe Leu  Glu Glu Lys Gly Tyr  Arg His Pro Lys Val  Leu Thr Lys
    1160                1165                1170

Leu Pro  Lys Tyr Thr Leu Tyr  Glu Cys Glu Lys Gly  Arg Arg Arg
    1175                1180                1185

Met Leu  Ala Ser Ala Asn Glu  Ala Gln Lys Gly Asn  Gln Leu Val
    1190                1195                1200

Leu Ser  Asn His Leu Val Ser  Leu Leu Tyr His Ala  Lys Asn Cys
    1205                1210                1215
```

```
Glu Ala  Ser Asp Gly Lys Ser  Leu Lys Tyr Ile Glu  Ala His Arg
    1220                 1225                 1230


Glu Thr  Phe Ser Glu Leu Leu  Ala Gln Val Ser Glu  Phe Ala Thr
    1235                 1240                 1245


Arg Tyr  Thr Leu Ala Asp Ala  Asn Leu Ser Lys Ile  Asn Asn Leu
    1250                 1255                 1260


Phe Glu  Gln Asn Lys Glu Gly  Asp Ile Lys Ala Ile  Ala Gln Ser
    1265                 1270                 1275


Phe Val  Asp Leu Met Ala Phe  Asn Ala Met Gly Ala  Pro Ala Ser
    1280                 1285                 1290


Phe Lys  Phe Phe Glu Ala Thr  Ile Asp Arg Lys Arg  Tyr Thr Asn
    1295                 1300                 1305


Leu Lys  Glu Leu Leu Ser Ser  Thr Ile Ile Tyr Gln  Ser Ile Thr
    1310                 1315                 1320


Gly Leu  Tyr Glu Ser Arg Lys  Arg Leu Asp Asp
    1325                 1330


<210>  21
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<212>  PRT
<213>  Mycoplasma mobile

<400>  21

Met Tyr Phe Tyr Lys Asn Lys Glu Asn Lys Leu Asn Lys Lys Val Val
1               5                   10                  15


Leu Gly Leu Asp Leu Gly Ile Ala Ser Val Gly Trp Cys Leu Thr Asp
            20                  25                  30


Ile Ser Gln Lys Glu Asp Asn Lys Phe Pro Ile Ile Leu His Gly Val
        35                  40                  45
```

```
Arg Leu Phe Glu Thr Val Asp Asp Ser Asp Asp Lys Leu Leu Asn Glu
    50                  55                  60

Thr Arg Arg Lys Lys Arg Gly Gln Arg Arg Arg Asn Arg Arg Leu Phe
65                  70                  75                  80

Thr Arg Lys Arg Asp Phe Ile Lys Tyr Leu Ile Asp Asn Asn Ile Ile
                85                  90                  95

Glu Leu Glu Phe Asp Lys Asn Pro Lys Ile Leu Val Arg Asn Phe Ile
            100                 105                 110

Glu Lys Tyr Ile Asn Pro Phe Ser Lys Asn Leu Glu Leu Lys Tyr Lys
        115                 120                 125

Ser Val Thr Asn Leu Pro Ile Gly Phe His Asn Leu Arg Lys Ala Ala
    130                 135                 140

Ile Asn Glu Lys Tyr Lys Leu Asp Lys Ser Glu Leu Ile Val Leu Leu
145                 150                 155                 160

Tyr Phe Tyr Leu Ser Leu Arg Gly Ala Phe Phe Asp Asn Pro Glu Asp
                165                 170                 175

Thr Lys Ser Lys Glu Met Asn Lys Asn Glu Ile Glu Ile Phe Asp Lys
            180                 185                 190

Asn Glu Ser Ile Lys Asn Ala Glu Phe Pro Ile Asp Lys Ile Ile Glu
        195                 200                 205

Phe Tyr Lys Ile Ser Gly Lys Ile Arg Ser Thr Ile Asn Leu Lys Phe
    210                 215                 220

Gly His Gln Asp Tyr Leu Lys Glu Ile Lys Gln Val Phe Glu Lys Gln
225                 230                 235                 240

Asn Ile Asp Phe Met Asn Tyr Glu Lys Phe Ala Met Glu Glu Lys Ser
```

```
                245                 250                 255

Phe Phe Ser Arg Ile Arg Asn Tyr Ser Glu Gly Pro Gly Asn Glu Lys
            260                 265                 270

Ser Phe Ser Lys Tyr Gly Leu Tyr Ala Asn Glu Asn Gly Asn Pro Glu
        275                 280                 285

Leu Ile Ile Asn Glu Lys Gly Gln Lys Ile Tyr Thr Lys Ile Phe Lys
    290                 295                 300

Thr Leu Trp Glu Ser Lys Ile Gly Lys Cys Ser Tyr Asp Lys Lys Leu
305                 310                 315                 320

Tyr Arg Ala Pro Lys Asn Ser Phe Ser Ala Lys Val Phe Asp Ile Thr
                325                 330                 335

Asn Lys Leu Thr Asp Trp Lys His Lys Asn Glu Tyr Ile Ser Glu Arg
            340                 345                 350

Leu Lys Arg Lys Ile Leu Leu Ser Arg Phe Leu Asn Lys Asp Ser Lys
        355                 360                 365

Ser Ala Val Glu Lys Ile Leu Lys Glu Glu Asn Ile Lys Phe Glu Asn
    370                 375                 380

Leu Ser Glu Ile Ala Tyr Asn Lys Asp Asp Asn Lys Ile Asn Leu Pro
385                 390                 395                 400

Ile Ile Asn Ala Tyr His Ser Leu Thr Thr Ile Phe Lys Lys His Leu
                405                 410                 415

Ile Asn Phe Glu Asn Tyr Leu Ile Ser Asn Glu Asn Asp Leu Ser Lys
            420                 425                 430

Leu Met Ser Phe Tyr Lys Gln Gln Ser Glu Lys Leu Phe Val Pro Asn
        435                 440                 445
```

```
Glu Lys Gly Ser Tyr Glu Ile Asn Gln Asn Asn Asn Val Leu His Ile
    450                 455                 460

Phe Asp Ala Ile Ser Asn Ile Leu Asn Lys Phe Ser Thr Ile Gln Asp
465                 470                 475                 480

Arg Ile Arg Ile Leu Glu Gly Tyr Phe Glu Phe Ser Asn Leu Lys Lys
                485                 490                 495

Asp Val Lys Ser Ser Glu Ile Tyr Ser Glu Ile Ala Lys Leu Arg Glu
            500                 505                 510

Phe Ser Gly Thr Ser Ser Leu Ser Phe Gly Ala Tyr Tyr Lys Phe Ile
        515                 520                 525

Pro Asn Leu Ile Ser Glu Gly Ser Lys Asn Tyr Ser Thr Ile Ser Tyr
    530                 535                 540

Glu Glu Lys Ala Leu Gln Asn Gln Lys Asn Asn Phe Ser His Ser Asn
545                 550                 555                 560

Leu Phe Glu Lys Thr Trp Val Glu Asp Leu Ile Ala Ser Pro Thr Val
                565                 570                 575

Lys Arg Ser Leu Arg Gln Thr Met Asn Leu Leu Lys Glu Ile Phe Lys
            580                 585                 590

Tyr Ser Glu Lys Asn Asn Leu Glu Ile Glu Lys Ile Val Val Glu Val
        595                 600                 605

Thr Arg Ser Ser Asn Asn Lys His Glu Arg Lys Lys Ile Glu Gly Ile
    610                 615                 620

Asn Lys Tyr Arg Lys Glu Lys Tyr Glu Glu Leu Lys Lys Val Tyr Asp
625                 630                 635                 640

Leu Pro Asn Glu Asn Thr Thr Leu Leu Lys Lys Leu Trp Leu Leu Arg
```

```
                645                 650                 655

Gln Gln Gln Gly Tyr Asp Ala Tyr Ser Leu Arg Lys Ile Glu Ala Asn
            660                 665                 670

Asp Val Ile Asn Lys Pro Trp Asn Tyr Asp Ile Asp His Ile Val Pro
        675                 680                 685

Arg Ser Ile Ser Phe Asp Asp Ser Phe Ser Asn Leu Val Ile Val Asn
    690                 695                 700

Lys Leu Asp Asn Ala Lys Lys Ser Asn Asp Leu Ser Ala Lys Gln Phe
705                 710                 715                 720

Ile Glu Lys Ile Tyr Gly Ile Glu Lys Leu Lys Glu Ala Lys Glu Asn
                725                 730                 735

Trp Gly Asn Trp Tyr Leu Arg Asn Ala Asn Gly Lys Ala Phe Asn Asp
            740                 745                 750

Lys Gly Lys Phe Ile Lys Leu Tyr Thr Ile Asp Asn Leu Asp Glu Phe
        755                 760                 765

Asp Asn Ser Asp Phe Ile Asn Arg Asn Leu Ser Asp Thr Ser Tyr Ile
    770                 775                 780

Thr Asn Ala Leu Val Asn His Leu Thr Phe Ser Asn Ser Lys Tyr Lys
785                 790                 795                 800

Tyr Ser Val Val Ser Val Asn Gly Lys Gln Thr Ser Asn Leu Arg Asn
                805                 810                 815

Gln Ile Ala Phe Val Gly Ile Lys Asn Asn Lys Glu Thr Glu Arg Glu
            820                 825                 830

Trp Lys Arg Pro Glu Gly Phe Lys Ser Ile Asn Ser Asn Asp Phe Leu
        835                 840                 845
```

```
Ile Arg Glu Glu Gly Lys Asn Asp Val Lys Asp Asp Val Leu Ile Lys
    850                 855                 860

Asp Arg Ser Phe Asn Gly His His Ala Glu Asp Ala Tyr Phe Ile Thr
865                 870                 875                 880

Ile Ile Ser Gln Tyr Phe Arg Ser Phe Lys Arg Ile Glu Arg Leu Asn
                885                 890                 895

Val Asn Tyr Arg Lys Glu Thr Arg Glu Leu Asp Asp Leu Glu Lys Asn
            900                 905                 910

Asn Ile Lys Phe Lys Glu Lys Ala Ser Phe Asp Asn Phe Leu Leu Ile
        915                 920                 925

Asn Ala Leu Asp Glu Leu Asn Glu Lys Leu Asn Gln Met Arg Phe Ser
    930                 935                 940

Arg Met Val Ile Thr Lys Lys Asn Thr Gln Leu Phe Asn Glu Thr Leu
945                 950                 955                 960

Tyr Ser Gly Lys Tyr Asp Lys Gly Lys Asn Thr Ile Lys Lys Val Glu
                965                 970                 975

Lys Leu Asn Leu Leu Asp Asn Arg Thr Asp Lys Ile Lys Lys Ile Glu
            980                 985                 990

Glu Phe Phe Asp Glu Asp Lys Leu  Lys Glu Asn Glu Leu  Thr Lys Leu
        995                 1000                1005

His Ile  Phe Asn His Asp Lys  Asn Leu Tyr Glu Thr  Leu Lys Ile
    1010                1015                1020

Ile Trp  Asn Glu Val Lys Ile  Glu Ile Lys Asn Lys  Asn Leu Asn
    1025                1030                1035

Glu Lys  Asn Tyr Phe Lys Tyr  Phe Val Asn Lys Lys  Leu Gln Glu
```

```
    1040                1045                1050

Gly Lys  Ile Ser Phe Asn Glu  Trp Val Pro Ile Leu  Asp Asn Asp
    1055                1060                1065

Phe Lys  Ile Ile Arg Lys Ile  Arg Tyr Ile Lys Phe  Ser Ser Glu
    1070                1075                1080

Glu Lys  Glu Thr Asp Glu Ile  Ile Phe Ser Gln Ser  Asn Phe Leu
    1085                1090                1095

Lys Ile  Asp Gln Arg Gln Asn  Phe Ser Phe His Asn  Thr Leu Tyr
    1100                1105                1110

Trp Val  Gln Ile Trp Val Tyr  Lys Asn Gln Lys Asp  Gln Tyr Cys
    1115                1120                1125

Phe Ile  Ser Ile Asp Ala Arg  Asn Ser Lys Phe Glu  Lys Asp Glu
    1130                1135                1140

Ile Lys  Ile Asn Tyr Glu Lys  Leu Lys Thr Gln Lys  Glu Lys Leu
    1145                1150                1155

Gln Ile  Ile Asn Glu Glu Pro  Ile Leu Lys Ile Asn  Lys Gly Asp
    1160                1165                1170

Leu Phe  Glu Asn Glu Glu Lys  Glu Leu Phe Tyr Ile  Val Gly Arg
    1175                1180                1185

Asp Glu  Lys Pro Gln Lys Leu  Glu Ile Lys Tyr Ile  Leu Gly Lys
    1190                1195                1200

Lys Ile  Lys Asp Gln Lys Gln  Ile Gln Lys Pro Val  Lys Lys Tyr
    1205                1210                1215

Phe Pro  Asn Trp Lys Lys Val  Asn Leu Thr Tyr Met  Gly Glu Ile
    1220                1225                1230
```

Phe Lys Lys
    1235

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<211> 1372
<212> PRT
<213> Legionella pneumophila

<400> 22

Met Glu Ser Ser Gln Ile Leu Ser Pro Ile Gly Ile Asp Leu Gly Gly
1   5   10   15

Lys Phe Thr Gly Val Cys Leu Ser His Leu Glu Ala Phe Ala Glu Leu
            20   25   30

Pro Asn His Ala Asn Thr Lys Tyr Ser Val Ile Leu Ile Asp His Asn
        35   40   45

Asn Phe Gln Leu Ser Gln Ala Gln Arg Arg Ala Thr Arg His Arg Val
    50   55   60

Arg Asn Lys Lys Arg Asn Gln Phe Val Lys Arg Val Ala Leu Gln Leu
65   70   75   80

Phe Gln His Ile Leu Ser Arg Asp Leu Asn Ala Lys Glu Glu Thr Ala
                85   90   95

Leu Cys His Tyr Leu Asn Asn Arg Gly Tyr Thr Tyr Val Asp Thr Asp
            100   105   110

Leu Asp Glu Tyr Ile Lys Asp Glu Thr Thr Ile Asn Leu Leu Lys Glu
        115   120   125

Leu Leu Pro Ser Glu Ser Glu His Asn Phe Ile Asp Trp Phe Leu Gln
    130   135   140

Lys Met Gln Ser Ser Glu Phe Arg Lys Ile Leu Val Ser Lys Val Glu
145   150   155   160

```
Glu Lys Lys Asp Asp Lys Glu Leu Lys Asn Ala Val Lys Asn Ile Lys
                165                 170                 175

Asn Phe Ile Thr Gly Phe Glu Lys Asn Ser Val Glu Gly His Arg His
            180                 185                 190

Arg Lys Val Tyr Phe Glu Asn Ile Lys Ser Asp Ile Thr Lys Asp Asn
        195                 200                 205

Gln Leu Asp Ser Ile Lys Lys Lys Ile Pro Ser Val Cys Leu Ser Asn
    210                 215                 220

Leu Leu Gly His Leu Ser Asn Leu Gln Trp Lys Asn Leu His Arg Tyr
225                 230                 235                 240

Leu Ala Lys Asn Pro Lys Gln Phe Asp Glu Gln Thr Phe Gly Asn Glu
                245                 250                 255

Phe Leu Arg Met Leu Lys Asn Phe Arg His Leu Lys Gly Ser Gln Glu
            260                 265                 270

Ser Leu Ala Val Arg Asn Leu Ile Gln Gln Leu Glu Gln Ser Gln Asp
        275                 280                 285

Tyr Ile Ser Ile Leu Glu Lys Thr Pro Pro Glu Ile Thr Ile Pro Pro
    290                 295                 300

Tyr Glu Ala Arg Thr Asn Thr Gly Met Glu Lys Asp Gln Ser Leu Leu
305                 310                 315                 320

Leu Asn Pro Glu Lys Leu Asn Asn Leu Tyr Pro Asn Trp Arg Asn Leu
                325                 330                 335

Ile Pro Gly Ile Ile Asp Ala His Pro Phe Leu Glu Lys Asp Leu Glu
            340                 345                 350
```

```
His Thr Lys Leu Arg Asp Arg Lys Arg Ile Ile Ser Pro Ser Lys Gln
        355                 360                 365

Asp Glu Lys Arg Asp Ser Tyr Ile Leu Gln Arg Tyr Leu Asp Leu Asn
    370                 375                 380

Lys Lys Ile Asp Lys Phe Lys Ile Lys Lys Gln Leu Ser Phe Leu Gly
385                 390                 395                 400

Gln Gly Lys Gln Leu Pro Ala Asn Leu Ile Glu Thr Gln Lys Glu Met
                405                 410                 415

Glu Thr His Phe Asn Ser Ser Leu Val Ser Val Leu Ile Gln Ile Ala
            420                 425                 430

Ser Ala Tyr Asn Lys Glu Arg Glu Asp Ala Ala Gln Gly Ile Trp Phe
        435                 440                 445

Asp Asn Ala Phe Ser Leu Cys Glu Leu Ser Asn Ile Asn Pro Pro Arg
    450                 455                 460

Lys Gln Lys Ile Leu Pro Leu Leu Val Gly Ala Ile Leu Ser Glu Asp
465                 470                 475                 480

Phe Ile Asn Asn Lys Asp Lys Trp Ala Lys Phe Lys Ile Phe Trp Asn
                485                 490                 495

Thr His Lys Ile Gly Arg Thr Ser Leu Lys Ser Lys Cys Lys Glu Ile
            500                 505                 510

Glu Glu Ala Arg Lys Asn Ser Gly Asn Ala Phe Lys Ile Asp Tyr Glu
        515                 520                 525

Glu Ala Leu Asn His Pro Glu His Ser Asn Asn Lys Ala Leu Ile Lys
    530                 535                 540

Ile Ile Gln Thr Ile Pro Asp Ile Ile Gln Ala Ile Gln Ser His Leu
545                 550                 555                 560
```

```
Gly His Asn Asp Ser Gln Ala Leu Ile Tyr His Asn Pro Phe Ser Leu
               565                 570                 575

Ser Gln Leu Tyr Thr Ile Leu Glu Thr Lys Arg Asp Gly Phe His Lys
            580                 585                 590

Asn Cys Val Ala Val Thr Cys Glu Asn Tyr Trp Arg Ser Gln Lys Thr
        595                 600                 605

Glu Ile Asp Pro Glu Ile Ser Tyr Ala Ser Arg Leu Pro Ala Asp Ser
    610                 615                 620

Val Arg Pro Phe Asp Gly Val Leu Ala Arg Met Met Gln Arg Leu Ala
625                 630                 635                 640

Tyr Glu Ile Ala Met Ala Lys Trp Glu Gln Ile Lys His Ile Pro Asp
               645                 650                 655

Asn Ser Ser Leu Leu Ile Pro Ile Tyr Leu Glu Gln Asn Arg Phe Glu
            660                 665                 670

Phe Glu Glu Ser Phe Lys Lys Ile Lys Gly Ser Ser Ser Asp Lys Thr
        675                 680                 685

Leu Glu Gln Ala Ile Glu Lys Gln Asn Ile Gln Trp Glu Glu Lys Phe
    690                 695                 700

Gln Arg Ile Ile Asn Ala Ser Met Asn Ile Cys Pro Tyr Lys Gly Ala
705                 710                 715                 720

Ser Ile Gly Gly Gln Gly Glu Ile Asp His Ile Tyr Pro Arg Ser Leu
               725                 730                 735

Ser Lys Lys His Phe Gly Val Ile Phe Asn Ser Glu Val Asn Leu Ile
            740                 745                 750
```

```
Tyr Cys Ser Ser Gln Gly Asn Arg Glu Lys Lys Glu Glu His Tyr Leu
        755                 760                 765

Leu Glu His Leu Ser Pro Leu Tyr Leu Lys His Gln Phe Gly Thr Asp
    770                 775                 780

Asn Val Ser Asp Ile Lys Asn Phe Ile Ser Gln Asn Val Ala Asn Ile
785                 790                 795                 800

Lys Lys Tyr Ile Ser Phe His Leu Leu Thr Pro Glu Gln Gln Lys Ala
                805                 810                 815

Ala Arg His Ala Leu Phe Leu Asp Tyr Asp Asp Glu Ala Phe Lys Thr
            820                 825                 830

Ile Thr Lys Phe Leu Met Ser Gln Gln Lys Ala Arg Val Asn Gly Thr
        835                 840                 845

Gln Lys Phe Leu Gly Lys Gln Ile Met Glu Phe Leu Ser Thr Leu Ala
    850                 855                 860

Asp Ser Lys Gln Leu Gln Leu Glu Phe Ser Ile Lys Gln Ile Thr Ala
865                 870                 875                 880

Glu Glu Val His Asp His Arg Glu Leu Leu Ser Lys Gln Glu Pro Lys
                885                 890                 895

Leu Val Lys Ser Arg Gln Gln Ser Phe Pro Ser His Ala Ile Asp Ala
            900                 905                 910

Thr Leu Thr Met Ser Ile Gly Leu Lys Glu Phe Pro Gln Phe Ser Gln
        915                 920                 925

Glu Leu Asp Asn Ser Trp Phe Ile Asn His Leu Met Pro Asp Glu Val
    930                 935                 940

His Leu Asn Pro Val Arg Ser Lys Glu Lys Tyr Asn Lys Pro Asn Ile
945                 950                 955                 960
```

```
Ser Ser Thr Pro Leu Phe Lys Asp Ser Leu Tyr Ala Glu Arg Phe Ile
               965                 970                 975

Pro Val Trp Val Lys Gly Glu Thr Phe Ala Ile Gly Phe Ser Glu Lys
            980                 985                 990

Asp Leu Phe Glu Ile Lys Pro Ser  Asn Lys Glu Lys Leu  Phe Thr Leu
        995                 1000                1005

Leu Lys  Thr Tyr Ser Thr Lys  Asn Pro Gly Glu Ser  Leu Gln Glu
    1010                1015                1020

Leu Gln  Ala Lys Ser Lys Ala  Lys Trp Leu Tyr Phe  Pro Ile Asn
    1025                1030                1035

Lys Thr  Leu Ala Leu Glu Phe  Leu His His Tyr Phe  His Lys Glu
    1040                1045                1050

Ile Val  Thr Pro Asp Asp Thr  Thr Val Cys His Phe  Ile Asn Ser
    1055                1060                1065

Leu Arg  Tyr Tyr Thr Lys Lys  Glu Ser Ile Thr Val  Lys Ile Leu
    1070                1075                1080

Lys Glu  Pro Met Pro Val Leu  Ser Val Lys Phe Glu  Ser Ser Lys
    1085                1090                1095

Lys Asn  Val Leu Gly Ser Phe  Lys His Thr Ile Ala  Leu Pro Ala
    1100                1105                1110

Thr Lys  Asp Trp Glu Arg Leu  Phe Asn His Pro Asn  Phe Leu Ala
    1115                1120                1125

Leu Lys  Ala Asn Pro Ala Pro  Asn Pro Lys Glu Phe  Asn Glu Phe
    1130                1135                1140
```

```
Ile Arg  Lys Tyr Phe Leu Ser  Asp Asn Asn Pro Asn  Ser Asp Ile
    1145                1150                1155

Pro Asn  Asn Gly His Asn Ile  Lys Pro Gln Lys His  Lys Ala Val
    1160                1165                1170

Arg Lys  Val Phe Ser Leu Pro  Val Ile Pro Gly Asn  Ala Gly Thr
    1175                1180                1185

Met Met  Arg Ile Arg Arg Lys  Asp Asn Lys Gly Gln  Pro Leu Tyr
    1190                1195                1200

Gln Leu  Gln Thr Ile Asp Asp  Thr Pro Ser Met Gly  Ile Gln Ile
    1205                1210                1215

Asn Glu  Asp Arg Leu Val Lys  Gln Glu Val Leu Met  Asp Ala Tyr
    1220                1225                1230

Lys Thr  Arg Asn Leu Ser Thr  Ile Asp Gly Ile Asn  Asn Ser Glu
    1235                1240                1245

Gly Gln  Ala Tyr Ala Thr Phe  Asp Asn Trp Leu Thr  Leu Pro Val
    1250                1255                1260

Ser Thr  Phe Lys Pro Glu Ile  Ile Lys Leu Glu Met  Lys Pro His
    1265                1270                1275

Ser Lys  Thr Arg Arg Tyr Ile  Arg Ile Thr Gln Ser  Leu Ala Asp
    1280                1285                1290

Phe Ile  Lys Thr Ile Asp Glu  Ala Leu Met Ile Lys  Pro Ser Asp
    1295                1300                1305

Ser Ile  Asp Asp Pro Leu Asn  Met Pro Asn Glu Ile  Val Cys Lys
    1310                1315                1320

Asn Lys  Leu Phe Gly Asn Glu  Leu Lys Pro Arg Asp  Gly Lys Met
    1325                1330                1335
```

Lys Ile Val Ser Thr Gly Lys Ile Val Thr Tyr Glu Phe Glu Ser
    1340   1345   1350

Asp Ser Thr Pro Gln Trp Ile Gln Thr Leu Tyr Val Thr Gln Leu
    1355   1360   1365

Lys Lys Gln Pro
    1370

<210> 23
<211> 1122
<212> PRT
<213> Streptococcus thermophilus

<400> 23

Met Ser Asp Leu Val Leu Gly Leu Asp Ile Gly Ile Gly Ser Val Gly
1   5   10   15

Val Gly Ile Leu Asn Lys Val Thr Gly Glu Ile Ile His Lys Asn Ser
            20   25   30

Arg Ile Phe Pro Ala Ala Gln Ala Glu Asn Asn Leu Val Arg Arg Thr
        35   40   45

Asn Arg Gln Gly Arg Arg Leu Thr Arg Arg Lys Lys His Arg Ile Val
    50   55   60

Arg Leu Asn Arg Leu Phe Glu Glu Ser Gly Leu Ile Thr Asp Phe Thr
65   70   75   80

Lys Ile Ser Ile Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly Leu
                85   90   95

Thr Asp Glu Leu Ser Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Met
            100   105   110

Val Lys His Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Asp Asp Gly

```
        115                 120                 125

Asn Ser Ser Val Gly Asp Tyr Ala Gln Ile Val Lys Glu Asn Ser Lys
    130                 135                 140

Gln Leu Glu Thr Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Tyr Gln
145                 150                 155                 160

Thr Tyr Gly Gln Leu Arg Gly Asp Phe Thr Val Glu Lys Asp Gly Lys
                165                 170                 175

Lys His Arg Leu Ile Asn Val Phe Pro Thr Ser Ala Tyr Arg Ser Glu
            180                 185                 190

Ala Leu Arg Ile Leu Gln Thr Gln Gln Glu Phe Asn Ser Gln Ile Thr
        195                 200                 205

Asp Glu Phe Ile Asn Arg Tyr Leu Glu Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240

Tyr Arg Thr Asn Gly Glu Thr Leu Asp Asn Ile Phe Gly Ile Leu Ile
                245                 250                 255

Gly Lys Cys Thr Phe Tyr Pro Asp Glu Phe Arg Ala Ala Lys Ala Ser
            260                 265                 270

Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285

Val Pro Thr Glu Thr Lys Lys Leu Ser Lys Glu Gln Lys Asn Gln Ile
    290                 295                 300

Ile Asn Tyr Val Lys Asn Glu Lys Val Met Gly Pro Ala Lys Leu Phe
305                 310                 315                 320
```

```
Lys Tyr Ile Ala Lys Leu Leu Ser Cys Asp Val Ala Asp Ile Lys Gly
                325                 330                 335

His Arg Ile Asp Lys Ser Gly Lys Ala Glu Ile His Thr Phe Glu Ala
            340                 345                 350

Tyr Arg Lys Met Lys Thr Leu Glu Thr Leu Asp Ile Glu Gln Met Asp
        355                 360                 365

Arg Glu Thr Leu Asp Lys Leu Ala Tyr Val Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Gln Glu Ala Leu Glu His Glu Phe Ala Asp Gly Ser
385                 390                 395                 400

Phe Ser Gln Lys Gln Val Asp Glu Leu Val Gln Phe Arg Lys Ala Asn
                405                 410                 415

Ser Ser Ile Phe Gly Lys Gly Trp His Asn Phe Ser Val Lys Leu Met
            420                 425                 430

Met Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr
        435                 440                 445

Ile Leu Thr Arg Leu Gly Lys Gln Lys Thr Thr Ser Ser Ser Asn Lys
    450                 455                 460

Thr Lys Tyr Ile Asp Glu Lys Leu Leu Thr Glu Glu Ile Tyr Asn Pro
465                 470                 475                 480

Val Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Val Asn Ala Ala
                485                 490                 495

Ile Lys Glu Tyr Gly Asp Phe Asp Asn Ile Val Ile Glu Met Ala Arg
            500                 505                 510

Glu Thr Asn Glu Asp Asp Glu Lys Lys Ala Ile Gln Lys Ile Gln Lys
```

```
        515                 520                 525

Ala Asn Lys Asp Glu Lys Asp Ala Ala Met Leu Lys Ala Ala Asn Gln
    530                 535                 540

Tyr Asn Gly Lys Ala Glu Leu Pro His Ser Val Phe His Gly His Lys
545                 550                 555                 560

Gln Leu Ala Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Arg Cys
                565                 570                 575

Leu Tyr Thr Gly Lys Thr Ile Ser Ile His Asp Leu Ile Asn Asn Pro
            580                 585                 590

Asn Gln Phe Glu Val Asp His Ile Leu Pro Leu Ser Ile Thr Phe Asp
        595                 600                 605

Asp Ser Leu Ala Asn Lys Val Leu Val Tyr Ala Thr Ala Asn Gln Glu
    610                 615                 620

Lys Gly Gln Arg Thr Pro Tyr Gln Ala Leu Asp Ser Met Asp Asp Ala
625                 630                 635                 640

Trp Ser Phe Arg Glu Leu Lys Ala Phe Val Arg Glu Ser Lys Thr Leu
                645                 650                 655

Ser Asn Lys Lys Lys Glu Tyr Leu Leu Thr Glu Glu Asp Ile Ser Lys
            660                 665                 670

Phe Asp Val Arg Lys Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Ala Ser Arg Val Val Leu Asn Ala Leu Gln Glu His Phe Arg Ala
    690                 695                 700

His Lys Ile Asp Thr Lys Val Ser Val Val Arg Gly Gln Phe Thr Ser
705                 710                 715                 720
```

```
Gln Leu Arg Arg His Trp Gly Ile Glu Lys Thr Arg Asp Thr Tyr His
               725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Asn
            740                 745                 750

Leu Trp Lys Lys Gln Lys Asn Thr Leu Val Ser Tyr Ser Glu Glu Gln
        755                 760                 765

Leu Leu Asp Ile Glu Thr Gly Glu Leu Ile Ser Asp Asp Glu Tyr Lys
    770                 775                 780

Glu Ser Val Phe Lys Ala Pro Tyr Gln His Phe Val Asp Thr Leu Lys
785                 790                 795                 800

Ser Lys Glu Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln Val Asp Ser
               805                 810                 815

Lys Phe Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg Gln
            820                 825                 830

Ala Lys Val Gly Lys Asp Lys Lys Asp Glu Thr Tyr Val Leu Gly Lys
        835                 840                 845

Ile Lys Asp Ile Tyr Thr Gln Asp Gly Tyr Asp Ala Phe Met Lys Ile
    850                 855                 860

Tyr Lys Lys Asp Lys Ser Lys Phe Leu Met Tyr Arg His Asp Pro Gln
865                 870                 875                 880

Thr Phe Glu Lys Val Ile Glu Pro Ile Leu Glu Asn Tyr Pro Asn Lys
               885                 890                 895

Glu Met Asn Glu Lys Gly Lys Glu Val Pro Cys Asn Pro Phe Leu Lys
            900                 905                 910

Tyr Lys Glu Glu His Gly Tyr Ile Arg Lys Tyr Ser Lys Lys Gly Asn
```

```
        915                 920                 925

Gly Pro Glu Ile Lys Ser Leu Lys Tyr Tyr Asp Ser Lys Leu Leu Gly
    930                 935                 940

Asn Pro Ile Asp Ile Thr Pro Glu Asn Ser Lys Asn Lys Val Val Leu
945                 950                 955                 960

Gln Ser Leu Lys Pro Trp Arg Thr Asp Val Tyr Phe Asn Lys Asn Thr
                965                 970                 975

Gly Lys Tyr Glu Ile Leu Gly Leu Lys Tyr Ala Asp Leu Gln Phe Glu
            980                 985                 990

Lys Lys Thr Gly Thr Tyr Lys Ile  Ser Gln Glu Lys Tyr  Asn Gly Ile
        995                 1000                1005

Met Lys  Glu Glu Gly Val Asp  Ser Asp Ser Glu Phe  Lys Phe Thr
    1010                1015                1020

Leu Tyr  Lys Asn Asp Leu Leu  Leu Val Lys Asp Thr  Glu Thr Lys
    1025                1030                1035

Glu Gln  Gln Leu Phe Arg Phe  Leu Ser Arg Thr Met  Pro Asn Val
    1040                1045                1050

Lys Tyr  Tyr Val Glu Leu Lys  Pro Tyr Ser Lys Asp  Lys Phe Glu
    1055                1060                1065

Lys Asn  Glu Ser Leu Ile Glu  Ile Leu Gly Ser Ala  Asp Lys Ser
    1070                1075                1080

Gly Arg  Cys Ile Lys Gly Leu  Gly Lys Ser Asn Ile  Ser Ile Tyr
    1085                1090                1095

Lys Val  Arg Thr Asp Val Leu  Gly Asn Gln His Ile  Ile Lys Asn
    1100                1105                1110
```

Glu Gly Asp Lys Pro Lys Leu Asp Phe
    1115   1120

<210> 24
<211> 1128
<212> PRT
<213> Streptococcus thermophilus

<400> 24

Met Ser Asp Leu Val Leu Gly Leu Asp Ile Gly Ile Gly Ser Val Gly
1   5   10   15

Val Gly Ile Leu Asn Lys Val Thr Gly Glu Ile Ile His Lys Asn Ser
            20   25   30

Arg Ile Phe Pro Ala Ala Gln Ala Glu Asn Asn Leu Val Arg Arg Thr
        35   40   45

Asn Arg Gln Gly Arg Arg Leu Thr Arg Arg Lys Lys His Arg Ile Val
    50   55   60

Arg Leu Asn Arg Leu Phe Glu Glu Ser Gly Leu Ile Thr Asp Phe Thr
65   70   75   80

Lys Ile Ser Ile Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly Leu
                85   90   95

Thr Asp Glu Leu Ser Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Met
            100   105   110

Val Lys His Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Asp Asp Gly
        115   120   125

Asn Ser Ser Val Gly Asp Tyr Ala Gln Ile Val Lys Glu Asn Ser Lys
    130   135   140

Gln Leu Glu Thr Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Tyr Gln
145   150   155   160

```
Thr Tyr Gly Gln Leu Arg Gly Asp Phe Thr Val Glu Lys Asp Gly Lys
                165                 170                 175

Lys His Arg Leu Ile Asn Val Phe Pro Thr Ser Ala Tyr Arg Ser Glu
            180                 185                 190

Ala Leu Arg Ile Leu Gln Thr Gln Gln Glu Phe Asn Pro Gln Ile Thr
        195                 200                 205

Asp Glu Phe Ile Asn Arg Tyr Leu Glu Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240

Tyr Arg Thr Ser Gly Glu Thr Leu Asp Asn Ile Phe Gly Ile Leu Ile
                245                 250                 255

Gly Lys Cys Thr Phe Tyr Pro Glu Glu Phe Arg Ala Ala Lys Ala Ser
            260                 265                 270

Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285

Val Pro Thr Glu Thr Lys Lys Leu Ser Lys Glu Gln Lys Asn Gln Ile
    290                 295                 300

Ile Asn Tyr Val Lys Asn Glu Lys Ala Met Gly Pro Ala Lys Leu Phe
305                 310                 315                 320

Lys Tyr Ile Ala Lys Leu Leu Ser Cys Asp Val Ala Asp Ile Lys Gly
                325                 330                 335

Tyr Arg Ile Asp Lys Ser Gly Lys Ala Glu Ile His Thr Phe Glu Ala
            340                 345                 350
```

```
Tyr Arg Lys Met Lys Thr Leu Glu Thr Leu Asp Ile Glu Gln Met Asp
        355                 360                 365

Arg Glu Thr Leu Asp Lys Leu Ala Tyr Val Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Gln Glu Ala Leu Glu His Glu Phe Ala Asp Gly Ser
385                 390                 395                 400

Phe Ser Gln Lys Gln Val Asp Glu Leu Val Gln Phe Arg Lys Ala Asn
                405                 410                 415

Ser Ser Ile Phe Gly Lys Gly Trp His Asn Phe Ser Val Lys Leu Met
            420                 425                 430

Met Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr
        435                 440                 445

Ile Leu Thr Arg Leu Gly Lys Gln Lys Arg Leu Arg Leu Gln Ile Lys
    450                 455                 460

Gln Asn Ile Ser Asn Lys Thr Lys Tyr Ile Asp Glu Lys Leu Leu Thr
465                 470                 475                 480

Glu Glu Ile Tyr Asn Pro Val Val Ala Lys Ser Val Arg Gln Ala Ile
                485                 490                 495

Lys Ile Val Asn Ala Ala Ile Lys Glu Tyr Gly Asp Phe Asp Asn Ile
            500                 505                 510

Val Ile Glu Met Ala Arg Glu Thr Asn Glu Asp Asp Glu Lys Lys Ala
        515                 520                 525

Ile Gln Lys Ile Gln Lys Ala Asn Lys Asp Glu Lys Asp Ala Ala Met
    530                 535                 540

Leu Lys Ala Ala Asn Gln Tyr Asn Gly Lys Ala Glu Leu Pro His Ser
545                 550                 555                 560
```

```
Val Phe His Gly His Lys Gln Leu Ala Thr Lys Ile Arg Leu Trp His
                565                 570                 575

Gln Gln Gly Glu Arg Cys Leu Tyr Thr Gly Lys Thr Ile Ser Ile His
            580                 585                 590

Asp Leu Ile Asn Asn Pro Asn Gln Phe Glu Val Asp His Ile Leu Pro
        595                 600                 605

Leu Ser Ile Thr Phe Asp Asp Ser Leu Ala Asn Lys Val Leu Val Tyr
    610                 615                 620

Ala Thr Ala Asn Gln Glu Lys Gly Gln Arg Thr Pro Tyr Gln Ala Leu
625                 630                 635                 640

Asp Ser Met Asp Asp Ala Trp Ser Phe Arg Glu Leu Lys Ala Phe Val
                645                 650                 655

Arg Glu Ser Lys Thr Leu Ser Asn Lys Lys Lys Glu Tyr Leu Leu Thr
            660                 665                 670

Glu Glu Asp Ile Ser Lys Phe Asp Val Arg Lys Lys Phe Ile Glu Arg
        675                 680                 685

Asn Leu Val Asp Thr Arg Tyr Ala Ser Arg Val Val Leu Asn Ala Leu
    690                 695                 700

Gln Glu His Phe Arg Ala His Lys Ile Asp Thr Lys Val Ser Val Val
705                 710                 715                 720

Arg Gly Gln Phe Thr Ser Gln Leu Arg Arg His Trp Gly Ile Glu Lys
                725                 730                 735

Thr Arg Asp Thr Tyr His His His Ala Val Asp Ala Leu Ile Ile Ala
            740                 745                 750
```

```
Ala Ser Ser Gln Leu Asn Leu Trp Lys Lys Gln Lys Asn Thr Leu Val
        755                 760                 765

Ser Tyr Ser Glu Glu Gln Leu Leu Asp Ile Glu Thr Gly Glu Leu Ile
    770                 775                 780

Ser Asp Asp Glu Tyr Lys Glu Ser Val Phe Lys Ala Pro Tyr Gln His
785                 790                 795                 800

Phe Val Asp Thr Leu Lys Ser Lys Glu Phe Glu Asp Ser Ile Leu Phe
                805                 810                 815

Ser Tyr Gln Val Asp Ser Lys Phe Asn Arg Lys Ile Ser Asp Ala Thr
            820                 825                 830

Ile Tyr Ala Thr Arg Gln Ala Lys Val Gly Lys Asp Lys Lys Asp Glu
        835                 840                 845

Thr Tyr Val Leu Gly Lys Ile Lys Asp Ile Tyr Thr Gln Asp Gly Tyr
    850                 855                 860

Asp Ala Phe Met Lys Ile Tyr Lys Lys Asp Lys Ser Lys Phe Leu Met
865                 870                 875                 880

Tyr Arg His Asp Pro Gln Thr Phe Glu Lys Val Ile Glu Pro Ile Leu
                885                 890                 895

Glu Asn Tyr Pro Asn Lys Gln Met Asn Glu Lys Gly Lys Glu Val Pro
            900                 905                 910

Cys Asn Pro Phe Leu Lys Tyr Lys Glu Glu His Gly Tyr Ile Arg Lys
        915                 920                 925

Tyr Ser Lys Lys Gly Asn Gly Pro Glu Ile Lys Ser Leu Lys Tyr Tyr
    930                 935                 940

Asp Ser Lys Leu Leu Gly Asn Pro Ile Asp Ile Thr Pro Glu Asn Ser
945                 950                 955                 960
```

```
Lys Asn Lys Val Val Leu Gln Ser Leu Lys Pro Trp Arg Thr Asp Val
               965                 970                 975


Tyr Phe Asn Lys Ala Thr Gly Lys Tyr Glu Ile Leu Gly Leu Lys Tyr
            980                 985                 990


Ala Asp Leu Gln Phe Glu Lys Gly  Thr Gly Thr Tyr Lys  Ile Ser Gln
        995                 1000                1005


Glu Lys  Tyr Asn Asp Ile Lys  Lys Lys Glu Gly Val  Asp Ser Asp
    1010                1015                1020


Ser Glu  Phe Lys Phe Thr Leu  Tyr Lys Asn Asp Leu  Leu Leu Val
    1025                1030                1035


Lys Asp  Thr Glu Thr Lys Glu  Gln Gln Leu Phe Arg  Phe Leu Ser
    1040                1045                1050


Arg Thr  Leu Pro Lys Gln Lys  His Tyr Val Glu Leu  Lys Pro Tyr
    1055                1060                1065


Asp Lys  Gln Lys Phe Glu Gly  Gly Glu Ala Leu Ile  Lys Val Leu
    1070                1075                1080


Gly Asn  Val Ala Asn Gly Gly  Gln Cys Ile Lys Gly  Leu Ala Lys
    1085                1090                1095


Ser Asn  Ile Ser Ile Tyr Lys  Val Arg Thr Asp Val  Leu Gly Asn
    1100                1105                1110


Gln His  Ile Ile Lys Asn Glu  Gly Asp Lys Pro Lys  Leu Asp Phe
    1115                1120                1125


<210>  25
<211>  1123
<212>  PRT
<213>  Francisella tularensis
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<400> 25

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Met Asn Val Lys Ile Leu Pro Ile Ala Ile Asp Leu Asp Val Lys Asn
1               5                  10                  15

Thr Gly Val Phe Ser Ala Phe Tyr Gln Lys Gly Thr Ser Leu Glu Lys
            20                  25                  30

Leu Asp Asn Lys Asn Gly Lys Val Tyr Glu Leu Ser Lys Asp Ser Tyr
        35                  40                  45

Thr Leu Leu Met Asn Asn Arg Thr Ala Arg Arg His Lys Arg Arg Gly
    50                  55                  60

Ile Asp Arg Lys Gln Leu Val Lys Arg Leu Phe Lys Leu Val Trp Thr
65                  70                  75                  80

Glu Gln Leu Asn Leu Glu Trp Asp Lys Asp Thr Gln Gln Ala Ile Ser
                85                  90                  95

Phe Leu Phe Asn Arg Arg Gly Phe Ser Phe Ile Thr Asp Gly Tyr Ser
            100                 105                 110

Thr Glu Tyr Leu Asn Ile Val Pro Glu Gln Val Lys Ala Ile Leu Met
        115                 120                 125

Asp Ile Phe Asp Asp Tyr Asn Gly Glu Asp Asp Leu Asp Ser Tyr Leu
    130                 135                 140

Lys Leu Ala Thr Glu Gln Glu Ser Lys Ile Ser Glu Ile Tyr Asn Lys
145                 150                 155                 160

Leu Met Gln Lys Ile Leu Glu Phe Lys Leu Arg Lys Leu Cys Thr Asp
                165                 170                 175

Ile Lys Asp Asp Lys Val Ser Thr Lys Thr Leu Lys Glu Ile Thr Ser
            180                 185                 190
```

```
Tyr Glu Phe Glu Leu Leu Ala Asp Tyr Leu Ala Asn Tyr Ser Glu Ser
        195                 200                 205

Leu Lys Thr Gln Lys Phe Ser Tyr Thr Asp Lys Gln Gly Asn Leu Lys
    210                 215                 220

Glu Leu Ser Tyr Tyr His His Asp Lys Tyr Asn Ile Gln Glu Phe Leu
225                 230                 235                 240

Lys Arg His Ala Thr Ile Asn Asp Glu Ile Leu Gly Thr Leu Leu Thr
                245                 250                 255

Asp Asp Phe Asp Ile Trp Asn Phe Asn Phe Glu Lys Phe Asp Phe Asp
            260                 265                 270

Lys Asn Glu Glu Lys Leu Gln Asn Gln Glu Asp Lys Asp His Thr Gln
        275                 280                 285

Ala His Leu His His Phe Val Phe Val Val Asn Lys Ile Lys Ser Glu
    290                 295                 300

Met Ala Ser Gly Gly Arg His Arg Ser Gln Tyr Phe Gln Glu Ile Thr
305                 310                 315                 320

Asn Val Leu Asp Glu Asn Asn His Gln Glu Gly Tyr Leu Lys Asn Phe
                325                 330                 335

Cys Glu Asn Leu His Asn Lys Lys Tyr Ser Asn Leu Ser Val Lys Asn
            340                 345                 350

Leu Val Asn Leu Val Gly Asn Leu Ser Asn Leu Glu Leu Lys Pro Leu
        355                 360                 365

Arg Lys Tyr Phe Asn Asp Lys Ile His Ala Lys Ala Asp His Trp Asp
    370                 375                 380

Glu Gln Lys Phe Thr Glu Thr Tyr Cys His Trp Ile Leu Gly Glu Trp
```

```
385                 390                 395                 400

Arg Val Gly Val Lys Asp Gln Asp Lys Lys Asp Gly Ala Lys Tyr Ser
                405                 410                 415

Tyr Lys Asp Leu Cys Asn Glu Leu Lys Gln Lys Val Thr Lys Ala Gly
            420                 425                 430

Leu Ile Asp Phe Leu Leu Glu Leu Asp Pro Cys Arg Thr Ile Pro Pro
        435                 440                 445

Tyr Leu Asp Asn Asn Asn Arg Lys Pro Pro Lys Cys Gln Ser Leu Ile
    450                 455                 460

Leu Asn Pro Lys Phe Leu Asp Asn Gln Tyr Pro Asn Trp Gln Gln Tyr
465                 470                 475                 480

Leu Gln Glu Leu Lys Lys Leu Gln Ser Ile Gln Asp Tyr Leu Asp Ser
                485                 490                 495

Phe Glu Thr Asp Leu Lys Asp Leu Lys Ser Ser Lys Asp Gln Pro Tyr
            500                 505                 510

Phe Val Glu Tyr Lys Ser Ser Asn Gln Gln Met Ala Ser Gly Gln Arg
        515                 520                 525

Asp Tyr Lys Asp Leu Asp Ala Arg Ile Leu Gln Phe Ile Phe Asp Arg
    530                 535                 540

Val Lys Ala Ser Asp Glu Leu Leu Leu Asn Glu Ile Tyr Phe Gln Ala
545                 550                 555                 560

Lys Lys Leu Lys Gln Lys Ala Ser Ser Glu Leu Glu Lys Leu Glu Ser
                565                 570                 575

Ser Lys Lys Leu Asp Glu Val Ile Ala Asn Ser Gln Leu Ser Gln Ile
            580                 585                 590
```

```
Leu Lys Ser Gln His Thr Asn Gly Ile Phe Glu Gln Gly Thr Phe Leu
        595                 600                 605

His Leu Val Cys Lys Tyr Tyr Lys Gln Arg Gln Arg Ala Arg Asp Ser
    610                 615                 620

Arg Leu Tyr Ile Met Pro Glu Tyr Arg Tyr Asp Lys Lys Leu Asp Lys
625                 630                 635                 640

Tyr Asn Asn Thr Gly Arg Phe Asp Asp Asn Asn Gln Leu Leu Thr Tyr
                645                 650                 655

Cys Asn His Lys Pro Arg Gln Lys Arg Tyr Gln Leu Leu Asn Asp Leu
            660                 665                 670

Ala Gly Val Leu Gln Val Ser Arg Asn Gln Leu Leu Ser Ser Val Glu
        675                 680                 685

Glu Trp Phe Gln Gln Ala Gln Arg Val Gly Glu Ile Ser Lys Ser Gln
    690                 695                 700

Asp Glu Gln Ile Phe Glu Trp Leu Lys Ser Phe Lys Ile Ala Ser Tyr
705                 710                 715                 720

Cys Lys Ala Ala Val Glu Met Gln Lys Gln Tyr Arg Gly Thr Leu Lys
                725                 730                 735

Asn Ala Ile Gln Thr Ala Ile Phe Arg Gln Ser Glu Asn Ile Asn Lys
            740                 745                 750

Asn Lys Asn Thr Gly Asn Gln Gln Gln Ala Leu Ser Glu Asn Ser Lys
        755                 760                 765

Asp Val Lys Ser Leu Thr Ala Asp Glu Lys Lys Leu Leu Lys Leu Ile
    770                 775                 780

Glu Asn Ile Ala Lys Ala Ser Gln Lys Ile Gly Glu Ser Leu Gly Leu
```

785 790 795 800

Asn Asp Lys Gln Ile Lys Lys Phe Asn Ser Ile Tyr Ser Phe Ala Gln
805 810 815

Ile Gln Gln Ile Ala Phe Ala Lys Arg Lys Gly Asn Ala Asn Thr Cys
820 825 830

Ala Val Cys Ser Ala Asp Asn Ala His Arg Met Gln Gln Ile Lys Ile
835 840 845

Thr Glu Leu Val Glu Asp Asn Lys Asp Asn Ile Ile Leu Ser Ala Lys
850 855 860

Ala Gln Arg Leu Pro Ala Ile Pro Thr Arg Ile Val Asp Gly Ala Val
865 870 875 880

Lys Lys Met Ala Thr Ile Leu Ala Lys Asn Ile Val Asp Asp Asn Trp
885 890 895

Gln Asn Ile Lys Gln Val Leu Ser Ala Lys His Gln Leu His Ile Pro
900 905 910

Ile Ile Thr Glu Ser Asn Ala Phe Glu Phe Glu Pro Ala Leu Ala Asp
915 920 925

Val Lys Gly Lys Ser Leu Lys Asp Arg Arg Lys Lys Ala Leu Glu Arg
930 935 940

Ile Ser Pro Glu Asn Ile Phe Lys Asp Lys Asn Asn Arg Ile Lys Glu
945 950 955 960

Phe Ala Lys Gly Ile Ser Ala Tyr Ser Gly Ala Asn Leu Thr Asp Gly
965 970 975

Asp Phe Asp Gly Ala Lys Glu Glu Leu Asp His Ile Ile Pro Arg Ser
980 985 990

```
His Lys Lys Tyr Gly Thr Leu Asn  Asp Glu Ala Asn Leu  Ile Cys Val
        995                 1000                1005


Thr Arg  Asp Asp Asn Lys Asn  Ile Phe Ala Ile Asp  Thr Ser Lys
    1010                1015                1020


Trp Phe  Glu Ile Glu Thr Pro  Ser Asp Leu Arg Asp  Ile Gly Val
    1025                1030                1035


Ala Thr  Ile Gln Tyr Lys Ile  Asp Asn Asn Ser Arg  Pro Lys Val
    1040                1045                1050


Arg Val  Lys Leu Asp Tyr Val  Ile Asp Asp Asp Ser  Lys Ile Asn
    1055                1060                1065


Tyr Phe  Met Asn His Ser Leu  Leu Lys Ser Arg Tyr  Pro Asp Lys
    1070                1075                1080


Val Leu  Glu Ile Leu Lys Gln  Ser Thr Ile Ile Glu  Phe Glu Ser
    1085                1090                1095


Ser Gly  Phe Asn Lys Thr Ile  Lys Glu Met Leu Gly  Met Thr Leu
    1100                1105                1110


Ala Gly  Ile Tyr Asn Glu Thr  Ser Asn Asn
    1115                1120


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<212>  PRT
<213>  Bacteroides fragilis

<400>  26

Met Lys Arg Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Leu Val Asn Glu Ala Glu Asn Lys Asp Glu Arg Ser Ser Ile Val
            20                  25                  30
```

```
Lys Leu Gly Val Arg Val Asn Pro Leu Thr Val Asp Glu Leu Thr Asn
        35                  40                  45

Phe Glu Lys Gly Lys Ser Ile Thr Thr Asn Ala Asp Arg Thr Leu Lys
    50                  55                  60

Arg Gly Met Arg Arg Asn Leu Gln Arg Tyr Lys Leu Arg Arg Glu Thr
65                  70                  75                  80

Leu Thr Glu Val Leu Lys Glu His Lys Leu Ile Thr Glu Asp Thr Ile
                85                  90                  95

Leu Ser Glu Asn Gly Asn Arg Thr Thr Phe Glu Thr Tyr Arg Leu Arg
            100                 105                 110

Ala Lys Ala Val Thr Glu Glu Ile Ser Leu Glu Glu Phe Ala Arg Val
        115                 120                 125

Leu Leu Met Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Ala
    130                 135                 140

Lys Gly Val Glu Glu Gly Thr Leu Ile Asp Gly Met Asp Ile Ala Arg
145                 150                 155                 160

Glu Leu Tyr Asn Asn Asn Leu Thr Pro Gly Glu Leu Cys Leu Gln Leu
                165                 170                 175

Leu Asp Ala Gly Lys Lys Phe Leu Pro Asp Phe Tyr Arg Ser Asp Leu
            180                 185                 190

Gln Asn Glu Leu Asp Arg Ile Trp Glu Lys Gln Lys Glu Tyr Tyr Pro
        195                 200                 205

Glu Ile Leu Thr Asp Val Leu Lys Glu Glu Leu Arg Gly Lys Lys Arg
    210                 215                 220
```

```
Asp Ala Val Trp Ala Ile Cys Ala Lys Tyr Phe Val Trp Lys Glu Asn
225                 230                 235                 240

Tyr Thr Glu Trp Asn Lys Glu Lys Gly Lys Thr Glu Gln Gln Glu Arg
                245                 250                 255

Glu His Lys Leu Glu Gly Ile Tyr Ser Lys Arg Lys Arg Asp Glu Ala
            260                 265                 270

Lys Arg Glu Asn Leu Gln Trp Arg Val Asn Gly Leu Lys Glu Lys Leu
        275                 280                 285

Ser Leu Glu Gln Leu Val Ile Val Phe Gln Glu Met Asn Thr Gln Ile
    290                 295                 300

Asn Asn Ser Ser Gly Tyr Leu Gly Ala Ile Ser Asp Arg Ser Lys Glu
305                 310                 315                 320

Leu Tyr Phe Asn Lys Gln Thr Val Gly Gln Tyr Gln Met Glu Met Leu
                325                 330                 335

Asp Lys Asn Pro Asn Ala Ser Leu Arg Asn Met Val Phe Tyr Arg Gln
            340                 345                 350

Asp Tyr Leu Asp Glu Phe Asn Met Leu Trp Glu Lys Gln Ala Val Tyr
        355                 360                 365

His Lys Glu Leu Thr Glu Glu Leu Lys Lys Glu Ile Arg Asp Ile Ile
    370                 375                 380

Ile Phe Tyr Gln Arg Arg Leu Lys Ser Gln Lys Gly Leu Ile Gly Phe
385                 390                 395                 400

Cys Glu Phe Glu Ser Arg Gln Ile Glu Val Asp Ile Asp Gly Lys Lys
                405                 410                 415

Lys Ile Lys Thr Val Gly Asn Arg Val Ile Ser Arg Ser Ser Pro Leu
            420                 425                 430
```

```
Phe Gln Glu Phe Lys Ile Trp Gln Ile Leu Asn Asn Ile Glu Val Thr
        435                 440                 445

Val Val Gly Lys Lys Arg Lys Arg Arg Lys Leu Lys Glu Asn Tyr Ser
    450                 455                 460

Ala Leu Phe Glu Glu Leu Asn Asp Ala Glu Gln Leu Glu Leu Asn Gly
465                 470                 475                 480

Ser Arg Arg Leu Cys Gln Glu Glu Lys Glu Leu Leu Ala Gln Glu Leu
                485                 490                 495

Phe Ile Arg Asp Lys Met Thr Lys Ser Glu Val Leu Lys Leu Leu Phe
            500                 505                 510

Asp Asn Pro Gln Glu Leu Asp Leu Asn Phe Lys Thr Ile Asp Gly Asn
        515                 520                 525

Lys Thr Gly Tyr Ala Leu Phe Gln Ala Tyr Ser Lys Met Ile Glu Met
    530                 535                 540

Ser Gly His Glu Pro Val Asp Phe Lys Lys Pro Val Glu Lys Val Val
545                 550                 555                 560

Glu Tyr Ile Lys Ala Val Phe Asp Leu Leu Asn Trp Asn Thr Asp Ile
                565                 570                 575

Leu Gly Phe Asn Ser Asn Glu Glu Leu Asp Asn Gln Pro Tyr Tyr Lys
            580                 585                 590

Leu Trp His Leu Leu Tyr Ser Phe Glu Gly Asp Asn Thr Pro Thr Gly
        595                 600                 605

Asn Gly Arg Leu Ile Gln Lys Met Thr Glu Leu Tyr Gly Phe Glu Lys
    610                 615                 620
```

```
Glu Tyr Ala Thr Ile Leu Ala Asn Val Ser Phe Gln Asp Asp Tyr Gly
625                 630                 635                 640

Ser Leu Ser Ala Lys Ala Ile His Lys Ile Leu Pro His Leu Lys Glu
                645                 650                 655

Gly Asn Arg Tyr Asp Val Ala Cys Val Tyr Ala Gly Tyr Arg His Ser
            660                 665                 670

Glu Ser Ser Leu Thr Arg Glu Glu Ile Ala Asn Lys Val Leu Lys Asp
        675                 680                 685

Arg Leu Met Leu Leu Pro Lys Asn Ser Leu His Asn Pro Val Val Glu
    690                 695                 700

Lys Ile Leu Asn Gln Met Val Asn Val Ile Asn Val Ile Ile Asp Ile
705                 710                 715                 720

Tyr Gly Lys Pro Asp Glu Ile Arg Val Glu Leu Ala Arg Glu Leu Lys
                725                 730                 735

Lys Asn Ala Lys Glu Arg Glu Glu Leu Thr Lys Ser Ile Ala Gln Thr
            740                 745                 750

Thr Lys Ala His Glu Glu Tyr Lys Thr Leu Leu Gln Thr Glu Phe Gly
        755                 760                 765

Leu Thr Asn Val Ser Arg Thr Asp Ile Leu Arg Tyr Lys Leu Tyr Lys
    770                 775                 780

Glu Leu Glu Ser Cys Gly Tyr Lys Thr Leu Tyr Ser Asn Thr Tyr Ile
785                 790                 795                 800

Ser Arg Glu Lys Leu Phe Ser Lys Glu Phe Asp Ile Glu His Ile Ile
                805                 810                 815

Pro Gln Ala Arg Leu Phe Asp Asp Ser Phe Ser Asn Lys Thr Leu Glu
            820                 825                 830
```

```
Ala Arg Ser Val Asn Ile Glu Lys Gly Asn Lys Thr Ala Tyr Asp Phe
        835                 840                 845

Val Lys Glu Lys Phe Gly Glu Ser Gly Ala Asp Asn Ser Leu Glu His
    850                 855                 860

Tyr Leu Asn Asn Ile Glu Asp Leu Phe Lys Ser Gly Lys Ile Ser Lys
865                 870                 875                 880

Thr Lys Tyr Asn Lys Leu Lys Met Ala Glu Gln Asp Ile Pro Asp Gly
                885                 890                 895

Phe Ile Glu Arg Asp Leu Arg Asn Thr Gln Tyr Ile Ala Lys Lys Ala
            900                 905                 910

Leu Ser Met Leu Asn Glu Ile Ser His Arg Val Val Ala Thr Ser Gly
        915                 920                 925

Ser Val Thr Asp Lys Leu Arg Glu Asp Trp Gln Leu Ile Asp Val Met
    930                 935                 940

Lys Glu Leu Asn Trp Glu Lys Tyr Lys Ala Leu Gly Leu Val Glu Tyr
945                 950                 955                 960

Phe Glu Asp Arg Asp Gly Arg Gln Ile Gly Arg Ile Lys Asp Trp Thr
                965                 970                 975

Lys Arg Asn Asp His Arg His His Ala Met Asp Ala Leu Thr Val Ala
            980                 985                 990

Phe Thr Lys Asp Val Phe Ile Gln  Tyr Phe Asn Asn Lys  Asn Ala Ser
        995                 1000                1005

Leu Asp  Pro Asn Ala Asn Glu  His Ala Ile Lys Asn  Lys Tyr Phe
    1010                1015                1020
```

```
Gln Asn  Gly Arg Ala Ile Ala  Pro Met Pro Leu Arg  Glu Phe Arg
    1025                1030                1035

Ala Glu  Ala Lys Lys His Leu  Glu Asn Thr Leu Ile  Ser Ile Lys
    1040                1045                1050

Ala Lys  Asn Lys Val Ile Thr  Gly Asn Ile Asn Lys  Thr Arg Lys
    1055                1060                1065

Lys Gly  Gly Val Asn Lys Asn  Met Gln Gln Thr Pro  Arg Gly Gln
    1070                1075                1080

Leu His  Leu Glu Thr Ile Tyr  Gly Ser Gly Lys Gln  Tyr Leu Thr
    1085                1090                1095

Lys Glu  Glu Lys Val Asn Ala  Ser Phe Asp Met Arg  Lys Ile Gly
    1100                1105                1110

Thr Val  Ser Lys Ser Ala Tyr  Arg Asp Ala Leu Leu  Lys Arg Leu
    1115                1120                1125

Tyr Glu  Asn Asp Asn Asp Pro  Lys Lys Ala Phe Ala  Gly Lys Asn
    1130                1135                1140

Ser Leu  Asp Lys Gln Pro Ile  Trp Leu Asp Lys Glu  Gln Met Arg
    1145                1150                1155

Lys Val  Pro Glu Lys Val Lys  Ile Val Thr Leu Glu  Ala Ile Tyr
    1160                1165                1170

Thr Ile  Arg Lys Glu Ile Ser  Pro Asp Leu Lys Val  Asp Lys Val
    1175                1180                1185

Ile Asp  Val Gly Val Arg Lys  Ile Leu Ile Asp Arg  Leu Asn Glu
    1190                1195                1200

Tyr Gly  Asn Asp Ala Lys Lys  Ala Phe Ser Asn Leu  Asp Lys Asn
    1205                1210                1215
```

```
Pro Ile  Trp Leu Asn Lys Glu  Lys Gly Ile Ser Ile  Lys Arg Val
    1220                1225                1230

Thr Ile  Ser Gly Ile Ser Asn  Ala Gln Ser Leu His  Val Lys Lys
    1235                1240                1245

Asp Lys  Asp Gly Lys Pro Ile  Leu Asp Glu Asn Gly  Arg Asn Ile
    1250                1255                1260

Pro Val  Asp Phe Val Asn Thr  Gly Asn Asn His His  Val Ala Val
    1265                1270                1275

Tyr Tyr  Arg Pro Val Ile Asp  Lys Arg Gly Gln Leu  Val Val Asp
    1280                1285                1290

Glu Ala  Gly Asn Pro Lys Tyr  Glu Leu Glu Glu Val  Val Val Ser
    1295                1300                1305

Phe Phe  Glu Ala Val Thr Arg  Ala Asn Leu Gly Leu  Pro Ile Ile
    1310                1315                1320

Asp Lys  Asp Tyr Lys Thr Thr  Glu Gly Trp Gln Phe  Leu Phe Ser
    1325                1330                1335

Met Lys  Gln Asn Glu Tyr Phe  Val Phe Pro Asn Glu  Lys Thr Gly
    1340                1345                1350

Phe Asn  Pro Lys Glu Ile Asp  Leu Leu Asp Val Glu  Asn Tyr Gly
    1355                1360                1365

Leu Ile  Ser Pro Asn Leu Phe  Arg Val Gln Lys Phe  Ser Leu Lys
    1370                1375                1380

Asn Tyr  Val Phe Arg His His  Leu Glu Thr Thr Ile  Lys Asp Thr
    1385                1390                1395
```

```
Ser Ser  Ile Leu Arg Gly Ile  Thr Trp Ile Asp Phe  Arg Ser Ser
    1400                1405                1410


Lys Gly  Leu Asp Thr Ile Val  Lys Val Arg Val Asn  His Ile Gly
    1415                1420                1425


Gln Ile  Val Ser Val Gly Glu  Tyr
    1430                1435
```

<210> 27
<211> 1314
<212> PRT
<213> Mycoplasma synoviae

<400> 27

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Met Leu Arg Leu Tyr Cys Ala Asn Asn Leu Val Leu Asn Asn Val Gln
1               5                   10                  15


Asn Leu Trp Lys Tyr Leu Leu Leu Leu Ile Phe Asp Lys Lys Ile Ile
            20                  25                  30


Phe Leu Phe Lys Ile Lys Val Ile Leu Ile Arg Arg Tyr Met Glu Asn
        35                  40                  45


Asn Asn Lys Glu Lys Ile Val Ile Gly Phe Asp Leu Gly Val Ala Ser
    50                  55                  60


Val Gly Trp Ser Ile Val Asn Ala Glu Thr Lys Glu Val Ile Asp Leu
65                  70                  75                  80


Gly Val Arg Leu Phe Ser Glu Pro Glu Lys Ala Asp Tyr Arg Arg Ala
                85                  90                  95


Lys Arg Thr Thr Arg Arg Leu Leu Arg Arg Lys Lys Phe Lys Arg Glu
            100                 105                 110


Lys Phe His Lys Leu Ile Leu Lys Asn Ala Glu Ile Phe Gly Leu Gln
        115                 120                 125
```

```
Ser Arg Asn Glu Ile Leu Asn Val Tyr Lys Asp Gln Ser Ser Lys Tyr
    130                 135                 140

Arg Asn Ile Leu Lys Leu Lys Ile Asn Ala Leu Lys Glu Glu Ile Lys
145                 150                 155                 160

Pro Ser Glu Leu Val Trp Ile Leu Arg Asp Tyr Leu Gln Asn Arg Gly
                165                 170                 175

Tyr Phe Tyr Lys Asn Glu Lys Leu Thr Asp Glu Phe Val Ser Asn Ser
            180                 185                 190

Phe Pro Ser Lys Lys Leu His Glu His Tyr Glu Lys Tyr Gly Phe Phe
        195                 200                 205

Arg Gly Ser Val Lys Leu Asp Asn Lys Leu Asp Asn Lys Lys Asp Lys
    210                 215                 220

Ala Lys Glu Lys Asp Glu Glu Glu Glu Ser Asp Ala Lys Lys Glu Ser
225                 230                 235                 240

Glu Glu Leu Ile Phe Ser Asn Lys Gln Trp Ile Asn Glu Ile Val Lys
                245                 250                 255

Val Phe Glu Asn Gln Ser Tyr Leu Thr Glu Ser Phe Lys Glu Glu Tyr
            260                 265                 270

Leu Lys Leu Phe Asn Tyr Val Arg Pro Phe Asn Lys Gly Pro Gly Ser
        275                 280                 285

Lys Asn Ser Arg Thr Ala Tyr Gly Val Phe Ser Thr Asp Ile Asp Pro
    290                 295                 300

Glu Thr Asn Lys Phe Lys Asp Tyr Ser Asn Ile Trp Asp Lys Thr Ile
305                 310                 315                 320

Gly Lys Cys Ser Leu Phe Glu Glu Glu Ile Arg Ala Pro Lys Asn Leu
```

```
                325                 330                 335

Pro Ser Ala Leu Ile Phe Asn Leu Gln Asn Glu Ile Cys Thr Ile Lys
            340                 345                 350

Asn Glu Phe Thr Glu Phe Lys Asn Trp Trp Leu Asn Ala Glu Gln Lys
        355                 360                 365

Ser Glu Ile Leu Lys Phe Val Phe Thr Glu Leu Phe Asn Trp Lys Asp
    370                 375                 380

Lys Lys Tyr Ser Asp Lys Lys Phe Asn Lys Asn Leu Gln Asp Lys Ile
385                 390                 395                 400

Lys Lys Tyr Leu Leu Asn Phe Ala Leu Glu Asn Phe Asn Leu Asn Glu
                405                 410                 415

Glu Ile Leu Lys Asn Arg Asp Leu Glu Asn Asp Thr Val Leu Gly Leu
            420                 425                 430

Lys Gly Val Lys Tyr Tyr Glu Lys Ser Asn Ala Thr Ala Asp Ala Ala
        435                 440                 445

Leu Glu Phe Ser Ser Leu Lys Pro Leu Tyr Val Phe Ile Lys Phe Leu
    450                 455                 460

Lys Glu Lys Lys Leu Asp Leu Asn Tyr Leu Leu Gly Leu Glu Asn Thr
465                 470                 475                 480

Glu Ile Leu Tyr Phe Leu Asp Ser Ile Tyr Leu Ala Ile Ser Tyr Ser
                485                 490                 495

Ser Asp Leu Lys Glu Arg Asn Glu Trp Phe Lys Lys Leu Leu Lys Glu
            500                 505                 510

Leu Tyr Pro Lys Ile Lys Asn Asn Asn Leu Glu Ile Ile Glu Asn Val
        515                 520                 525
```

```
Glu Asp Ile Phe Glu Ile Thr Asp Gln Glu Lys Phe Glu Ser Phe Ser
    530                 535                 540

Lys Thr His Ser Leu Ser Arg Glu Ala Phe Asn His Ile Ile Pro Leu
545                 550                 555                 560

Leu Leu Ser Asn Asn Glu Gly Lys Asn Tyr Glu Ser Leu Lys His Ser
                565                 570                 575

Asn Glu Glu Leu Lys Lys Arg Thr Glu Lys Ala Glu Leu Lys Ala Gln
            580                 585                 590

Gln Asn Gln Lys Tyr Leu Lys Asp Asn Phe Leu Lys Glu Ala Leu Val
        595                 600                 605

Pro Leu Ser Val Lys Thr Ser Val Leu Gln Ala Ile Lys Ile Phe Asn
    610                 615                 620

Gln Ile Ile Lys Asn Phe Gly Lys Lys Tyr Glu Ile Ser Gln Val Val
625                 630                 635                 640

Ile Glu Met Ala Arg Glu Leu Thr Lys Pro Asn Leu Glu Lys Leu Leu
                645                 650                 655

Asn Asn Ala Thr Asn Ser Asn Ile Lys Ile Leu Lys Glu Lys Leu Asp
            660                 665                 670

Gln Thr Glu Lys Phe Asp Asp Phe Thr Lys Lys Lys Phe Ile Asp Lys
        675                 680                 685

Ile Glu Asn Ser Val Val Phe Arg Asn Lys Leu Phe Leu Trp Phe Glu
    690                 695                 700

Gln Asp Arg Lys Asp Pro Tyr Thr Gln Leu Asp Ile Lys Ile Asn Glu
705                 710                 715                 720

Ile Glu Asp Glu Thr Glu Ile Asp His Val Ile Pro Tyr Ser Lys Ser
```

```
                725                 730                 735

Ala Asp Asp Ser Trp Phe Asn Lys Leu Leu Val Lys Lys Ser Thr Asn
            740                 745                 750

Gln Leu Lys Lys Asn Lys Thr Val Trp Glu Tyr Tyr Gln Asn Glu Ser
        755                 760                 765

Asp Pro Glu Ala Lys Trp Asn Lys Phe Val Ala Trp Ala Lys Arg Ile
    770                 775                 780

Tyr Leu Val Gln Lys Ser Asp Lys Glu Ser Lys Asp Asn Ser Glu Lys
785                 790                 795                 800

Asn Ser Ile Phe Lys Asn Lys Lys Pro Asn Leu Lys Phe Lys Asn Ile
                805                 810                 815

Thr Lys Lys Leu Phe Asp Pro Tyr Lys Asp Leu Gly Phe Leu Ala Arg
            820                 825                 830

Asn Leu Asn Asp Thr Arg Tyr Ala Thr Lys Val Phe Arg Asp Gln Leu
        835                 840                 845

Asn Asn Tyr Ser Lys His His Ser Lys Asp Asp Glu Asn Lys Leu Phe
    850                 855                 860

Lys Val Val Cys Met Asn Gly Ser Ile Thr Ser Phe Leu Arg Lys Ser
865                 870                 875                 880

Met Trp Arg Lys Asn Glu Glu Gln Val Tyr Arg Phe Asn Phe Trp Lys
                885                 890                 895

Lys Asp Arg Asp Gln Phe Phe His His Ala Val Asp Ala Ser Ile Ile
            900                 905                 910

Ala Ile Phe Ser Leu Leu Thr Lys Thr Leu Tyr Asn Lys Leu Arg Val
        915                 920                 925
```

```
Tyr Glu Ser Tyr Asp Val Gln Arg Arg Glu Asp Gly Val Tyr Leu Ile
    930                 935                 940

Asn Lys Glu Thr Gly Glu Val Lys Lys Ala Asp Lys Asp Tyr Trp Lys
945                 950                 955                 960

Asp Gln His Asn Phe Leu Lys Ile Arg Glu Asn Ala Ile Glu Ile Lys
                965                 970                 975

Asn Val Leu Asn Asn Val Asp Phe Gln Asn Gln Val Arg Tyr Ser Arg
            980                 985                 990

Lys Ala Asn Thr Lys Leu Asn Thr  Gln Leu Phe Asn Glu  Thr Leu Tyr
        995                 1000                1005

Gly Val  Lys Glu Phe Glu Asn  Asn Phe Tyr Lys Leu  Glu Lys Val
    1010                1015                1020

Asn Leu  Phe Ser Arg Lys Asp  Leu Arg Lys Phe Ile  Leu Glu Asp
    1025                1030                1035

Leu Asn  Glu Glu Ser Glu Lys  Asn Lys Lys Asn Glu  Asn Gly Ser
    1040                1045                1050

Arg Lys  Arg Ile Leu Thr Glu  Lys Tyr Ile Val Asp  Glu Ile Leu
    1055                1060                1065

Gln Ile  Leu Glu Asn Glu Glu  Phe Lys Asp Ser Lys  Ser Asp Ile
    1070                1075                1080

Asn Ala  Leu Asn Lys Tyr Met  Asp Ser Leu Pro Ser  Lys Phe Ser
    1085                1090                1095

Glu Phe  Phe Ser Gln Asp Phe  Ile Asn Lys Cys Lys  Lys Glu Asn
    1100                1105                1110

Ser Leu  Ile Leu Thr Phe Asp  Ala Ile Lys His Asn  Asp Pro Lys
```

```
    1115                1120                1125

Lys Val  Ile Lys Ile Lys Asn  Leu Lys Phe Phe Arg  Glu Asp Ala
    1130                1135                1140

Thr Leu  Lys Asn Lys Gln Ala  Val His Lys Asp Ser  Lys Asn Gln
    1145                1150                1155

Ile Lys  Ser Phe Tyr Glu Ser  Tyr Lys Cys Val Gly  Phe Ile Trp
    1160                1165                1170

Leu Lys  Asn Lys Asn Asp Leu  Glu Glu Ser Ile Phe  Val Pro Ile
    1175                1180                1185

Asn Ser  Arg Val Ile His Phe  Gly Asp Lys Asp Lys  Asp Ile Phe
    1190                1195                1200

Asp Phe  Asp Ser Tyr Asn Lys  Glu Lys Leu Leu Asn  Glu Ile Asn
    1205                1210                1215

Leu Lys  Arg Pro Glu Asn Lys  Lys Phe Asn Ser Ile  Asn Glu Ile
    1220                1225                1230

Glu Phe  Val Lys Phe Val Lys  Pro Gly Ala Leu Leu  Leu Asn Phe
    1235                1240                1245

Glu Asn  Gln Gln Ile Tyr Tyr  Ile Ser Thr Leu Glu  Ser Ser Ser
    1250                1255                1260

Leu Arg  Ala Lys Ile Lys Leu  Leu Asn Lys Met Asp  Lys Gly Lys
    1265                1270                1275

Ala Val  Ser Met Lys Lys Ile  Thr Asn Pro Asp Glu  Tyr Lys Ile
    1280                1285                1290

Ile Glu  His Val Asn Pro Leu  Gly Ile Asn Leu Asn  Trp Thr Lys
    1295                1300                1305
```

Lys Leu Glu Asn Asn Asn
    1310

<210> 28
<211> 1368
<212> PRT
<213> Streptococcus pyogenes

<400> 28

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20   25   30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35   40   45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50   55   60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65   70   75   80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85   90   95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100   105   110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115   120   125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130   135   140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145   150   155   160

```
Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Leu Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350
```

```
Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560
```

```
Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
               565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
               645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
               725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750
```

```
Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asn Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser
945                 950                 955                 960
```

```
Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
               965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
           980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020

Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050

Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080

Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140
```

```
Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155

Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170

Phe Glu  Lys Asn Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Arg Lys Asp Leu Ile  Val Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215

Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230

Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245

Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260

His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275

Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290

Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                1300                1305

Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
    1310                1315                1320

Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1325                1330                1335
```

Thr Lys Glu Val Leu Asp Ala Thr Phe Ile His Gln Ser Ile Thr
1340 1345 1350

Gly Leu Tyr Glu Thr Arg Ile Asp Leu Ser Gln Leu Gly Gly Asp
1355 1360 1365

<210> 29
<211> 1368
<212> PRT
<213> Streptococcus pyogenes

<400> 29

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
20 25 30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
85 90 95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
100 105 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
115 120 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp

```
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335
```

```
Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
```

```
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735
```

```
Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
```

```
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser
945                 950                 955                 960

Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020

Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050

Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080

Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125
```

```
Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155

Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170

Phe Glu  Lys Asn Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Lys Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215

Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230

Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245

Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260

His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275

Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290

Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                1300                1305

Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
```

```
    1310                1315                1320

Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1325                1330                1335

Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1340                1345                1350

Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                1360                1365
```

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<211> 1370
<212> PRT
<213> Streptococcus agalactiae

<400> 30

```
Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110
```

```
Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320
```

```
Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510
```

```
Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720
```

```
Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
               725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asp Leu Asn Gly Asn Ile
785                 790                 795                 800

Leu Lys Glu Tyr Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu
               805                 810                 815

Phe Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala
            820                 825                 830

Leu Asp Ile Asp Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro
        835                 840                 845

Gln Ala Phe Ile Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser
    850                 855                 860

Ser Ala Lys Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile
865                 870                 875                 880

Val Lys Asp Cys Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu
               885                 890                 895

Met Ser Gln Arg Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly
            900                 905                 910
```

```
Leu Thr Ser Asp Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu
        915                 920                 925

Thr Arg Gln Ile Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe
    930                 935                 940

Asn Asn Glu Leu Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile
945                 950                 955                 960

Val Thr Leu Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly
                965                 970                 975

Phe Tyr Lys Ile Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala
            980                 985                 990

Tyr Leu Asn Ala Val Val Ala Lys  Ala Ile Leu Thr Lys  Tyr Pro Gln
        995                 1000                1005

Leu Glu  Pro Glu Phe Val Tyr  Gly Asp Tyr Pro Lys  Tyr Asn Ser
    1010                1015                1020

Tyr Lys  Thr Arg Lys Ser Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser
    1025                1030                1035

Asn Ile  Met Asn Phe Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly
    1040                1045                1050

Thr Val  Val Val Lys Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly
    1055                1060                1065

Glu Ile  Val Trp Asp Lys Lys  Lys His Phe Ala Thr  Val Arg Lys
    1070                1075                1080

Val Leu  Ser Tyr Pro Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile
    1085                1090                1095

Gln Thr  Gly Gly Phe Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn
    1100                1105                1110
```

```
Ser Asp  Lys Leu Ile Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp
    1115                1120                1125

Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser
    1130                1135                1140

Val Leu  Val Val Ala Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu
    1145                1150                1155

Lys Thr  Val Thr Glu Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser
    1160                1165                1170

Arg Phe  Glu Lys Asn Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr
    1175                1180                1185

Leu Asn  Ile Arg Ala Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser
    1190                1195                1200

Leu Phe  Glu Leu Glu Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala
    1205                1210                1215

Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe
    1220                1225                1230

Met Lys  Phe Leu Tyr Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly
    1235                1240                1245

Lys Pro  Glu Glu Ile Glu Lys  Lys Gln Glu Phe Val  Asn Gln His
    1250                1255                1260

Val Ser  Tyr Phe Asp Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser
    1265                1270                1275

Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys
    1280                1285                1290
```

```
Leu Tyr  Gln Asp Asn Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala
    1295                1300                1305


Asn Asn  Ile Ile Asn Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro
    1310                1315                1320


Ala Ala  Phe Lys Phe Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr
    1325                1330                1335


Thr Ser  Thr Lys Glu Val Leu  Asn Ser Thr Leu Ile  His Gln Ser
    1340                1345                1350


Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly
    1355                1360                1365


Glu Asp
    1370


<210>  31
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<212>  PRT
<213>  Rhodospirillum rubrum

<400>  31

Met Arg Pro Ile Glu Pro Trp Ile Leu Gly Leu Asp Ile Gly Thr Asp
1               5                   10                  15


Ser Leu Gly Trp Ala Val Phe Ser Cys Glu Glu Lys Gly Pro Pro Thr
            20                  25                  30


Ala Lys Glu Leu Leu Gly Gly Gly Val Arg Leu Phe Asp Ser Gly Arg
        35                  40                  45


Asp Ala Lys Asp His Thr Ser Arg Gln Ala Glu Arg Gly Ala Phe Arg
    50                  55                  60


Arg Ala Arg Arg Gln Thr Arg Thr Trp Pro Trp Arg Arg Asp Arg Leu
65                  70                  75                  80
```

```
Ile Ala Leu Phe Gln Ala Ala Gly Leu Thr Pro Pro Ala Ala Glu Thr
                85                  90                  95

Arg Gln Ile Ala Leu Ala Leu Arg Arg Glu Ala Val Ser Arg Pro Leu
            100                 105                 110

Ala Pro Asp Ala Leu Trp Ala Ala Leu Leu His Leu Ala His His Arg
        115                 120                 125

Gly Phe Arg Ser Asn Arg Ile Asp Lys Arg Glu Arg Ala Ala Ala Lys
    130                 135                 140

Ala Leu Ala Lys Ala Lys Pro Ala Lys Ala Thr Ala Lys Ala Thr Ala
145                 150                 155                 160

Pro Ala Lys Glu Ala Asp Asp Glu Ala Gly Phe Trp Glu Gly Ala Glu
                165                 170                 175

Ala Ala Leu Arg Gln Arg Met Ala Ala Ser Gly Ala Pro Thr Val Gly
            180                 185                 190

Ala Leu Leu Ala Asp Asp Leu Asp Arg Gly Gln Pro Val Arg Met Arg
        195                 200                 205

Tyr Asn Gln Ser Asp Arg Asp Gly Val Val Ala Pro Thr Arg Ala Leu
    210                 215                 220

Ile Ala Glu Glu Leu Ala Glu Ile Val Ala Arg Gln Ser Ser Ala Tyr
225                 230                 235                 240

Pro Gly Leu Asp Trp Pro Ala Val Thr Arg Leu Val Leu Asp Gln Arg
                245                 250                 255

Pro Leu Arg Ser Lys Gly Ala Gly Pro Cys Ala Phe Leu Pro Gly Glu
            260                 265                 270

Asp Arg Ala Leu Arg Ala Leu Pro Thr Val Gln Asp Phe Ile Ile Arg
```

```
        275                 280                 285

Gln Thr Leu Ala Asn Leu Arg Leu Pro Ser Thr Ser Ala Asp Glu Pro
    290                 295                 300

Arg Pro Leu Thr Asp Glu Glu His Ala Lys Ala Leu Ala Leu Leu Ser
305                 310                 315                 320

Thr Ala Arg Phe Val Glu Trp Pro Ala Leu Arg Arg Ala Leu Gly Leu
                325                 330                 335

Lys Arg Gly Val Lys Phe Thr Ala Glu Thr Glu Arg Asn Gly Ala Lys
            340                 345                 350

Gln Ala Ala Arg Gly Thr Ala Gly Asn Leu Thr Glu Ala Ile Leu Ala
        355                 360                 365

Pro Leu Ile Pro Gly Trp Ser Gly Trp Asp Leu Asp Arg Lys Asp Arg
    370                 375                 380

Val Phe Ser Asp Leu Trp Ala Ala Arg Gln Asp Arg Ser Ala Leu Leu
385                 390                 395                 400

Ala Leu Ile Gly Asp Pro Arg Gly Pro Thr Arg Val Thr Glu Asp Glu
                405                 410                 415

Thr Ala Glu Ala Val Ala Asp Ala Ile Gln Ile Val Leu Pro Thr Gly
            420                 425                 430

Arg Ala Ser Leu Ser Ala Lys Ala Ala Arg Ala Ile Ala Gln Ala Met
        435                 440                 445

Ala Pro Gly Ile Gly Tyr Asp Glu Ala Val Thr Leu Ala Leu Gly Leu
    450                 455                 460

His His Ser His Arg Pro Arg Gln Glu Arg Leu Ala Arg Leu Pro Tyr
465                 470                 475                 480
```

```
Tyr Ala Ala Ala Leu Pro Asp Val Gly Leu Asp Gly Asp Pro Val Gly
                485                 490                 495

Pro Pro Pro Ala Glu Asp Asp Gly Ala Ala Ala Glu Ala Tyr Tyr Gly
            500                 505                 510

Arg Ile Gly Asn Ile Ser Val His Ile Ala Leu Asn Glu Thr Arg Lys
        515                 520                 525

Ile Val Asn Ala Leu Leu His Arg His Gly Pro Ile Leu Arg Leu Val
    530                 535                 540

Met Val Glu Thr Thr Arg Glu Leu Lys Ala Gly Ala Asp Glu Arg Lys
545                 550                 555                 560

Arg Met Ile Ala Glu Gln Ala Glu Arg Glu Arg Glu Asn Ala Glu Ile
                565                 570                 575

Asp Val Glu Leu Arg Lys Ser Asp Arg Trp Met Ala Asn Ala Arg Glu
            580                 585                 590

Arg Arg Gln Arg Val Arg Leu Ala Arg Arg Gln Asn Asn Leu Cys Pro
        595                 600                 605

Tyr Thr Ser Thr Pro Ile Gly His Ala Asp Leu Leu Gly Asp Ala Tyr
    610                 615                 620

Asp Ile Asp His Val Ile Pro Leu Ala Arg Gly Gly Arg Asp Ser Leu
625                 630                 635                 640

Asp Asn Met Val Leu Cys Gln Ser Asp Ala Asn Lys Thr Lys Gly Asp
                645                 650                 655

Lys Thr Pro Trp Glu Ala Phe His Asp Lys Pro Gly Trp Ile Ala Gln
            660                 665                 670

Arg Asp Asp Phe Leu Ala Arg Leu Asp Pro Gln Thr Ala Lys Ala Leu
```

```
        675                 680                 685

Ala Trp Arg Phe Ala Asp Asp Ala Gly Glu Arg Val Ala Arg Lys Ser
    690                 695                 700

Ala Glu Asp Glu Asp Gln Gly Phe Leu Pro Arg Gln Leu Thr Asp Thr
705                 710                 715                 720

Gly Tyr Ile Ala Arg Val Ala Leu Arg Tyr Leu Ser Leu Val Thr Asn
                725                 730                 735

Glu Pro Asn Ala Val Val Ala Thr Asn Gly Arg Leu Thr Gly Leu Leu
            740                 745                 750

Arg Leu Ala Trp Asp Ile Thr Pro Gly Pro Ala Pro Arg Asp Leu Leu
        755                 760                 765

Pro Thr Pro Arg Asp Ala Leu Arg Asp Asp Thr Ala Ala Arg Arg Phe
    770                 775                 780

Leu Asp Gly Leu Thr Pro Pro Pro Leu Ala Lys Ala Val Glu Gly Ala
785                 790                 795                 800

Val Gln Ala Arg Leu Ala Ala Leu Gly Arg Ser Arg Val Ala Asp Ala
                805                 810                 815

Gly Leu Ala Asp Ala Leu Gly Leu Thr Leu Ala Ser Leu Gly Gly Gly
            820                 825                 830

Gly Lys Asn Arg Ala Asp His Arg His His Phe Ile Asp Ala Ala Met
        835                 840                 845

Ile Ala Val Thr Thr Arg Gly Leu Ile Asn Gln Ile Asn Gln Ala Ser
    850                 855                 860

Gly Ala Gly Arg Ile Leu Asp Leu Arg Lys Trp Pro Arg Thr Asn Phe
865                 870                 875                 880
```

```
Glu Pro Pro Tyr Pro Thr Phe Arg Ala Glu Val Met Lys Gln Trp Asp
               885                 890                 895


His Ile His Pro Ser Ile Arg Pro Ala His Arg Asp Gly Gly Ser Leu
            900                 905                 910


His Ala Ala Thr Val Phe Gly Val Arg Asn Arg Pro Asp Ala Arg Val
        915                 920                 925


Leu Val Gln Arg Lys Pro Val Glu Lys Leu Phe Leu Asp Ala Asn Ala
    930                 935                 940


Lys Pro Leu Pro Ala Asp Lys Ile Ala Glu Ile Ile Asp Gly Phe Ala
945                 950                 955                 960


Ser Pro Arg Met Ala Lys Arg Phe Lys Ala Leu Leu Ala Arg Tyr Gln
               965                 970                 975


Ala Ala His Pro Glu Val Pro Pro Ala Leu Ala Ala Leu Ala Val Ala
            980                 985                 990


Arg Asp Pro Ala Phe Gly Pro Arg  Gly Met Thr Ala Asn  Thr Val Ile
        995                 1000                1005


Ala Gly  Arg Ser Asp Gly Asp  Gly Glu Asp Ala Gly  Leu Ile Thr
    1010                1015                1020


Pro Phe  Arg Ala Asn Pro Lys  Ala Ala Val Arg Thr  Met Gly Asn
    1025                1030                1035


Ala Val  Tyr Glu Val Trp Glu  Ile Gln Val Lys Gly  Arg Pro Arg
    1040                1045                1050


Trp Thr  His Arg Val Leu Thr  Arg Phe Asp Arg Thr  Gln Pro Ala
    1055                1060                1065


Pro Pro  Pro Pro Pro Glu Asn  Ala Arg Leu Val Met  Arg Leu Arg
```

```
    1070                1075                1080

Arg Gly  Asp Leu Val Tyr Trp  Pro Leu Glu Ser Gly  Asp Arg Leu
    1085                1090                1095

Phe Leu  Val Lys Lys Met Ala  Val Asp Gly Arg Leu  Ala Leu Trp
    1100                1105                1110

Pro Ala  Arg Leu Ala Thr Gly  Lys Ala Thr Ala Leu  Tyr Ala Gln
    1115                1120                1125

Leu Ser  Cys Pro Asn Ile Asn  Leu Asn Gly Asp Gln  Gly Tyr Cys
    1130                1135                1140

Val Gln  Ser Ala Glu Gly Ile  Arg Lys Glu Lys Ile  Arg Thr Thr
    1145                1150                1155

Ser Cys  Thr Ala Leu Gly Arg  Leu Arg Leu Ser Lys  Lys Ala Thr
    1160                1165                1170


<210>  32
<211>  997
<212>  PRT
<213>  Maritimibacter alkaliphilus

<400>  32

Met Lys Val Leu Val Asp Ala Gly Leu Met Pro Ser Asp Pro Ala Ala
1               5                   10                  15

Ala Lys Ala Leu Glu Thr Leu Asp Pro Tyr Glu Leu Arg Ala Thr Gly
            20                  25                  30

Leu Asp Val Met Leu Pro Leu Thr His Leu Gly Arg Ala Val Phe His
        35                  40                  45

Leu Asn Gln Arg Arg Gly Phe Lys Ser Asn Arg Lys Thr Asp Arg Gly
    50                  55                  60
```

```
Asp Asn Glu Ser Gly Lys Ile Lys Asp Ala Thr Lys Arg Leu Thr Trp
65                  70                  75                  80

Ala Met Gln Glu Ala Gly Ala Arg Thr Tyr Gly Glu Phe Leu His Met
                85                  90                  95

Arg Arg Ala Arg Ala Ser Asp Pro Arg Gln Val Pro Ser Val Arg Thr
            100                 105                 110

Arg Leu Ser Val Ala Ser Arg Gly Gly Pro Asp Ser Lys Glu Glu Ala
        115                 120                 125

Gly Tyr Asp Phe Tyr Pro Glu Arg Ala His Leu Glu Asp Glu Phe His
    130                 135                 140

Ala Leu Trp Ser Ala Gln Ala Ala Phe His Pro Asp Leu Thr Cys Glu
145                 150                 155                 160

Leu Arg Asp Val Val Phe Glu Lys Ile Phe Tyr Gln Arg Pro Leu Lys
                165                 170                 175

Glu Pro Lys Val Gly Leu Cys Leu Phe Thr Ala Glu Glu Arg Leu Pro
            180                 185                 190

Lys Ala His Pro Leu Thr Gly Arg Arg Val Leu Tyr Glu Thr Val Asn
        195                 200                 205

Gln Leu Arg Val Thr Ala Asp Gly Arg Thr Thr Arg Pro Leu Thr Leu
    210                 215                 220

Glu Glu Arg Asp Met Ile Val Tyr Ala Leu Asp Asn Lys Lys Pro Val
225                 230                 235                 240

Lys Ser Leu Ser Ser Met His Leu Lys Leu Val Ala Leu Gly Lys Leu
                245                 250                 255

Val Lys Leu Lys Asp Gly Glu Arg Phe Thr Leu Glu Ser Gly Val Arg
            260                 265                 270
```

```
Asp Ala Ile Ala Cys Asp Pro Ile Arg Ala Thr Met Gly His Pro Asp
        275                 280                 285

Gly Phe Gly Pro Ala Trp Ser Arg Leu Asp Trp Gln Ala Gln Trp Ala
    290                 295                 300

Leu Ile Glu Lys Leu Arg Gln Val Gln Ser Asp Asp Asp Phe Ala Ser
305                 310                 315                 320

Leu Val Ala Trp Leu Gly Ala Thr His Asn Leu Ser Glu Asp His Ala
                325                 330                 335

Lys Arg Val Ala Asn Leu His Leu Pro Glu Gly Tyr Gly Arg Leu Gly
            340                 345                 350

Leu Thr Ala Thr Glu Ala Ile Leu Cys Asn Leu Lys Ala Glu Val Cys
        355                 360                 365

Thr Tyr Ser Gln Ala Val Glu Arg Trp Gly Lys His His Ser Asn Gln
    370                 375                 380

Arg Thr Gly Glu Cys Leu Glu Ala Leu Pro Tyr Tyr Gly Glu Val Leu
385                 390                 395                 400

Asp Arg His Val Ile Pro Gly Thr Tyr Asn Glu Asp Asp Asp Asp Val
                405                 410                 415

Thr Arg Tyr Gly Arg Ile Thr Asn Pro Thr Val His Ile Gly Leu Asn
            420                 425                 430

Gln Leu Arg Arg Leu Val Asn Arg Ile Ile Ala Thr Tyr Gly Lys Pro
        435                 440                 445

Asp Gln Ile Val Val Glu Leu Ala Arg Glu Leu Lys Gln Ser Glu Ala
    450                 455                 460
```

```
Gln Lys Ser Glu Ala Leu Lys Lys Ile Arg Asp Thr Thr Ala Asp Ala
465                 470                 475                 480

Ile Arg Arg Gly Arg Gln Leu Glu Glu Ile Gly Gln Lys Asn Thr Gly
                485                 490                 495

Ala Asn Arg Leu Leu Leu Arg Leu Trp Glu Asp Leu Gly Pro Ala Val
            500                 505                 510

Gly Pro Arg Cys Cys Pro Tyr Thr Gly Lys Pro Ile Ser Val Thr Met
        515                 520                 525

Leu Phe Asp Gly Ala Cys Asp Val Asp His Ile Leu Pro Tyr Ser Arg
    530                 535                 540

Thr Leu Asp Asp Ser Phe Ala Asn Arg Thr Ile Cys Leu Arg Glu Ala
545                 550                 555                 560

Asn Arg Gln Lys Gly Asp Arg Thr Pro Trp Glu Ala Trp Gly Gly Ser
                565                 570                 575

Asp Gln Trp Asp Ala Ile Glu Ala Asn Leu Lys Asp Leu Pro Glu Asn
            580                 585                 590

Lys Arg Lys Arg Phe Ala Pro Asp Ala Met Glu Arg Phe Glu Gly Glu
        595                 600                 605

Arg Asp Phe Leu Asp Arg Ala Leu Val Asp Thr Gln Tyr Leu Ala Arg
    610                 615                 620

Ile Ser Arg Ala Tyr Leu Asp Thr Leu Phe Thr Glu Gly Gly His Val
625                 630                 635                 640

Trp Val Val Pro Gly Arg Met Thr Glu Met Leu Arg Arg His Trp Gly
                645                 650                 655

Leu Asn Ala Leu Leu Ser Asp Lys Asp Arg Gly Ala Gly Lys Val Lys
            660                 665                 670
```

```
Asn Arg Thr Asp His Arg His His Ala Ile Asp Ala Ala Val Ile Ala
        675                 680                 685

Ala Thr Asp His Ser Leu Val Asn Arg Ile Ser Lys Ala Ala Gly Gln
    690                 695                 700

Gly Glu Ser Ala Gly Gln Ser Ala Glu Leu Ile Ala Arg Asp Thr Pro
705                 710                 715                 720

Glu Pro Trp Glu Gly Phe Arg Asn Asp Ile Ser Ala Gln Ile Ala Arg
                725                 730                 735

Ile Val Val Ser His Arg Ala Asp His Gly Arg Ile Asp Val Glu Gly
            740                 745                 750

Arg Lys His Gly Lys Asp Ser Thr Ala Gly Arg Leu His Asn Asp Thr
        755                 760                 765

Ala Tyr Gly Ile Val Asp Asp His Thr Val Val Ser Arg Thr Pro Leu
    770                 775                 780

Leu Ser Leu Lys Pro Gly Asp Ile Glu Val Thr Thr Lys Gly Lys Asn
785                 790                 795                 800

Ile Arg Asp Thr Gln Leu Gln Lys Ala Leu Ser Val Ala Thr Thr Gly
                805                 810                 815

Lys Asp Gly Lys Gly Phe Glu Glu Ala Leu Arg Asn Phe Ala Glu Lys
            820                 825                 830

Glu Gly Pro Tyr Gln Gly Ile Arg Arg Val Arg Leu Ile Glu Thr Leu
        835                 840                 845

Gln Ser Ser Ala Arg Val Glu Val Gly Ser Asp Glu Asp Gly Gln Pro
    850                 855                 860
```

```
Leu Lys Ala Tyr Lys Gly Asp Ser Asn His Cys Tyr Asp Leu Trp Lys
865                 870                 875                 880


Leu Pro Asp Gly Lys Val Val Pro His Val Val Ser Thr Tyr Glu Ala
                885                 890                 895


His Ala Gly Thr Asp Lys Arg Pro His Pro Ala Ala Lys Arg Ile Leu
            900                 905                 910


Arg Val Phe Lys Lys Asp Met Val Ala Ile Glu Gln Asp Asp Gln Thr
        915                 920                 925


Ala Ile Phe Tyr Val Gln Lys Leu Asp Arg Ala Asn Gly Leu Phe Leu
    930                 935                 940


Ala Pro His Leu Glu Ala Asn Ala Asp Ala Arg His Arg Asn Pro Asn
945                 950                 955                 960


Asp Ala Phe Lys Phe Leu Gln Met Gly Ala Gly Ser Val Val Arg Asn
                965                 970                 975


Lys Leu Arg Arg Val Tyr Val Asp Glu Ile Gly Arg Ile Lys Asp Pro
            980                 985                 990


Gly Pro Pro Lys His
        995


<210>  33
<211>  1027
<212>  PRT
<213>  Blastopirellula marina

<400>  33

Met Phe Ser Glu Ser Gly Asp Gln Pro Ser Leu Val Asp Cys Gly Val
1               5                   10                  15


Arg Ile Phe Pro Glu Gly Val Glu Arg Asp Gln Gln Gly Gly Glu Lys
            20                  25                  30
```

```
Ser Lys Ser Gln Ser Arg Arg Val Ala Arg Gly Ile Arg Arg Gln Val
        35                  40                  45

Arg Arg Arg Ala Gln Arg Leu Arg His Leu Lys His Ala Leu Ile Thr
    50                  55                  60

Thr Gly Leu Phe Pro Ala Asp Val Val Asp Gln Gln Glu Val Leu Ala
65                  70                  75                  80

Ser Asn Pro Tyr Glu Leu Arg Ser Arg Ala Leu Ser Glu Lys Leu Glu
                85                  90                  95

Pro Tyr Glu Ile Gly Arg Ile Leu Leu His Leu Ala Lys Arg Arg Gly
            100                 105                 110

Phe Leu Ser Asn Arg Thr Thr Asp Arg Ser Gly Gly Asn Glu Leu Lys
        115                 120                 125

Gly Ile Leu Ala Glu Met Thr Gln Leu Gln Gly Glu Ile Ala Ala His
    130                 135                 140

Gly Cys Gln Thr Leu Gly Gln Tyr Leu His Gln Leu Gly Asp Asp Gly
145                 150                 155                 160

Glu Thr Phe Ala Gln Arg Leu Arg Gly Arg His Thr Leu Arg Ala Met
                165                 170                 175

Tyr Glu Asp Glu Phe Glu Lys Ile Trp Glu Arg Gln Ala Ser Tyr Tyr
            180                 185                 190

Pro Ala Leu Leu Thr Glu Glu Leu Arg Gly Gly Glu Glu Gly Lys Gln
        195                 200                 205

Ser Tyr Pro Leu Val Pro Thr Ala Arg Arg Lys Ser Glu Ser Leu Leu
    210                 215                 220

Lys Arg Phe Gly Leu His Gly Leu Leu Phe Phe Gln Arg Lys Met Tyr
```

```
225                 230                 235                 240

Trp Pro Lys Ser Val Ile Gly Arg Cys Asp Leu Glu Pro Lys Glu Lys
                245                 250                 255

Arg Cys Pro Lys Ala Asp Arg Leu Ala Gln Arg Phe Arg Ile Leu Gln
            260                 265                 270

Glu Val Asn Asn Leu Arg Leu Ile Ser Pro Ala Asp Arg Lys Glu Tyr
        275                 280                 285

Thr Phe Ala Glu Phe Val Gly Ala Gly Ala Asp Lys Lys Leu Val Asp
    290                 295                 300

Tyr Leu Cys Glu Ala Lys Glu Arg Thr Phe Pro Gln Ile Arg Lys Lys
305                 310                 315                 320

Phe Lys Leu Pro Glu Thr Ile Ser Phe Asn Tyr Glu Arg Gly Glu Arg
                325                 330                 335

Ser Lys Leu Gln Gly His Glu Thr Asp Ala His Phe Asn Gly Lys Lys
            340                 345                 350

Gly Leu Gly Lys Arg Arg Trp Ser Glu Ile Ala Glu Asp Val Lys Asp
        355                 360                 365

His Ile Ile Gln Ile Val Leu Glu Glu Asp Arg Glu Asp Val Ala Leu
    370                 375                 380

Arg Lys Leu Thr Gln Asp Cys Ser Leu Thr Val Glu Glu Ala His Lys
385                 390                 395                 400

Ala Met Ala Leu His Leu Pro Ala Gly Tyr Ser Gln Tyr Ser Arg Val
                405                 410                 415

Ala Ile Ser Arg Leu Leu Pro His Leu Glu Leu Gly Lys Leu Leu Met
            420                 425                 430
```

```
Gly Asn Asp Ala Ser Asp Ser Ala Met His Ala Ala Gly Tyr Leu Arg
        435                 440                 445

Pro Asp Glu Arg Glu Val Arg Gln Tyr Asp Leu Leu Pro Glu Pro Pro
    450                 455                 460

Asp Ile Pro Asn Pro Leu Val Arg Gln Ala Leu Tyr Glu Val Arg Lys
465                 470                 475                 480

Val Ile Asn Ala Ile Ile Arg Glu Tyr Gly Ala Leu Gly Thr Ile Arg
                485                 490                 495

Val Glu Leu Ala Arg Glu Ala Lys Lys Ser Ala Glu Gln Arg Thr Gln
            500                 505                 510

Ile Arg Ile Ala Asn Ala Lys Arg Glu Arg Glu Asn Ala Ala Ile Ala
        515                 520                 525

Lys Thr Leu Gln Glu Met Ser Pro Ala Ile Arg Pro Thr Arg Arg Asn
    530                 535                 540

Ile Gln Arg Tyr Leu Leu Trp Lys Asp Gln Gly Gly Val Cys Ile Tyr
545                 550                 555                 560

Thr Gly Lys Val Ile Ser Gln Ala Gln Leu Phe Asp Ser Gly Glu Val
                565                 570                 575

Asp Val Asp His Ile Leu Pro Arg Trp Arg Ser Leu Asp Asp Ser Met
            580                 585                 590

Ala Asn Lys Val Ile Ala His Arg Ser Ala Asn Asn Glu Lys Gly Asp
        595                 600                 605

Arg Thr Pro Trp Glu Trp Leu Gly His Asp Lys Pro Arg Phe Asp Glu
    610                 615                 620

Leu Leu Leu Arg Ala Gln Arg Leu Pro Tyr Gly Lys Arg Gln Arg Phe
```

625 630 635 640

Ile Gln Lys Glu Val Glu Leu Thr Asn Phe Val Glu Arg Gln Leu Arg
645 650 655

Asp Thr Thr Tyr Val Ser Arg Leu Val Val Gln Tyr Leu Lys Gly Leu
660 665 670

Gly Val Pro Ile Thr Thr Val Lys Gly Pro Met Thr Ala Glu Leu Arg
675 680 685

His His Trp Gly Leu Asn Ala Leu Leu Asn Glu Asp Gly Ser Gln Lys
690 695 700

Lys Asn Arg Ser Asp His Arg His His Ala Ile Asp Ala Ile Val Ile
705 710 715 720

Gly Leu Thr Asp Ala Lys Arg Leu His Ala Leu Ala Asn Ala Arg Gly
725 730 735

Lys Asp Leu Gln Pro Pro Trp Ser Glu Phe Arg Ser Asp Val Ala Thr
740 745 750

Ala Leu Gly Arg Met Ala Val Ser His Arg Val Arg Arg Arg Ile Gln
755 760 765

Gly Ala Leu His Glu Glu Thr Ile Tyr Gly Pro Thr Gln Lys Ala Ala
770 775 780

Gln Pro Thr Ser Thr Asp Gln Arg Pro Trp Ala Lys Asp Trp Ile Glu
785 790 795 800

Asp Ser Gln Ile Val Val Arg Arg Lys Ser Val Ser Asp Leu Thr Asn
805 810 815

Thr Lys His Leu Ala Lys Ile Arg Asp Val Thr Ile Arg Lys Ile Leu
820 825 830

```
Glu Asp His Leu Arg Arg Gln Lys Val Asp Pro Thr Lys Pro Gly Val
        835                 840                 845

Ile Pro Lys Asp Ala Phe Ala Gly Ser Asn Ala Pro Gln Met Pro Ser
    850                 855                 860

Gly Val Pro Ile Lys Lys Val Arg Leu Val Glu Arg Gly Glu Thr Trp
865                 870                 875                 880

Arg Lys Ile Gly Ser Gly Glu Ala Ser Lys Phe Ile Lys Pro Gly Ser
                885                 890                 895

Asn His His Ile Ser Tyr Phe Ala Ile Ser Arg Lys Gly Arg Glu Ser
            900                 905                 910

Trp Lys Ala His Val Thr Ile Met Leu Asp Ala Ala Cys Ile Ala Lys
        915                 920                 925

Glu Ser Ile Asn Asn Gly Lys Ile Val Asn Arg Ser Ile Gly Asp Gln
    930                 935                 940

Gly Arg Phe Leu Met Ser Leu Ser Ile Gly Glu Met Phe Glu Ile Thr
945                 950                 955                 960

Asn Asn Gly Gly Glu Ile Leu Leu Cys Val Val Arg Lys Ile Asp Gln
                965                 970                 975

Ser Gly Arg Ile Tyr Tyr Lys Ile His Asp Asp Ala Arg Glu Ser Met
            980                 985                 990

Asp Leu Lys Lys Asp Asn Leu Tyr  Met Ser Pro Ser Lys  Met Gln Gln
        995                 1000                1005

Phe Asp  Ala Arg Lys Val Thr  Val Thr Pro Leu Gly  Lys Ile Arg
    1010                1015                1020

Asn Ala  Asn Asp
```

1025

<210> 34
<211> 158
<212> PRT
<213> Francisella tularensis

<400> 34

Met Ile Asp Phe Leu Leu Glu Leu Asp Pro Cys Ile Thr Ile Pro Pro
1 5 10 15

Tyr Leu Asp Asn Asn Asn Arg Lys Pro Pro Lys Cys Gln Ser Leu Ile
20 25 30

Leu Asn Pro Lys Phe Leu Asp Asn Gln Tyr Pro Asn Trp Gln Gln Tyr
35 40 45

Leu Gln Glu Leu Lys Lys Leu Gln Ser Ile Gln Asp Tyr Leu Asp Ser
50 55 60

Phe Glu Thr Asp Leu Lys Asp Leu Lys Ser Ser Lys Asp Gln Pro Tyr
65 70 75 80

Phe Val Glu Tyr Lys Ser Ser Asn Gln Gln Met Ala Ser Gly Gln Arg
85 90 95

Asp Tyr Lys Asp Leu Asp Ala Arg Ile Leu Gln Phe Ile Phe Asp Arg
100 105 110

Val Lys Ala Ser Asp Glu Leu Leu Leu Ser Glu Ile Tyr Phe Gln Ala
115 120 125

Lys Lys Leu Lys Gln Lys Ala Ser Ser Glu Leu Glu Lys Leu Glu Ser
130 135 140

Ser Lys Lys Leu Asp Glu Val Ile Ala Asn Ser Gln Leu Ser
145 150 155

<210> 35
<211> 393
<212> PRT
<213> Francisella tularensis

<400> 35

Met Asn Val Lys Ile Leu Pro Ile Ala Ile Asp Leu Asp Val Lys Asn
1 5 10 15

Thr Gly Val Phe Ser Ala Phe Tyr Gln Lys Gly Thr Ser Leu Glu Lys
20 25 30

Leu Asp Asn Lys Asn Gly Lys Val Tyr Glu Leu Ser Lys Asp Ser Tyr
35 40 45

Thr Leu Leu Met Asn Asn Arg Thr Ala Gln Arg His Gln Arg Arg Gly
50 55 60

Ile Asp Arg Lys Gln Leu Val Lys Arg Leu Phe Lys Leu Val Trp Thr
65 70 75 80

Glu Gln Leu Asn Leu Glu Trp Asp Lys Asp Thr Gln Gln Ala Ile Ser
85 90 95

Phe Leu Phe Asn Arg Arg Gly Phe Ser Phe Ile Thr Asp Gly Tyr Ser
100 105 110

Thr Glu Tyr Leu Asn Ile Val Pro Glu Gln Val Lys Ala Ile Leu Met
115 120 125

Asp Ile Phe Asp Asp Tyr Asn Gly Glu Asp Asp Leu Asp Ser Tyr Leu
130 135 140

Lys Leu Ala Thr Glu Gln Glu Ser Lys Ile Ser Glu Ile Tyr Asn Lys
145 150 155 160

Leu Met Gln Lys Ile Leu Glu Phe Lys Leu Arg Lys Leu Cys Thr Asp
165 170 175

```
Ile Lys Asp Asp Lys Val Ser Thr Lys Thr Leu Lys Glu Ile Thr Ser
            180                 185                 190

Tyr Glu Phe Glu Leu Leu Ala Asp Tyr Leu Ala Asn Tyr Ser Glu Ser
        195                 200                 205

Leu Lys Thr Gln Lys Phe Ser Tyr Thr Asp Lys Gln Gly Asn Leu Lys
    210                 215                 220

Glu Leu Ser Tyr Tyr His His Asp Lys Tyr Asn Ile Gln Glu Phe Leu
225                 230                 235                 240

Lys Arg His Ala Thr Ile Asn Asp Glu Ile Leu Asp Thr Leu Leu Thr
                245                 250                 255

Asp Asp Phe Asp Ile Trp Asn Phe Asn Phe Glu Lys Phe Asp Phe Asp
            260                 265                 270

Lys Asn Glu Glu Lys Leu Gln Ser Gln Glu Asp Lys Asp His Thr Gln
        275                 280                 285

Ala Tyr Phe His His Phe Val Phe Ala Val Asn Lys Ile Lys Ser Glu
    290                 295                 300

Met Ala Ser Gly Gly Arg His Arg Ser Gln Tyr Phe Gln Glu Ile Thr
305                 310                 315                 320

Asn Val Leu Asp Glu Asn Asn His Gln Glu Gly Tyr Leu Lys Asn Phe
                325                 330                 335

Cys Glu Asn Leu His Asn Lys Lys Tyr Ser Asn Leu Ser Val Lys Asn
            340                 345                 350

Leu Val Asn Leu Val Gly Asn Leu Ser Asn Leu Glu Leu Lys Pro Leu
        355                 360                 365

Arg Lys Tyr Phe Asn Asp Lys Asn Leu Ile Ile Gly Met Ser Lys Ser
```

370 375 380

Leu Gln Lys Leu Ile Ala Thr Gly Tyr
385 390

<210> 36
<211> 1066
<212> PRT
<213> Rhodopseudomonas palustris

<400> 36

Met Ser Glu Arg Val Val Arg Arg Ile Leu Gly Ile Asp Leu Gly Ile
1 5 10 15

Ala Ser Cys Gly Trp Gly Val Val Asp Ile Ser Gly Ala Gly Gly Gly
20 25 30

Ile Ile Ala Thr Gly Val Arg Cys Phe Asp Ala Pro Leu Ile Asp Lys
35 40 45

Thr Gly Glu Pro Lys Ser Ala Thr Arg Arg Thr Ala Arg Gly Gln Arg
50 55 60

Arg Ile Val Arg Arg Arg Arg Gln Arg Met Asn Gly Val Arg Arg Leu
65 70 75 80

Leu Cys Glu Phe Gly Leu Leu Pro Asp Pro Arg Pro Asp Ala Leu Asn
85 90 95

Gln Ala Met Arg Arg Ile Ser Thr Ala Ser Ala Ala Ala Gln Val Thr
100 105 110

Pro Trp Thr Leu Arg Ala Ala Ala His Gln Arg Leu Leu Ser Asn Glu
115 120 125

Glu Leu Ala Val Val Leu Gly His Ile Ala Arg His Arg Gly Phe Arg
130 135 140

```
Ser Asn Ala Lys Asn Glu Ala Gly Ala Asn Ala Ala Asp Glu Thr Ser
145                 150                 155                 160

Lys Met Lys Lys Ala Met Glu Ala Thr Arg Glu Gly Leu Ala Lys Tyr
                165                 170                 175

His Ala Phe Gly Asp Met Ile Ala Asn Asp Pro Lys Phe Ala Asn Arg
            180                 185                 190

Lys Arg Asn Arg Asp Lys Asp Tyr Ser His Thr Ala Lys Arg Ser Asp
        195                 200                 205

Leu Glu Asp Glu Val Arg Ala Ile Leu Arg Ala Gln Leu Arg Phe Gly
    210                 215                 220

Ser Ala Ala Ala Thr Glu Thr Leu Ala Gln Thr Phe Ala Asp Val Ala
225                 230                 235                 240

Phe Phe Gln Arg Pro Leu Gln Asp Ser Glu Asp Arg Val Gly Asp Cys
                245                 250                 255

Pro Phe Glu Pro Gly Gln Lys Arg Ala Ala Arg Arg Ala Pro Ser Phe
            260                 265                 270

Glu Leu Phe Arg Phe Leu Ser Arg Leu Ala Asn Leu Lys Leu Ala Val
        275                 280                 285

Gly Arg Ser Pro Glu Arg Arg Leu Thr Ala Glu Glu Ile Ala Leu Ala
    290                 295                 300

Ala Lys Gly Phe Gly Glu Thr Lys Lys Thr Ile Thr Phe Lys Ser Leu
305                 310                 315                 320

Arg Glu Ala Leu Asp Leu Asp Pro Asn Ala Arg Phe Ser Gly Ile Gly
                325                 330                 335

Lys Asp Lys Glu Ala Ser Leu Asp Val Val Ala Arg Thr Gly Gly Ala
            340                 345                 350
```

```
Ala Tyr Gly Thr Lys Thr Leu Lys Asp Ala Leu Gly Asp Ala Pro Trp
        355                 360                 365

Arg Ser Leu Ser Arg Thr Pro Glu Thr Leu Asp Arg Ile Ala Glu Ile
    370                 375                 380

Leu Ser Phe Arg Glu Asp Ile Thr Ser Ile Arg Asn Gly Leu Glu Asp
385                 390                 395                 400

Leu Gly Leu Asp Ser Leu Val Val Glu Ala Leu Met Gln Ala Ala Ala
                405                 410                 415

Asn Gly Asp Phe Lys Glu Phe Thr Arg Ala Gly His Ile Ser Ala Arg
            420                 425                 430

Ala Ala Arg Asn Ile Ile Pro Gly Leu Arg Glu Gly Leu Val Tyr Ser
        435                 440                 445

Glu Ala Cys Ala Arg Val Gly Tyr Asp His Ala Ala Arg Leu Ser Val
    450                 455                 460

Pro Leu Asp Gln Val Gly Ser Pro Val Thr Arg Lys Ala Leu Ser Glu
465                 470                 475                 480

Ala Leu Lys Gln Val Arg Ala Val Ala Arg Glu Tyr Gly Pro Ile Asp
                485                 490                 495

Tyr Phe His Ile Glu Leu Ala Arg Ser Val Gly Lys Ser Ala Glu Glu
            500                 505                 510

Arg Lys Gln Leu Thr Asp Gly Ile Glu Ala Arg Asn Val Glu Lys Ala
        515                 520                 525

Lys Arg Arg Lys Gln Ala Glu Glu His Leu Gly Arg Ala Pro Ser Asp
    530                 535                 540
```

```
Asp Glu Leu Leu Arg Tyr Glu Leu Ala Lys Glu Gln Asn Phe Lys Cys
545                 550                 555                 560

Ile Tyr Ser Gly Asp Ala Ile Asp Pro Ala Gly Val Ala Ala Asn Asp
                565                 570                 575

Thr Arg Tyr Gln Val Asp His Ile Leu Pro Trp Ser Arg Phe Gly Asp
            580                 585                 590

Asp Ser Tyr Leu Asn Lys Thr Leu Cys Thr Ala Arg Ser Asn Gln Asn
        595                 600                 605

Lys Arg Gly Arg Thr Pro Phe Glu Trp Phe Glu Ala Asp Lys Thr Asp
    610                 615                 620

Val Glu Trp Met Glu Tyr Val Ala Arg Val Glu Asn Leu Gln Glu Val
625                 630                 635                 640

Lys Gly Arg Lys Lys Arg Asn Tyr Ser Ile Lys Asp Ala Ala Ala Ile
                645                 650                 655

Glu Asp Lys Phe Lys Ala Arg Asn Leu Thr Asp Thr Gln Trp Ala Thr
            660                 665                 670

Arg Leu Leu Ala Asp Glu Leu Ser Arg Met Phe Pro Pro Arg Glu Cys
        675                 680                 685

Glu Arg Ala Ile Cys Gly Arg Ala Asp Gly Gly Asn Asp Gly Leu Thr
    690                 695                 700

Ile Val Glu Glu Arg Arg Val Phe Thr Arg Pro Gly Ala Ile Thr Ser
705                 710                 715                 720

Lys Leu Arg Arg Ala Trp Gly Leu Glu Gly Leu Lys Lys Gln Asp Gly
                725                 730                 735

Lys Arg Val Glu Asp Asp Arg His His Ala Val Asp Ala Leu Val Leu
            740                 745                 750
```

```
Ala Ala Thr Thr Glu Ser Leu Leu Gln Arg Leu Thr Val Glu Val Gln
        755                 760                 765

Arg Arg Glu Arg Glu Gly Arg Pro Asp Asp Ile Phe His Cys Ala Glu
    770                 775                 780

Pro Trp Arg Gly Phe Arg Ala Asp Val Arg Arg Thr Val Tyr Gly Ser
785                 790                 795                 800

Glu Thr Met Pro Gly Ile Phe Val Ser Arg Ala Glu Arg Arg Arg Ala
                805                 810                 815

Arg Gly Lys Ala His Asp Ala Thr Ile Lys Gln Ile Arg Glu Ile Glu
            820                 825                 830

Gly Glu Arg Leu Val Phe Glu Arg Lys Pro Val Glu Lys Leu Thr Asp
        835                 840                 845

Lys Asp Leu Glu Lys Ile Pro Ile Pro Lys Pro Tyr Gly Gln Val Ser
    850                 855                 860

Asp Pro Lys Arg Leu Arg Asp Glu Leu Val Glu Ser Leu Arg Ala Trp
865                 870                 875                 880

Ile Ala Ala Gly Lys Pro Lys Asp Arg Pro Pro Leu Ser Pro Lys Gly
                885                 890                 895

Asp Val Ile Arg Lys Val Arg Ile Gln Thr Asn Asp Lys Val Ser Val
            900                 905                 910

Glu Ile Asn Gly Gly Thr Val Asp Arg Gly Asp Met Ala Arg Val Asp
        915                 920                 925

Val Phe Arg Lys Lys Asn Lys Lys Ala Val Trp Glu Tyr Tyr Val Val
    930                 935                 940
```

```
Pro Ile Tyr Pro His Gln Ile Val Ala Leu Asn Asp Pro Pro Asp Arg
945                 950                 955                 960


Ala Val Ile Ala Tyr Ala Glu Asp Lys Asp Trp Lys Glu Ile Asp Ser
                965                 970                 975


Ser Tyr Glu Phe Leu Trp Ser Leu Phe Gly Leu Ser Tyr Val Glu Ile
            980                 985                 990


Ser Lys Ala Asn Gly Glu Cys Ile  Asp Gly Tyr Phe Arg  Gly Leu His
        995                 1000                1005


Arg Gly  Thr Gly Ala Ala Ser  Val Cys Lys His Ile  Ser Leu Gly
    1010                1015                1020


Lys Asp  Ala Thr Val Ser Gly  Ile Gly Leu Lys Thr  Leu Ala Ser
    1025                1030                1035


Phe Lys  Lys Phe Thr Ile Asp  Arg Leu Gly Arg Lys  Phe Glu Ile
    1040                1045                1050


Pro Arg  Glu Val Arg Thr Trp  Arg Gly Glu Ala Cys  Thr
    1055                1060                1065


<210>  37
<211>  1149
<212>  PRT
<213>  Lactobacillus salivarius

<400>  37

Met Glu Arg Tyr His Ile Gly Leu Asp Ile Gly Thr Ser Ser Ile Gly
1               5                   10                  15


Trp Ala Val Ile Gly Asp Asp Phe Lys Ile Lys Arg Lys Lys Gly Lys
            20                  25                  30


Asn Leu Ile Gly Val Arg Leu Phe Lys Glu Gly Asp Thr Ala Ala Glu
        35                  40                  45
```

```
Arg Arg Gly Phe Arg Thr Gln Arg Arg Arg Leu Asn Arg Arg Lys Trp
    50                  55                  60

Arg Leu Lys Leu Leu Glu Glu Ile Phe Asp Pro Tyr Met Ala Glu Val
65                  70                  75                  80

Asp Lys Tyr Phe Phe Ala Arg Leu Lys Glu Ser Asn Leu Ser Pro Lys
                85                  90                  95

Asp Ser Asn Lys Lys Tyr Leu Gly Ser Leu Leu Phe Pro Asp Ile Ser
            100                 105                 110

Asp Ser Asn Phe Tyr Asp Lys Tyr Pro Thr Ile Tyr His Leu Arg Arg
        115                 120                 125

Asp Leu Met Glu Lys Asp Lys Lys Phe Asp Leu Arg Glu Ile Tyr Leu
    130                 135                 140

Ala Ile His His Ile Val Lys Tyr Arg Gly Asn Phe Leu Glu Lys Val
145                 150                 155                 160

Pro Ala Lys Asn Tyr Lys Asn Ser Gly Ala Ser Ile Gly Phe Leu Leu
                165                 170                 175

Glu Glu Val Asn Asp Leu Tyr Gly Asn Ile Ile Gly Asn Glu Asp Val
            180                 185                 190

Ala Ile Leu Asp Asn Asp Lys Phe Glu Asp Val Glu Lys Ile Ile Leu
        195                 200                 205

Asn Asp Glu Ile Arg Asn Ile Asp Lys Gln Lys Asn Val Gly Arg Leu
    210                 215                 220

Leu Val Lys Asp Lys Lys Glu Lys Asn Ile Val Thr Ala Phe Ser Lys
225                 230                 235                 240

Ala Ile Phe Gly Tyr Lys Phe Asn Leu Glu Asp Leu Leu Leu Ile Glu
```

```
                245                 250                 255

Ser Asp Glu Lys Asn Lys Leu Thr Phe Asn Asp Glu Asn Ile Asp Asp
            260                 265                 270

Ile Phe Asn Glu Leu Ser His Ser Leu Asn Asp Asn Gln Met Asp Leu
        275                 280                 285

Leu Thr Lys Thr Arg Glu Ile Tyr Phe Lys Phe Lys Leu Asn Met Ile
    290                 295                 300

Val Pro Thr Gly Tyr Thr Ile Ser Glu Ser Met Ile Glu Lys Tyr Glu
305                 310                 315                 320

Met His Lys Ala His Leu Lys Met Tyr Lys Glu Phe Ile Asn Thr Leu
                325                 330                 335

Asn Ala Lys Asp Arg Lys Ile Leu Lys Asn Ala Tyr Ser Asp Tyr Ile
            340                 345                 350

Asn Asn Glu Lys Ala Lys Ala Ala Asn Ala Gln Glu Asn Phe Tyr Lys
        355                 360                 365

Thr Val Lys Lys Thr Ile Lys Glu Asn Asp Ser Asp Thr Ala Lys Lys
    370                 375                 380

Ile Ile Gly Leu Ile Asp Glu Gly Asn Phe Met Pro Lys Gln Arg Thr
385                 390                 395                 400

Gly Glu Asn Gly Val Ile Pro His Gln Leu His Gln Ile Glu Leu Asp
                405                 410                 415

Arg Ile Ile Glu Asn Gln Ala Lys Tyr Tyr Pro Trp Leu Ala Glu Glu
            420                 425                 430

Asn Pro Val Glu Lys Asn Arg Lys Phe Ala Lys Tyr Lys Leu Asp Glu
        435                 440                 445
```

```
Leu Val Thr Phe Arg Val Pro Tyr Tyr Val Gly Pro Leu Ile Asp Lys
    450                 455                 460

Thr Glu Ser Asn Lys Asn Glu Lys Glu Thr Lys Phe Ala Trp Met Val
465                 470                 475                 480

Arg Lys Ala Lys Gly Thr Ile Thr Pro Trp Asn Phe Glu Asn Leu Val
                485                 490                 495

Asp Arg Thr Glu Ser Ala Asn Arg Phe Ile Lys Arg Met Thr Ser Lys
            500                 505                 510

Asp Thr Tyr Ile Ile Gly Glu Asp Val Leu Pro Ala Ser Ser Leu Leu
        515                 520                 525

Tyr Glu Lys Tyr Lys Val Leu Asn Glu Leu Asn Asn Ile Lys Val Asn
    530                 535                 540

Lys Lys Lys Leu Asp Val Glu Gln Lys Gln His Val Tyr Leu Asp Leu
545                 550                 555                 560

Phe Thr Thr Arg Lys Asn Val Thr Lys Asp Asp Leu Ala Thr Ser Leu
                565                 570                 575

Asn Cys Asp Val Glu Ser Ile Thr Gly Leu Thr Asp Asn Lys Lys Phe
            580                 585                 590

Asn Ser Ser Leu Ser Ser Tyr Ile Asp Leu Lys Ala Ile Leu Gly Asn
        595                 600                 605

Ile Val Asp Asp Tyr Ser Lys Asn Glu Asp Leu Glu Lys Ile Ile Glu
    610                 615                 620

Tyr Ser Thr Ile Phe Glu Asp Gly Asn Ile Tyr Lys Glu Lys Leu Ser
625                 630                 635                 640

Glu Ile Ser Trp Leu Thr Asp Glu Gln Ile Glu Lys Leu Ser Asn Ile
```

```
                645                 650                 655

His Phe Lys Gly Trp Gly Arg Leu Ser Lys Lys Leu Leu Thr Gln Ile
            660                 665                 670

Thr Asn Glu Asn Gly Glu Arg Ile Ile Asp Thr Leu Trp Asn Thr Ser
        675                 680                 685

Asn Asn Phe Ile Gln Val Ile Ser Asp Glu Ser Ile Gln Ala Lys Leu
    690                 695                 700

Ala Glu Ile Asn Gly Glu Tyr Ala Asn Lys Tyr Asn Leu Glu Asp Ile
705                 710                 715                 720

Leu Asp Glu Ala Tyr Thr Ser Pro Gln Asn Lys Lys Ala Ile Arg Gln
                725                 730                 735

Val Met Lys Val Val Glu Asp Ile Glu Lys Ala Met Lys Cys Glu Pro
            740                 745                 750

Thr Ser Ile Ala Ile Glu Phe Thr Arg Glu Lys Arg Lys Ser Lys Leu
        755                 760                 765

Thr Asn Thr Arg Tyr Lys Lys Ile Ser Glu Thr Tyr Glu Lys Ile Thr
    770                 775                 780

Asp Glu Leu Ile Ser Glu Tyr Glu Leu Gly Lys Leu Gln Ser Glu Leu
785                 790                 795                 800

Asp Ser Lys Val Asn Asn Met Arg Asp Arg Tyr Tyr Leu Tyr Phe Met
                805                 810                 815

Gln Leu Gly Arg Asp Met Tyr Thr Gly Glu Lys Met Asn Ile Asp Glu
            820                 825                 830

Leu His Gln Lys Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Phe Ile
        835                 840                 845
```

```
Lys Asp Asp Ser Leu Asn Asn Arg Val Leu Thr Ser Lys Ser Val Asn
    850                 855                 860

Ile Lys Glu Lys Ser Asp Lys Thr Ala Ala Asp Leu Tyr Ala Ala Lys
865                 870                 875                 880

Met Gly Asp Phe Trp Arg Lys Leu Arg Lys Gln Gly Leu Met Thr Glu
                885                 890                 895

Gln Lys Tyr Lys Asn Leu Leu Thr Arg Thr Asp Ser Ile Asn Lys Tyr
            900                 905                 910

Thr Lys Gln Ser Phe Ile Lys Arg Gln Leu Val Glu Thr Ser Gln Val
        915                 920                 925

Val Lys Leu Ala Ala Asn Ile Leu Gln Asp Lys Tyr Arg Asn Thr Lys
    930                 935                 940

Ile Ile Glu Ile Arg Ala Arg Leu Asn Ser Asp Leu Arg Lys Lys Tyr
945                 950                 955                 960

Glu Leu Ile Lys Asn Arg Glu Val Asn Asp Tyr His His Ala Ile Asp
                965                 970                 975

Gly Tyr Leu Thr Thr Phe Val Gly Gln Tyr Leu Tyr Lys Val Tyr Pro
            980                 985                 990

Lys Leu Arg Ser Tyr Phe Val Tyr  Asp Asp Phe Lys Lys  Leu Asp Ser
        995                 1000                1005

Asn Tyr  Leu Lys His Met Asp  Lys Phe Asn Phe Ile  Trp Lys Leu
    1010                1015                1020

Glu Asp  Lys Lys Ala Glu Asp  Val Tyr Asp Lys Val  Asn Asp Glu
    1025                1030                1035

Phe Val  Leu Asn Val Pro Glu  Met Lys Glu Tyr Ile  Arg Lys Ile
```

```
    1040                1045                1050

Tyr Asn  Tyr Lys Tyr Met Leu  Val Ser Lys Glu Val  Thr Thr Lys
    1055                1060                1065

Asn Gly  Ala Phe Tyr Asp Gln  Thr Lys Tyr Asn Ala  Lys Thr Ile
    1070                1075                1080

Asn Leu  Ile Pro Ile Lys Lys  Asp Lys Pro Thr Asn  Ile Tyr Gly
    1085                1090                1095

Gly Tyr  Lys Gly Lys Val Ser  Ser Tyr Met Met Leu  Val Lys Ile
    1100                1105                1110

Gln Lys  Lys Lys Glu Val Ile  Tyr Lys Phe Val Gly  Val Pro Arg
    1115                1120                1125

Leu Trp  Thr Asp Glu Leu Asp  Arg Leu Ile Asp Thr  Asp Glu Lys
    1130                1135                1140

Lys Ala  Leu Leu Lys Lys
    1145
```

<210> 38
<211> 1064
<212> PRT
<213> Rhodopseudomonas palustris

<400> 38

```
Met Ser Glu Cys Val Thr Arg Arg Ile Leu Gly Ile Asp Leu Gly Ile
1               5                   10                  15

Ala Ser Cys Gly Trp Gly Val Ile Glu Val Gly Glu Ala Ser Gly Ser
            20                  25                  30

Ile Ile Ala Ser Gly Val Arg Cys Phe Asp Ala Pro Leu Ile Asp Lys
        35                  40                  45
```

```
Thr Gly Glu Pro Lys Ser Ala Thr Arg Arg Thr Ala Arg Gly Gln Arg
    50                  55                  60

Arg Ile Ile Arg Arg Arg Arg Gln Arg Met Asn Ala Val Arg Arg Leu
65                  70                  75                  80

Leu Ala Glu Phe Gly Val Leu Thr Gly Arg Ser Pro Asp Ala Leu His
                85                  90                  95

Gln Ala Leu Leu Arg Leu Ser Gln Ser Val Ala Gly Ser Gln Val Thr
            100                 105                 110

Pro Trp Thr Leu Arg Ala Ala Ala His Glu Arg Lys Leu Thr Asn Asp
        115                 120                 125

Glu Leu Ala Val Val Leu Gly His Ile Ala Arg His Arg Gly Phe Arg
    130                 135                 140

Ser Asn Ser Lys Asn Asp Gly Gly Ala Asn Ala Ala Asp Glu Thr Ser
145                 150                 155                 160

Lys Met Lys Lys Ala Met Glu Thr Thr Arg Glu Gly Leu Ala Arg Tyr
                165                 170                 175

His Ser Phe Gly Ala Met Ile Ala Ser Asp Pro Lys Phe Ala Asp Arg
            180                 185                 190

Lys Arg Asn Arg Asp Lys Asp Tyr Ser His Thr Ala Lys Arg Ser Asp
        195                 200                 205

Leu Glu Asp Glu Val Arg Thr Ile Phe Arg Ser Gln Thr Arg Phe Gly
    210                 215                 220

Ser Leu Val Ala Ser Glu Lys Leu Ser Gln Ala Phe Ala Asp Ala Ala
225                 230                 235                 240

Phe Phe Gln Arg Pro Leu Gln Asp Ser Glu Asp Met Val Gly Ser Cys
                245                 250                 255
```

```
Pro Phe Glu Pro Gly Gln Lys Arg Thr Ala Arg Arg Ala Pro Ser Phe
            260                 265                 270

Glu Leu Phe Arg Phe Leu Ser Arg Leu Ala Asn Leu Lys Leu Thr Val
        275                 280                 285

Gly Arg Ala Pro Glu Arg Arg Leu Thr Pro Asp Glu Ile Ala Leu Ala
    290                 295                 300

Ala Lys Gly Phe Gly Glu Thr Lys Lys Ser Ile Thr Phe Lys Ser Leu
305                 310                 315                 320

Arg Glu Ala Leu Asp Leu Asp Pro Asn Ala Arg Phe Ser Gly Val Ala
                325                 330                 335

Lys Glu Lys Glu Ser Thr Leu Asp Val Ala Ala Arg Thr Gly Gly Ala
            340                 345                 350

Ala Tyr Gly Thr Lys Thr Leu Lys Asp Ala Leu Gly Asp Ala Pro Trp
        355                 360                 365

Arg Ser Leu Ser Arg Met Pro Glu Lys Leu Asp Arg Ile Ala Glu Ile
    370                 375                 380

Leu Ser Phe Arg Glu Asp Met Lys Ala Ile Arg Asn Gly Leu Glu Glu
385                 390                 395                 400

Val Gly Leu Asp Gly Leu Val Val Asp Ala Leu Met Gln Ala Thr Ala
                405                 410                 415

Asn Gly Asp Phe Lys Asp Phe Thr Arg Ala Ala His Ile Ser Ala Leu
            420                 425                 430

Ala Ala Arg Asn Ile Ile Pro Gly Leu Arg Glu Gly Leu Val Tyr Ser
        435                 440                 445
```

```
Asp Ala Cys Thr Arg Val Gly Tyr Asp His Ala Ala Arg Pro Ala Val
    450                 455                 460

Pro Leu Ser Gln Ile Gly Ser Pro Val Thr Arg Lys Ala Leu Ser Glu
465                 470                 475                 480

Ala Leu Lys Gln Val Arg Ala Val Ala Arg Glu Tyr Gly Pro Ile Asp
                485                 490                 495

Tyr Phe His Ile Glu Leu Ala Arg Ser Ile Gly Lys Ser Ala Glu Glu
            500                 505                 510

Arg Lys Lys Leu Thr Asp Gly Ile Glu Ala Arg Asn Val Glu Lys Glu
        515                 520                 525

Lys Arg Arg Lys Glu Ala Ala Glu His Leu Gly Arg Ala Pro Ser Asp
    530                 535                 540

Asp Glu Leu Leu Arg Tyr Glu Leu Ala Lys Glu Gln Asn Phe Lys Cys
545                 550                 555                 560

Ile Tyr Ser Gly Asp Pro Ile Asp Pro Ala Gly Ile Ser Ala Asn Asp
                565                 570                 575

Thr Arg Tyr Gln Val Asp His Ile Leu Pro Trp Ser Arg Phe Gly Asp
            580                 585                 590

Asp Ser Tyr Val Asn Lys Thr Leu Cys Thr Ala Arg Ser Asn Gln Asn
        595                 600                 605

Lys Arg Gly Arg Thr Pro Phe Glu Trp Phe Asp Ala Asp Lys Thr Glu
    610                 615                 620

Ala Glu Trp Met Glu Tyr Ser Ala Arg Val Glu Asp Leu Lys Glu Val
625                 630                 635                 640

Lys Gly Arg Lys Lys Arg Asn Tyr Ser Ile Lys Asp Ala Ala Ser Val
                645                 650                 655
```

```
Glu Asp Lys Phe Lys Ala Arg Asn Leu Thr Asp Thr Gln Trp Ala Thr
            660                 665                 670

Arg Leu Leu Ala Asp Glu Leu Lys Arg Met Phe Pro Pro Arg Glu Cys
        675                 680                 685

Glu Arg Val Val Thr Val Arg Ala Asp Gly Gly Asn Asp Gly Leu Ser
    690                 695                 700

Ile Val Glu Glu Arg Arg Val Phe Thr Arg Pro Gly Ala Ile Thr Ser
705                 710                 715                 720

Lys Leu Arg Arg Ala Trp Gly Leu Glu Gly Leu Lys Lys Gln Asp Gly
                725                 730                 735

Lys Arg Val Glu Asp Asp Arg His His Ala Val Asp Ala Leu Val Leu
            740                 745                 750

Ala Ala Thr Thr Glu Ser Leu Leu Asn Arg Leu Thr Val Glu Val Gln
        755                 760                 765

Gln Arg Glu Arg Glu Gly Arg Gln Asp Asp Ile Phe His Cys Ser Gln
    770                 775                 780

Pro Trp Pro Gly Phe Arg Val Asp Val Gln Arg Thr Val Tyr Gly Ser
785                 790                 795                 800

Glu Thr Met Pro Gly Ile Phe Val Ser Arg Ala Glu Arg Arg Arg Ala
                805                 810                 815

Arg Gly Lys Ala His Asp Ala Thr Val Lys Gln Ile Arg Asp Ile Asp
            820                 825                 830

Gly Glu Arg Ile Val Phe Glu Arg Lys Pro Ile Glu Lys Leu Thr Asp
        835                 840                 845
```

```
Lys Asp Leu Glu Arg Ile Pro Val Pro Glu Pro Tyr Gly Lys Ala Ala
    850                 855                 860

Asp Pro Lys Lys Leu Arg Asp Glu Leu Val Glu Asn Leu Arg Ala Trp
865                 870                 875                 880

Ile Ala Ala Gly Lys Pro Lys Asp Lys Pro Pro Arg Ser Pro Lys Gly
                885                 890                 895

Asp Ile Ile Arg Lys Val Arg Ile Glu Thr Lys Asp Lys Val Ala Val
            900                 905                 910

Glu Ile Asn Gly Gly Thr Val Asp Arg Gly Asp Met Ala Arg Val Asp
        915                 920                 925

Val Phe Arg Lys Lys Asn Lys Lys Gly Val Trp Glu Phe Tyr Val Ile
    930                 935                 940

Pro Ile Tyr Pro His Gln Ile Val Ala Ser Ala Leu Pro Pro Asn Arg
945                 950                 955                 960

Ala Val Ile Ala Tyr Lys Ala Glu Ser Glu Trp Thr Ala Ile Asp Gly
                965                 970                 975

Cys Phe Glu Phe Ala Trp Ser Leu Asn Pro Met Ser Tyr Leu Glu Leu
            980                 985                 990

Val Lys Ser Asn Gly Glu Leu Ile  Glu Gly Tyr Phe Arg  Ser Met Asp
        995                 1000                1005

Arg Thr  Thr Gly Ala Ile Asn  Leu Ser Pro Met Ser  Thr Asn Ser
    1010                1015                1020

Glu Thr  Ile Arg Ser Ile Gly  Val Lys Thr Leu Ser  Ser Phe Arg
    1025                1030                1035

Lys Phe  Thr Val Asp Arg Leu  Gly Arg Lys Phe Glu  Ile Pro Arg
    1040                1045                1050
```

Glu Val Arg Thr Trp Arg Gly Glu Ala Cys Thr
    1055   1060

<210> 39
<211> 1166
<212> PRT
<213> Nitrobacter hamburgensis

<400> 39

Met His Val Glu Ile Asp Phe Pro His Phe Ser Arg Gly Asp Ser His
1   5   10   15

Leu Ala Met Asn Lys Asn Glu Ile Leu Arg Gly Ser Ser Val Leu Tyr
            20   25   30

Arg Leu Gly Leu Asp Leu Gly Ser Asn Ser Leu Gly Trp Phe Val Thr
        35   40   45

His Leu Glu Lys Arg Gly Asp Arg His Glu Pro Val Ala Leu Gly Pro
    50   55   60

Gly Gly Val Arg Ile Phe Pro Asp Gly Arg Asp Pro Gln Ser Gly Thr
65   70   75   80

Ser Asn Ala Val Asp Arg Arg Met Ala Arg Gly Ala Arg Lys Arg Arg
                85   90   95

Asp Arg Phe Val Glu Arg Arg Lys Glu Leu Ile Ala Ala Leu Ile Lys
            100   105   110

Tyr Asn Leu Leu Pro Asp Asp Ala Arg Glu Arg Arg Ala Leu Glu Val
        115   120   125

Leu Asp Pro Tyr Ala Leu Arg Lys Thr Ala Leu Thr Asp Thr Leu Pro
    130   135   140

Ala His His Val Gly Arg Ala Leu Phe His Leu Asn Gln Arg Arg Gly

```
145                 150                 155                 160

Phe Gln Ser Asn Arg Lys Thr Asp Ser Lys Gln Ser Glu Asp Gly Ala
                165                 170                 175

Ile Lys Gln Ala Ala Ser Arg Leu Ala Thr Asp Lys Gly Asn Glu Thr
            180                 185                 190

Leu Gly Val Phe Phe Ala Asp Met His Leu Arg Lys Ser Tyr Glu Asp
        195                 200                 205

Arg Gln Thr Ala Ile Arg Ala Glu Leu Val Arg Leu Gly Lys Asp His
    210                 215                 220

Leu Thr Gly Asn Ala Arg Lys Lys Ile Trp Ala Lys Val Arg Lys Arg
225                 230                 235                 240

Leu Phe Gly Asp Glu Val Leu Pro Arg Ala Asp Ala Pro His Gly Val
                245                 250                 255

Arg Ala Arg Ala Thr Ile Thr Gly Thr Lys Ala Ser Tyr Asp Tyr Tyr
            260                 265                 270

Pro Thr Arg Asp Met Leu Arg Asp Glu Phe Asn Ala Ile Trp Ala Gly
        275                 280                 285

Gln Ser Ala His His Ala Thr Ile Thr Asp Glu Ala Arg Thr Glu Ile
    290                 295                 300

Glu His Ile Ile Phe Tyr Gln Arg Pro Leu Lys Pro Ala Ile Val Gly
305                 310                 315                 320

Lys Cys Thr Leu Asp Pro Ala Thr Arg Pro Phe Lys Glu Asp Pro Glu
                325                 330                 335

Gly Tyr Arg Ala Pro Trp Ser His Pro Leu Ala Gln Arg Phe Arg Ile
            340                 345                 350
```

```
Leu Ser Glu Ala Arg Asn Leu Glu Ile Arg Asp Thr Gly Lys Gly Ser
        355                 360                 365

Arg Arg Leu Thr Lys Glu Gln Ser Asp Leu Val Val Ala Ala Leu Leu
    370                 375                 380

Ala Asn Arg Glu Val Lys Phe Asp Lys Leu Arg Thr Leu Leu Lys Leu
385                 390                 395                 400

Pro Ala Glu Ala Arg Phe Asn Leu Glu Ser Asp Arg Arg Ala Ala Leu
                405                 410                 415

Asp Gly Asp Gln Thr Ala Ala Arg Leu Ser Asp Lys Lys Gly Phe Asn
            420                 425                 430

Lys Ala Trp Arg Gly Phe Pro Pro Glu Arg Gln Ile Ala Ile Val Ala
        435                 440                 445

Arg Leu Glu Glu Thr Glu Asp Glu Asn Glu Leu Ile Ala Trp Leu Glu
    450                 455                 460

Lys Glu Cys Ala Leu Asp Gly Ala Ala Ala Ala Arg Val Ala Asn Thr
465                 470                 475                 480

Thr Leu Pro Asp Gly His Cys Arg Leu Gly Leu Arg Ala Ile Lys Lys
                485                 490                 495

Ile Val Pro Ile Met Gln Asp Gly Leu Asp Glu Asp Gly Val Ala Gly
            500                 505                 510

Ala Gly Tyr His Ile Ala Ala Lys Arg Ala Gly Tyr Asp His Ala Lys
        515                 520                 525

Leu Pro Thr Gly Glu Gln Leu Gly Arg Leu Pro Tyr Tyr Gly Gln Trp
    530                 535                 540

Leu Gln Asp Ala Val Val Gly Ser Gly Asp Ala Arg Asp Gln Lys Glu
```

```
545                 550                 555                 560

Lys Gln Tyr Gly Gln Phe Pro Asn Pro Thr Val His Ile Gly Leu Gly
                565                 570                 575

Gln Leu Arg Arg Val Val Asn Asp Leu Ile Asp Lys Tyr Gly Pro Pro
            580                 585                 590

Thr Glu Ile Ser Ile Glu Phe Thr Arg Ala Leu Lys Leu Ser Glu Gln
        595                 600                 605

Gln Lys Ala Glu Arg Gln Arg Glu Gln Arg Arg Asn Gln Asp Lys Asn
    610                 615                 620

Lys Ala Arg Ala Glu Glu Leu Ala Lys Phe Gly Arg Pro Ala Asn Pro
625                 630                 635                 640

Arg Asn Leu Leu Lys Met Arg Leu Trp Glu Glu Leu Ala His Asp Pro
                645                 650                 655

Leu Asp Arg Lys Cys Val Tyr Thr Gly Glu Gln Ile Ser Ile Glu Arg
            660                 665                 670

Leu Leu Ser Asp Glu Val Asp Ile Asp His Ile Leu Pro Val Ala Met
        675                 680                 685

Thr Leu Asp Asp Ser Pro Ala Asn Lys Ile Ile Cys Met Arg Tyr Ala
    690                 695                 700

Asn Arg His Lys Arg Lys Gln Thr Pro Ser Glu Ala Phe Gly Ser Ser
705                 710                 715                 720

Pro Thr Leu Gln Gly His Arg Tyr Asn Trp Asp Asp Ile Ala Ala Arg
                725                 730                 735

Ala Thr Gly Leu Pro Arg Asn Lys Arg Trp Arg Phe Asp Ala Asn Ala
            740                 745                 750
```

```
Arg Glu Glu Phe Asp Lys Arg Gly Gly Phe Leu Ala Arg Gln Leu Asn
        755                 760                 765

Glu Thr Gly Trp Leu Ala Arg Leu Ala Lys Gln Tyr Leu Gly Ala Val
    770                 775                 780

Thr Asp Pro Asn Gln Ile Trp Val Val Pro Gly Arg Leu Thr Ser Met
785                 790                 795                 800

Leu Arg Gly Lys Trp Gly Leu Asn Gly Leu Leu Pro Ser Asp Asn Tyr
                805                 810                 815

Ala Gly Val Gln Asp Lys Ala Glu Glu Phe Leu Ala Ser Thr Asp Asp
            820                 825                 830

Met Glu Phe Ser Gly Val Lys Asn Arg Ala Asp His Arg His His Ala
        835                 840                 845

Ile Asp Gly Leu Val Thr Ala Leu Thr Asp Arg Ser Leu Leu Trp Lys
    850                 855                 860

Met Ala Asn Ala Tyr Asp Glu Glu His Glu Lys Phe Val Ile Glu Pro
865                 870                 875                 880

Pro Trp Pro Thr Met Arg Asp Asp Leu Lys Ala Ala Leu Glu Lys Met
                885                 890                 895

Val Val Ser His Lys Pro Asp His Gly Ile Glu Gly Lys Leu His Glu
            900                 905                 910

Asp Ser Ala Tyr Gly Phe Val Lys Pro Leu Asp Ala Thr Gly Leu Lys
        915                 920                 925

Glu Glu Glu Ala Gly Asn Leu Val Tyr Arg Lys Ala Ile Glu Ser Leu
    930                 935                 940

Asn Glu Asn Glu Val Asp Arg Ile Arg Asp Ile Gln Leu Arg Thr Ile
```

```
945                 950                 955                 960

Val Arg Asp His Val Asn Val Glu Lys Thr Lys Gly Val Ala Leu Ala
               965                 970                 975

Asp Ala Leu Arg Gln Leu Gln Ala Pro Ser Asp Asp Tyr Pro Gln Phe
           980                 985                 990

Lys His Gly Leu Arg His Val Arg  Ile Leu Lys Lys Glu  Lys Gly Asp
        995                 1000                1005

Tyr Leu  Val Pro Ile Ala Asn  Arg Ala Ser Gly Val  Ala Tyr Lys
    1010                1015                1020

Ala Tyr  Ser Ala Gly Glu Asn  Phe Cys Val Glu Val  Phe Glu Thr
    1025                1030                1035

Ala Gly  Gly Lys Trp Asp Gly  Glu Ala Val Arg Arg  Phe Asp Ala
    1040                1045                1050

Asn Lys  Lys Asn Ala Gly Pro  Lys Ile Ala His Ala  Pro Gln Trp
    1055                1060                1065

Arg Asp  Ala Asn Glu Gly Ala  Lys Leu Val Met Arg  Ile His Lys
    1070                1075                1080

Gly Asp  Leu Ile Arg Leu Asp  His Glu Gly Arg Ala  Arg Ile Met
    1085                1090                1095

Val Val  His Arg Leu Asp Ala  Ala Ala Gly Arg Phe  Lys Leu Ala
    1100                1105                1110

Asp His  Asn Glu Thr Gly Asn  Leu Asp Lys Arg His  Ala Thr Asn
    1115                1120                1125

Asn Asp  Ile Asp Pro Phe Arg  Trp Leu Met Ala Ser  Tyr Asn Thr
    1130                1135                1140
```

```
Leu Lys  Lys Leu Ala Ala Val  Pro Val Arg Val Asp  Glu Leu Gly
    1145                1150                1155


Arg Val  Trp Arg Val Met Pro  Asn
    1160                1165


<210>  40
<211>  641
<212>  PRT
<213>  Nitrobacter hamburgensis

<400>  40

Met His Lys Arg Asn Ser Arg Ser Tyr Arg Leu Gly Leu Asp Leu Gly
1               5                   10                  15


Ser Asn Ser Leu Gly Trp Phe Val Thr His Leu Glu Lys Arg Gly Asp
            20                  25                  30


Arg Tyr Glu Pro Val Ala Leu Asp Pro Gly Gly Val Arg Ile Phe Pro
        35                  40                  45


Asp Gly Arg Asp Pro Gln Ser Gly Met Ser Asn Ala Val Asp Arg Arg
    50                  55                  60


Met Ala Arg Gly Ala Arg Lys Arg Arg Asp Arg Phe Val Asp Pro Tyr
65                  70                  75                  80


Ala Leu Arg Lys Ala Ala Leu Thr Asn Ala Leu Pro Ala His Arg Val
                85                  90                  95


Gly Arg Ala Ile Phe His Leu Asn Gln Arg Arg Gly Phe Gln Ser Asn
            100                 105                 110


Arg Lys Thr Asp Arg Lys Gln Ser Glu Asp Gly Ala Ile Lys Gln Ala
        115                 120                 125


Ala Ser Lys Leu Lys Ala Arg Met His Glu Glu Ala Ala Pro Thr Leu
    130                 135                 140
```

```
Gly Ala Phe Phe Ala Asp Met His Leu Arg Lys Ser Tyr Asp Asp Gln
145                 150                 155                 160

Gln Thr Ala Ile Arg Ala Glu Leu Val Arg Leu Gly Lys Asp His Leu
                165                 170                 175

Thr Gly Asn Ala Arg Lys Lys Val Trp Ala Lys Val Arg Lys Arg Leu
            180                 185                 190

Phe Gly Asp Glu Val Leu Arg Pro Lys Asp Thr Ser Asp Gly Ala Arg
        195                 200                 205

Ala Arg Ala Thr Thr Thr Gly Thr Lys Ala Ser Tyr Asp Phe Tyr Pro
    210                 215                 220

Thr Arg Ala Met Leu Leu Asp Glu Phe Asn Ala Ile Trp Ala Ala Gln
225                 230                 235                 240

Arg Glu His His Leu Ala Met Thr Asp Glu Ala Lys Ala Glu Ile Glu
                245                 250                 255

His Ile Ile Phe Tyr His Arg Pro Leu Lys Pro Ala Ile Val Gly Lys
            260                 265                 270

Cys Thr Leu Asp Pro Ala Thr Arg Pro Phe Lys Glu Asp Pro Glu Gly
        275                 280                 285

Tyr Arg Ala Pro Trp Ser His Pro Leu Ala Gln Arg Phe Arg Ile Leu
    290                 295                 300

Ser Glu Ala Arg Asn Leu Glu Ile Arg Glu Thr Gly Lys Thr Ser Arg
305                 310                 315                 320

Arg Leu Thr Lys Asp Gln Ser Asp Leu Val Val Ala Ala Leu Leu Ala
                325                 330                 335
```

```
Asn Arg Glu Val Lys Phe Asp Lys Leu Arg Thr Leu Leu Lys Leu Pro
            340                 345                 350

Ala Glu Ala Arg Phe Asn Leu Glu Ser Asp Arg Arg Ser Thr Ala Thr
        355                 360                 365

Arg Pro Pro His Gly Cys Arg Thr Arg Arg Ala Ser Ile Arg Arg Gly
    370                 375                 380

Ala Gly Phe Leu Arg Asn Gly Arg Ser Arg Ser Ser Pro Asp Trp Lys
385                 390                 395                 400

Lys Pro Lys Thr Lys Thr Asn Cys Ser His Gly Ser Lys Trp Asn Ala
                405                 410                 415

His Leu Thr Ala Gln Arg Pro Arg Ala Ser Pro Ile Arg Arg Cys Arg
            420                 425                 430

Thr Ala Ile Ala Gly Ser Ala Cys Ala Gln Ser Lys Arg Ser Cys Arg
        435                 440                 445

Ser Cys Arg Thr Ser Ser Met Arg Met Ala Leu Arg Ala Pro Ala Ile
    450                 455                 460

Thr Ser Trp Pro Ser Val Pro Ala Thr Thr Ile Pro Val Asp Thr Phe
465                 470                 475                 480

Gln Gln Gly Gly Asn Ala Phe Gly Arg Ile Leu Ser Val Val Thr Ile
                485                 490                 495

Glu Leu Phe Ala Ile Thr Asp Arg Val Asp Pro Val Gln Glu Gln Asp
            500                 505                 510

Ala Arg Cys Phe Ala Leu Arg Ile Ala Glu Cys Arg Ser Asp Gly Leu
        515                 520                 525

Gln His Phe Ala Glu Val Ser Leu Gly Leu Pro Pro Arg Asn Ala Ala
    530                 535                 540
```

```
Gln Asp Gln Arg His Ser Ala Gly Leu Cys Gln Ser Ser Cys Val Gly
545                 550                 555                 560


Arg Phe Val Pro Gly Thr Pro Cys Arg Arg Thr Pro Arg Ser Thr Ser
                565                 570                 575


Leu His Gly Lys Glu Pro Ser Ala His Ala Phe Gly Ser Thr Ala Arg
            580                 585                 590


Ser Arg Pro Gln Leu Pro Ala Ser Pro Arg Pro Cys Met Ser Phe Arg
        595                 600                 605


Asp Gly Thr Ser Ser Ser Pro Ala Arg Met Pro Glu Thr Leu Asp Arg
    610                 615                 620


Cys Ala Ile Ser Arg Ser Asn Arg Ser Ser Val Cys Arg Ala Glu Arg
625                 630                 635                 640


Leu
```

<210> 41
<211> 1368
<212> PRT
<213> Streptococcus pyogenes

<400> 41

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Ile Ala Glu Ala Thr Arg Leu
```

```
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255
```

```
Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Leu Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
```

```
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655
```

```
Thr Val Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
```

```
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser
945                 950                 955                 960

Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Leu Ala
    1010                1015                1020

Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050
```

```
Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080

Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155

Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170

Phe Glu  Lys Asn Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Arg Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215

Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230

Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
```

```
    1235                1240                1245

Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260

His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275

Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290

Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                1300                1305

Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Thr Ala
    1310                1315                1320

Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1325                1330                1335

Thr Lys  Glu Val Leu Asp Ala  Thr Phe Ile His Gln  Ser Ile Thr
    1340                1345                1350

Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                1360                1365


<210>  42
<211>  1368
<212>  PRT
<213>  Streptococcus pyogenes

<400>  42

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30
```

```
Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240
```

```
Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
               245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Leu Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
               325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
               405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430
```

```
Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640
```

```
His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
               645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
               725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
               805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830
```

```
Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser
945                 950                 955                 960

Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020

Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035
```

```
Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050

Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080

Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155

Ser Val  Lys Glu Leu Leu Gly  Leu Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170

Phe Glu  Lys Asn Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Lys Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215
```

```
Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230


Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245


Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260


His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275


Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290


Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                1300                1305


Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
    1310                1315                1320


Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1325                1330                1335


Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1340                1345                1350


Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                1360                1365


<210>  43
<211>  1368
<212>  PRT
<213>  Streptococcus pyogenes

<400>  43

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15
```

```
Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Ile Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
```

```
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Leu Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415
```

```
Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
```

```
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815
```

```
Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser
945                 950                 955                 960

Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Leu Ala
```

```
    1010                1015                1020

Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050

Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080

Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155

Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170

Phe Glu  Lys Asn Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Arg Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200
```

```
Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215


Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230


Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245


Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260


His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275


Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290


Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                1300                1305


Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Thr Ala
    1310                1315                1320


Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1325                1330                1335


Thr Lys  Glu Val Leu Asp Ala  Thr Phe Ile His Gln  Ser Ile Thr
    1340                1345                1350


Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                1360                1365


<210>  44
<211>  1371
<212>  PRT
<213>  Streptococcus pyogenes
```

<400> 44

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190
```

```
Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Arg Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Thr Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400
```

```
Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590
```

```
Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Lys Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg His Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Ile Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Ala Ile Gln Lys Ala Gln Val Ser Gly Gln Gly His Ser Leu
705                 710                 715                 720

His Glu Gln Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Ser Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
        755                 760                 765

Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu
    770                 775                 780

Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val
785                 790                 795                 800
```

```
Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln
                805                 810                 815

Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu
            820                 825                 830

Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp
        835                 840                 845

Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly
    850                 855                 860

Lys Ser Asp Asp Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn
865                 870                 875                 880

Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe
                885                 890                 895

Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys
            900                 905                 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925

His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu
    930                 935                 940

Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys
945                 950                 955                 960

Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu
                965                 970                 975

Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val
            980                 985                 990
```

```
Gly Thr Ala Leu Ile Lys Lys Tyr  Pro Lys Leu Glu Ser  Glu Phe Val
        995                 1000                1005


Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg Lys Met  Ile Ala Lys
    1010                1015                1020


Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala Lys Arg  Phe Phe Tyr
    1025                1030                1035


Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu Ile Thr  Leu Ala Asn
    1040                1045                1050


Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu Thr Asn  Glu Glu Thr
    1055                1060                1065


Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp Phe Ala  Thr Val Arg
    1070                1075                1080


Lys Val  Leu Ser Met Pro Gln  Val Asn Ile Val Lys  Lys Thr Glu
    1085                1090                1095


Val Gln  Thr Gly Ala Leu Thr  Asn Glu Ser Ile Tyr  Ala Arg Gly
    1100                1105                1110


Ser Phe  Asp Lys Leu Ile Ser  Arg Lys His Arg Phe  Glu Ser Ser
    1115                1120                1125


Lys Tyr  Gly Gly Phe Gly Ser  Pro Thr Val Thr Tyr  Ser Val Leu
    1130                1135                1140


Val Val  Ala Lys Ser Lys Val  Gln Asp Gly Lys Val  Lys Lys Ile
    1145                1150                1155


Lys Thr  Gly Lys Glu Leu Ile  Gly Ile Thr Leu Leu  Asp Lys Leu
    1160                1165                1170


Val Phe  Glu Lys Asn Pro Leu  Lys Phe Ile Glu Asp  Lys Gly Tyr
    1175                1180                1185
```

```
Gly Asn  Val Gln Ile Asp Lys  Cys Ile Lys Leu Pro  Lys Tyr Ser
    1190                1195                1200

Leu Phe  Glu Phe Glu Asn Gly  Thr Arg Arg Met Leu  Ala Ser Val
    1205                1210                1215

Met Ala  Asn Asn Asn Ser Arg  Gly Asp Leu Gln Lys  Ala Asn Glu
    1220                1225                1230

Met Phe  Leu Pro Ala Lys Leu  Val Thr Leu Leu Tyr  His Ala His
    1235                1240                1245

Lys Ile  Glu Ser Ser Lys Glu  Leu Glu His Glu Ala  Tyr Ile Leu
    1250                1255                1260

Asp His  Tyr Asn Asp Leu Tyr  Gln Leu Leu Ser Tyr  Ile Glu Arg
    1265                1270                1275

Phe Ala  Ser Leu Tyr Val Asp  Val Glu Lys Asn Ile  Ser Lys Val
    1280                1285                1290

Lys Glu  Leu Phe Ser Asn Ile  Glu Ser Tyr Ser Ile  Ser Glu Ile
    1295                1300                1305

Cys Ser  Ser Val Ile Asn Leu  Leu Thr Leu Thr Ala  Ser Gly Ala
    1310                1315                1320

Pro Ala  Asp Phe Lys Phe Leu  Gly Thr Thr Ile Pro  Arg Lys Arg
    1325                1330                1335

Tyr Gly  Ser Pro Gln Ser Ile  Leu Ser Ser Thr Leu  Ile His Gln
    1340                1345                1350

Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile Asp Leu  Ser Gln Leu
    1355                1360                1365
```

Gly Ser Asp
    1370

<210> 45
<211> 1121
<212> PRT
<213> Streptococcus thermophilus

<400> 45

Met Ser Asp Leu Val Leu Gly Leu Asp Ile Gly Ile Gly Ser Val Gly
1   5   10   15

Val Gly Ile Leu Asn Lys Val Thr Gly Glu Ile Ile His Lys Asn Ser
            20   25   30

Arg Ile Phe Pro Ala Ala Gln Ala Glu Asn Asn Leu Val Arg Arg Thr
        35   40   45

Asn Arg Gln Gly Arg Arg Leu Ala Arg Arg Lys Lys His Arg Arg Val
    50   55   60

Arg Leu Asn Arg Leu Phe Glu Glu Ser Gly Leu Ile Thr Asp Phe Thr
65   70   75   80

Lys Ile Ser Ile Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly Leu
                85   90   95

Thr Asp Glu Leu Ser Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Met
            100   105   110

Val Lys His Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Asp Asp Gly
        115   120   125

Asn Ser Ser Val Gly Asp Tyr Ala Gln Ile Val Lys Glu Asn Ser Lys
    130   135   140

Gln Leu Glu Thr Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Tyr Gln
145   150   155   160

```
Thr Tyr Gly Gln Leu Arg Gly Asp Phe Thr Val Glu Lys Asp Gly Lys
                165                 170                 175

Lys His Arg Leu Ile Asn Val Phe Pro Thr Ser Ala Tyr Arg Ser Glu
            180                 185                 190

Ala Leu Arg Ile Leu Gln Thr Gln Gln Glu Phe Asn Pro Gln Ile Thr
        195                 200                 205

Asp Glu Phe Ile Asn Arg Tyr Leu Glu Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240

Tyr Arg Thr Ser Gly Glu Thr Leu Asp Asn Ile Phe Gly Ile Leu Ile
                245                 250                 255

Gly Lys Cys Thr Phe Tyr Pro Asp Glu Phe Arg Ala Ala Lys Ala Ser
            260                 265                 270

Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285

Val Pro Thr Glu Thr Lys Lys Leu Ser Lys Glu Gln Lys Asn Gln Ile
    290                 295                 300

Ile Asn Tyr Val Lys Asn Glu Lys Ala Met Gly Pro Ala Lys Leu Phe
305                 310                 315                 320

Lys Tyr Ile Ala Lys Leu Leu Ser Cys Asp Val Ala Asp Ile Lys Gly
                325                 330                 335

Tyr Arg Ile Asp Lys Ser Gly Lys Ala Glu Ile His Thr Phe Glu Ala
            340                 345                 350

Tyr Arg Lys Met Lys Thr Leu Glu Thr Leu Asp Ile Glu Gln Met Asp
```

```
        355                 360                 365

Arg Glu Thr Leu Asp Lys Leu Ala Tyr Val Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Gln Glu Ala Leu Glu His Glu Phe Ala Asp Gly Ser
385                 390                 395                 400

Phe Ser Gln Lys Gln Val Asp Glu Leu Val Gln Phe Arg Lys Ala Asn
                405                 410                 415

Ser Ser Ile Phe Gly Lys Gly Trp His Asn Phe Ser Val Lys Leu Met
            420                 425                 430

Met Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr
        435                 440                 445

Ile Leu Thr Arg Leu Gly Lys Gln Lys Thr Thr Ser Ser Ser Asn Lys
    450                 455                 460

Thr Lys Tyr Ile Asp Glu Lys Leu Leu Thr Glu Glu Ile Tyr Asn Pro
465                 470                 475                 480

Val Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Val Asn Ala Ala
                485                 490                 495

Ile Lys Glu Tyr Gly Asp Phe Asp Asn Ile Val Ile Glu Met Ala Arg
            500                 505                 510

Glu Thr Asn Glu Asp Asp Glu Lys Lys Ala Ile Gln Lys Ile Gln Lys
        515                 520                 525

Ala Asn Lys Asp Glu Lys Asp Ala Ala Met Leu Lys Ala Ala Asn Gln
    530                 535                 540

Tyr Asn Gly Lys Ala Glu Leu Pro His Ser Val Phe His Gly His Lys
545                 550                 555                 560
```

```
Gln Leu Ala Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Arg Cys
                565                 570                 575

Leu Tyr Thr Gly Lys Thr Ile Ser Ile His Asp Leu Ile Asn Asn Ser
            580                 585                 590

Asn Gln Phe Glu Val Asp His Ile Leu Pro Leu Ser Ile Thr Phe Asp
        595                 600                 605

Asp Ser Leu Ala Asn Lys Val Leu Val Tyr Ala Thr Ala Asn Gln Glu
    610                 615                 620

Lys Gly Gln Arg Thr Pro Tyr Gln Ala Leu Asp Ser Met Asp Asp Ala
625                 630                 635                 640

Trp Ser Phe Arg Glu Leu Lys Ala Phe Val Arg Glu Ser Lys Thr Leu
                645                 650                 655

Ser Asn Lys Lys Lys Glu Tyr Leu Leu Thr Glu Glu Asp Ile Ser Lys
            660                 665                 670

Phe Asp Val Arg Lys Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Ala Ser Arg Val Val Leu Asn Ala Leu Gln Glu His Phe Arg Ala
    690                 695                 700

His Lys Ile Asp Thr Lys Val Ser Val Val Arg Gly Gln Phe Thr Ser
705                 710                 715                 720

Gln Leu Arg Arg His Trp Gly Ile Glu Lys Thr Arg Asp Thr Tyr His
                725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Asn
            740                 745                 750

Leu Trp Lys Lys Gln Lys Asn Thr Leu Val Ser Tyr Ser Glu Asp Gln
```

```
        755                 760                 765

Leu Leu Asp Ile Glu Thr Gly Glu Leu Ile Ser Asp Asp Glu Tyr Lys
    770                 775                 780

Glu Ser Val Phe Lys Ala Pro Tyr Gln His Phe Val Asp Thr Leu Lys
785                 790                 795                 800

Ser Lys Glu Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln Val Asp Ser
                805                 810                 815

Lys Phe Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg Gln
            820                 825                 830

Ala Lys Val Gly Lys Asp Lys Ala Asp Glu Thr Tyr Val Leu Gly Lys
        835                 840                 845

Ile Lys Asp Ile Tyr Thr Gln Asp Gly Tyr Asp Ala Phe Met Lys Ile
    850                 855                 860

Tyr Lys Lys Asp Lys Ser Lys Phe Leu Met Tyr Arg His Asp Pro Gln
865                 870                 875                 880

Thr Phe Glu Lys Val Ile Glu Pro Ile Leu Glu Asn Tyr Pro Asn Lys
                885                 890                 895

Gln Ile Asn Glu Lys Gly Lys Glu Val Pro Cys Asn Pro Phe Leu Lys
            900                 905                 910

Tyr Lys Glu Glu His Gly Tyr Ile Arg Lys Tyr Ser Lys Lys Gly Asn
        915                 920                 925

Gly Pro Glu Ile Lys Ser Leu Lys Tyr Tyr Asp Ser Lys Leu Gly Asn
    930                 935                 940

His Ile Asp Ile Thr Pro Lys Asp Ser Asn Asn Lys Val Val Leu Gln
945                 950                 955                 960
```

```
Ser Val Ser Pro Trp Arg Ala Asp Val Tyr Phe Asn Lys Thr Thr Gly
                965                 970                 975


Lys Tyr Glu Ile Leu Gly Leu Lys Tyr Ala Asp Leu Gln Phe Glu Lys
            980                 985                 990


Gly Thr Gly Thr Tyr Lys Ile Ser  Gln Glu Lys Tyr Asn  Asp Ile Lys
        995                 1000                1005


Lys Lys  Glu Gly Val Asp Ser  Asp Ser Glu Phe Lys  Phe Thr Leu
    1010                1015                1020


Tyr Lys  Asn Asp Leu Leu Leu  Val Lys Asp Thr Glu  Thr Lys Glu
    1025                1030                1035


Gln Gln  Leu Phe Arg Phe Leu  Ser Arg Thr Met Pro  Lys Gln Lys
    1040                1045                1050


His Tyr  Val Glu Leu Lys Pro  Tyr Asp Lys Gln Lys  Phe Glu Gly
    1055                1060                1065


Gly Glu  Ala Leu Ile Lys Val  Leu Gly Asn Val Ala  Asn Ser Gly
    1070                1075                1080


Gln Cys  Lys Lys Gly Leu Gly  Lys Ser Asn Ile Ser  Ile Tyr Lys
    1085                1090                1095


Val Arg  Thr Asp Val Leu Gly  Asn Gln His Ile Ile  Lys Asn Glu
    1100                1105                1110


Gly Asp  Lys Pro Lys Leu Asp  Phe
    1115                1120
```

<210> 46
<211> 1388
<212> PRT
<213> Streptococcus thermophilus

<400> 46

```
Met Thr Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Thr Thr Asp Asn Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Ser Lys Lys Tyr Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Val Leu Leu Phe Asp Ser Gly Ile Thr Ala Glu Gly Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Thr Glu Met Ala Thr Leu Asp Asp Ala
                85                  90                  95

Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Pro Asp Asp Lys Arg
            100                 105                 110

Asp Ser Lys Tyr Pro Ile Phe Gly Asn Leu Val Glu Glu Lys Ala Tyr
        115                 120                 125

His Asp Glu Phe Pro Thr Ile Tyr His Leu Arg Lys Tyr Leu Ala Asp
    130                 135                 140

Ser Thr Lys Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Phe Asn Ser
                165                 170                 175

Lys Asn Asn Asp Ile Gln Lys Asn Phe Gln Asp Phe Leu Asp Thr Tyr
            180                 185                 190
```

```
Asn Ala Ile Phe Glu Ser Asp Leu Ser Leu Glu Asn Ser Lys Gln Leu
        195                 200                 205

Glu Glu Ile Val Lys Asp Lys Ile Ser Lys Leu Glu Lys Lys Asp Arg
    210                 215                 220

Ile Leu Lys Leu Phe Pro Gly Glu Lys Asn Ser Gly Ile Phe Ser Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Arg Lys Cys Phe
                245                 250                 255

Asn Leu Asp Glu Lys Ala Ser Leu His Phe Ser Lys Glu Ser Tyr Asp
            260                 265                 270

Glu Asp Leu Glu Thr Leu Leu Gly Tyr Ile Gly Asp Asp Tyr Ser Asp
        275                 280                 285

Val Phe Leu Lys Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Phe Leu Thr Val Thr Asp Asn Glu Thr Glu Ala Pro Leu Ser Ser Ala
305                 310                 315                 320

Met Ile Lys Arg Tyr Asn Glu His Lys Glu Asp Leu Ala Leu Leu Lys
                325                 330                 335

Glu Tyr Ile Arg Asn Ile Ser Leu Lys Thr Tyr Asn Glu Val Phe Lys
            340                 345                 350

Asp Asp Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Asp Phe Tyr Val Tyr Leu Lys Lys Leu Leu Ala Glu Phe Glu
    370                 375                 380

Gly Ala Asp Tyr Phe Leu Glu Lys Ile Asp Arg Glu Asp Phe Leu Arg
385                 390                 395                 400
```

```
Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Leu Asp Lys Gln Ala Lys Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Lys Asn Lys Glu Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Asp Phe Ala Trp
    450                 455                 460

Ser Ile Arg Lys Arg Asn Glu Lys Ile Thr Pro Trp Asn Phe Glu Asp
465                 470                 475                 480

Val Ile Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Ser Phe Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Thr Phe Asn Val Tyr Asn Glu Leu Thr Lys Val Arg
        515                 520                 525

Phe Ile Ala Glu Ser Met Arg Asp Tyr Gln Phe Leu Asp Ser Lys Gln
    530                 535                 540

Lys Lys Asp Ile Val Arg Leu Tyr Phe Lys Asp Lys Arg Lys Val Thr
545                 550                 555                 560

Asp Lys Asp Ile Ile Glu Tyr Leu His Ala Ile Tyr Gly Tyr Asp Gly
                565                 570                 575

Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ser Ser Leu Ser Thr
            580                 585                 590
```

```
Tyr His Asp Leu Leu Asn Ile Ile Asn Asp Lys Glu Phe Leu Asp Asp
        595                 600                 605

Ser Ser Asn Glu Ala Ile Ile Glu Glu Ile Ile His Thr Leu Thr Ile
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ser Lys Phe Glu Asn
625                 630                 635                 640

Ile Phe Asp Lys Ser Val Leu Lys Lys Leu Ser Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asp Glu
            660                 665                 670

Lys Ser Gly Asn Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Ile Ser
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ala Leu Ser Phe Lys
    690                 695                 700

Lys Lys Ile Gln Lys Ala Gln Ile Ile Gly Asp Glu Asp Lys Gly Asn
705                 710                 715                 720

Ile Lys Glu Val Val Lys Ser Leu Pro Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met
            740                 745                 750

Gly Gly Arg Lys Pro Glu Ser Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Tyr Thr Asn Gln Gly Lys Ser Asn Ser Gln Gln Arg Leu Lys Arg
    770                 775                 780

Leu Glu Lys Ser Leu Lys Glu Leu Gly Ser Lys Ile Leu Lys Glu Asn
785                 790                 795                 800
```

```
Ile Pro Ala Lys Leu Ser Lys Ile Asp Asn Asn Ala Leu Gln Asn Asp
                805                 810                 815

Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly
            820                 825                 830

Asp Asp Leu Asp Ile Asp Arg Leu Ser Asn Tyr Asp Ile Asp His Ile
        835                 840                 845

Ile Pro Gln Ala Phe Leu Lys Asp Asn Ser Ile Asp Asn Lys Val Leu
    850                 855                 860

Val Ser Ser Ala Ser Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Leu
865                 870                 875                 880

Glu Val Val Lys Lys Arg Lys Thr Phe Trp Tyr Gln Leu Leu Lys Ser
                885                 890                 895

Lys Leu Ile Ser Gln Arg Lys Phe Asp Asn Leu Thr Lys Ala Glu Arg
            900                 905                 910

Gly Gly Leu Ser Pro Glu Asp Lys Ala Gly Phe Ile Gln Arg Gln Leu
        915                 920                 925

Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Arg Leu Leu Asp Glu
    930                 935                 940

Lys Phe Asn Asn Lys Lys Asp Glu Asn Asn Arg Ala Val Arg Thr Val
945                 950                 955                 960

Lys Ile Ile Thr Leu Lys Ser Thr Leu Val Ser Gln Phe Arg Lys Asp
                965                 970                 975

Phe Glu Leu Tyr Lys Val Arg Glu Ile Asn Asp Phe His His Ala His
            980                 985                 990
```

```
Asp Ala Tyr Leu Asn Ala Val Val  Ala Ser Ala Leu Leu  Lys Lys Tyr
        995                 1000                1005


Pro Lys  Leu Glu Pro Glu Phe  Val Tyr Gly Asp Tyr  Pro Lys Tyr
    1010                1015                1020


Asn Ser  Phe Arg Glu Arg Lys  Ser Ala Thr Glu Lys  Val Tyr Phe
    1025                1030                1035


Tyr Ser  Asn Ile Met Asn Ile  Phe Lys Lys Ser Ile  Ser Leu Ala
    1040                1045                1050


Asp Gly  Arg Val Ile Glu Arg  Pro Leu Ile Glu Val  Asn Glu Glu
    1055                1060                1065


Thr Gly  Glu Ser Val Trp Asn  Lys Glu Ser Asp Leu  Ala Thr Val
    1070                1075                1080


Arg Arg  Val Leu Ser Tyr Pro  Gln Val Asn Val Val  Lys Lys Val
    1085                1090                1095


Glu Glu  Gln Asn His Gly Leu  Asp Arg Gly Lys Pro  Lys Gly Leu
    1100                1105                1110


Phe Asn  Ala Asn Leu Ser Ser  Lys Pro Lys Pro Asn  Ser Asn Glu
    1115                1120                1125


Asn Leu  Val Gly Ala Lys Glu  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1130                1135                1140


Gly Tyr  Ala Gly Ile Ser Asn  Ser Phe Thr Val Leu  Val Lys Gly
    1145                1150                1155


Thr Ile  Glu Lys Gly Ala Lys  Lys Lys Ile Thr Asn  Val Leu Glu
    1160                1165                1170


Phe Gln  Gly Ile Ser Ile Leu  Asp Arg Ile Asn Tyr  Arg Lys Asp
    1175                1180                1185
```

```
Lys Leu  Asn Phe Leu Leu Glu  Lys Gly Tyr Lys Asp  Ile Glu Leu
    1190                1195                1200

Ile Ile  Glu Leu Pro Lys Tyr  Ser Leu Phe Glu Leu  Ser Asp Gly
    1205                1210                1215

Ser Arg  Arg Met Leu Ala Ser  Ile Leu Ser Thr Asn  Asn Lys Arg
    1220                1225                1230

Gly Glu  Ile His Lys Gly Asn  Gln Ile Phe Leu Ser  Gln Lys Phe
    1235                1240                1245

Val Lys  Leu Leu Tyr His Ala  Lys Arg Ile Ser Asn  Thr Ile Asn
    1250                1255                1260

Glu Asn  His Arg Lys Tyr Val  Glu Asn His Lys Lys  Glu Phe Glu
    1265                1270                1275

Glu Leu  Phe Tyr Tyr Ile Leu  Glu Phe Asn Glu Asn  Tyr Val Gly
    1280                1285                1290

Ala Lys  Lys Asn Gly Lys Leu  Leu Asn Ser Ala Phe  Gln Ser Trp
    1295                1300                1305

Gln Asn  His Ser Ile Asp Glu  Leu Cys Ser Ser Phe  Ile Gly Pro
    1310                1315                1320

Thr Gly  Ser Glu Arg Lys Gly  Leu Phe Glu Leu Thr  Ser Arg Gly
    1325                1330                1335

Ser Ala  Ala Asp Phe Glu Phe  Leu Gly Val Lys Ile  Pro Arg Tyr
    1340                1345                1350

Arg Asp  Tyr Thr Pro Ser Ser  Leu Leu Lys Asp Ala  Thr Leu Ile
    1355                1360                1365
```

```
His Gln  Ser Val Thr Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ala
    1370                1375                1380


Lys Leu  Gly Glu Gly
    1385
```

<210> 47
<211> 1138
<212> PRT
<213> Acidothermus cellulolyticus

<400> 47

```
Met Gly Gly Ser Glu Val Gly Thr Val Pro Val Thr Trp Arg Leu Gly
1               5                   10                  15


Val Asp Val Gly Glu Arg Ser Ile Gly Leu Ala Ala Val Ser Tyr Glu
            20                  25                  30


Glu Asp Lys Pro Lys Glu Ile Leu Ala Ala Val Ser Trp Ile His Asp
        35                  40                  45


Gly Gly Val Gly Asp Glu Arg Ser Gly Ala Ser Arg Leu Ala Leu Arg
    50                  55                  60


Gly Met Ala Arg Arg Ala Arg Arg Leu Arg Arg Phe Arg Arg Ala Arg
65                  70                  75                  80


Leu Arg Asp Leu Asp Met Leu Leu Ser Glu Leu Gly Trp Thr Pro Leu
                85                  90                  95


Pro Asp Lys Asn Val Ser Pro Val Asp Ala Trp Leu Ala Arg Lys Arg
            100                 105                 110


Leu Ala Glu Glu Tyr Val Val Asp Glu Thr Glu Arg Arg Arg Leu Leu
        115                 120                 125


Gly Tyr Ala Val Ser His Met Ala Arg His Arg Gly Trp Arg Asn Pro
    130                 135                 140
```

```
Trp Thr Thr Ile Lys Asp Leu Lys Asn Leu Pro Gln Pro Ser Asp Ser
145                 150                 155                 160

Trp Glu Arg Thr Arg Glu Ser Leu Glu Ala Arg Tyr Ser Val Ser Leu
                165                 170                 175

Glu Pro Gly Thr Val Gly Gln Trp Ala Gly Tyr Leu Leu Gln Arg Ala
            180                 185                 190

Pro Gly Ile Arg Leu Asn Pro Thr Gln Gln Ser Ala Gly Arg Arg Ala
        195                 200                 205

Glu Leu Ser Asn Ala Thr Ala Phe Glu Thr Arg Leu Arg Gln Glu Asp
    210                 215                 220

Val Leu Trp Glu Leu Arg Cys Ile Ala Asp Val Gln Gly Leu Pro Glu
225                 230                 235                 240

Asp Val Val Ser Asn Val Ile Asp Ala Val Phe Cys Gln Lys Arg Pro
                245                 250                 255

Ser Val Pro Ala Glu Arg Ile Gly Arg Asp Pro Leu Asp Pro Ser Gln
            260                 265                 270

Leu Arg Ala Ser Arg Ala Cys Leu Glu Phe Gln Glu Tyr Arg Ile Val
        275                 280                 285

Ala Ala Val Ala Asn Leu Arg Ile Arg Asp Gly Ser Gly Ser Arg Pro
    290                 295                 300

Leu Ser Leu Glu Glu Arg Asn Ala Val Ile Glu Ala Leu Leu Ala Gln
305                 310                 315                 320

Thr Glu Arg Ser Leu Thr Trp Ser Asp Ile Ala Leu Glu Ile Leu Lys
                325                 330                 335

Leu Pro Asn Glu Ser Asp Leu Thr Ser Val Pro Glu Glu Asp Gly Pro
```

```
            340                 345                 350

Ser Ser Leu Ala Tyr Ser Gln Phe Ala Pro Phe Asp Glu Thr Ser Ala
        355                 360                 365

Arg Ile Ala Glu Phe Ile Ala Lys Asn Arg Arg Lys Ile Pro Thr Phe
    370                 375                 380

Ala Gln Trp Trp Gln Glu Gln Asp Arg Thr Ser Arg Ser Asp Leu Val
385                 390                 395                 400

Ala Ala Leu Ala Asp Asn Ser Ile Ala Gly Glu Glu Glu Gln Glu Leu
                405                 410                 415

Leu Val His Leu Pro Asp Ala Glu Leu Glu Ala Leu Glu Gly Leu Ala
            420                 425                 430

Leu Pro Ser Gly Arg Val Ala Tyr Ser Arg Leu Thr Leu Ser Gly Leu
        435                 440                 445

Thr Arg Val Met Arg Asp Asp Gly Val Asp Val His Asn Ala Arg Lys
    450                 455                 460

Thr Cys Phe Gly Val Asp Asp Asn Trp Arg Pro Pro Leu Pro Ala Leu
465                 470                 475                 480

His Glu Ala Thr Gly His Pro Val Val Asp Arg Asn Leu Ala Ile Leu
                485                 490                 495

Arg Lys Phe Leu Ser Ser Ala Thr Met Arg Trp Gly Pro Pro Gln Ser
            500                 505                 510

Ile Val Val Glu Leu Ala Arg Gly Ala Ser Glu Ser Arg Glu Arg Gln
        515                 520                 525

Ala Glu Glu Glu Ala Ala Arg Arg Ala His Arg Lys Ala Asn Asp Arg
    530                 535                 540
```

```
Ile Arg Ala Glu Leu Arg Ala Ser Gly Leu Ser Asp Pro Ser Pro Ala
545                 550                 555                 560


Asp Leu Val Arg Ala Arg Leu Leu Glu Leu Tyr Asp Cys His Cys Met
                565                 570                 575


Tyr Cys Gly Ala Pro Ile Ser Trp Glu Asn Ser Glu Leu Asp His Ile
            580                 585                 590


Val Pro Arg Thr Asp Gly Gly Ser Asn Arg His Glu Asn Leu Ala Ile
        595                 600                 605


Thr Cys Gly Ala Cys Asn Lys Glu Lys Gly Arg Arg Pro Phe Ala Ser
    610                 615                 620


Trp Ala Glu Thr Ser Asn Arg Val Gln Leu Arg Asp Val Ile Asp Arg
625                 630                 635                 640


Val Gln Lys Leu Lys Tyr Ser Gly Asn Met Tyr Trp Thr Arg Asp Glu
                645                 650                 655


Phe Ser Arg Tyr Lys Lys Ser Val Val Ala Arg Leu Lys Arg Arg Thr
            660                 665                 670


Ser Asp Pro Glu Val Ile Gln Ser Ile Glu Ser Thr Gly Tyr Ala Ala
        675                 680                 685


Val Ala Leu Arg Asp Arg Leu Leu Ser Tyr Gly Glu Lys Asn Gly Val
    690                 695                 700


Ala Gln Val Ala Val Phe Arg Gly Gly Val Thr Ala Glu Ala Arg Arg
705                 710                 715                 720


Trp Leu Asp Ile Ser Ile Glu Arg Leu Phe Ser Arg Val Ala Ile Phe
                725                 730                 735


Ala Gln Ser Thr Ser Thr Lys Arg Leu Asp Arg Arg His His Ala Val
```

```
            740                 745                 750

Asp Ala Val Val Leu Thr Thr Leu Thr Pro Gly Val Ala Lys Thr Leu
        755                 760                 765

Ala Asp Ala Arg Ser Arg Arg Val Ser Ala Glu Phe Trp Arg Arg Pro
    770                 775                 780

Ser Asp Val Asn Arg His Ser Thr Glu Glu Pro Gln Ser Pro Ala Tyr
785                 790                 795                 800

Arg Gln Trp Lys Glu Ser Cys Ser Gly Leu Gly Asp Leu Leu Ile Ser
                805                 810                 815

Thr Ala Ala Arg Asp Ser Ile Ala Val Ala Ala Pro Leu Arg Leu Arg
            820                 825                 830

Pro Thr Gly Ala Leu His Glu Glu Thr Leu Arg Ala Phe Ser Glu His
        835                 840                 845

Thr Val Gly Ala Ala Trp Lys Gly Ala Glu Leu Arg Arg Ile Val Glu
    850                 855                 860

Pro Glu Val Tyr Ala Ala Phe Leu Ala Leu Thr Asp Pro Gly Gly Arg
865                 870                 875                 880

Phe Leu Lys Val Ser Pro Ser Glu Asp Val Leu Pro Ala Asp Glu Asn
                885                 890                 895

Arg His Ile Val Leu Ser Asp Arg Val Leu Gly Pro Arg Asp Arg Val
            900                 905                 910

Lys Leu Phe Pro Asp Asp Arg Gly Ser Ile Arg Val Arg Gly Gly Ala
        915                 920                 925

Ala Tyr Ile Ala Ser Phe His His Ala Arg Val Phe Arg Trp Gly Ser
    930                 935                 940
```

```
Ser His Ser Pro Ser Phe Ala Leu Leu Arg Val Ser Leu Ala Asp Leu
945                 950                 955                 960


Ala Val Ala Gly Leu Leu Arg Asp Gly Val Asp Val Phe Thr Ala Glu
                965                 970                 975


Leu Pro Pro Trp Thr Pro Ala Trp Arg Tyr Ala Ser Ile Ala Leu Val
            980                 985                 990


Lys Ala Val Glu Ser Gly Asp Ala  Lys Gln Val Gly Trp  Leu Val Pro
        995                 1000                1005


Gly Asp  Glu Leu Asp Phe Gly  Pro Glu Gly Val Thr  Thr Ala Ala
    1010                1015                1020


Gly Asp  Leu Ser Met Phe Leu  Lys Tyr Phe Pro Glu  Arg His Trp
    1025                1030                1035


Val Val  Thr Gly Phe Glu Asp  Asp Lys Arg Ile Asn  Leu Lys Pro
    1040                1045                1050


Ala Phe  Leu Ser Ala Glu Gln  Ala Glu Val Leu Arg  Thr Glu Arg
    1055                1060                1065


Ser Asp  Arg Pro Asp Thr Leu  Thr Glu Ala Gly Glu  Ile Leu Ala
    1070                1075                1080


Gln Phe  Phe Pro Arg Cys Trp  Arg Ala Thr Val Ala  Lys Val Leu
    1085                1090                1095


Cys His  Pro Gly Leu Thr Val  Ile Arg Arg Thr Ala  Leu Gly Gln
    1100                1105                1110


Pro Arg  Trp Arg Arg Gly His  Leu Pro Tyr Ser Trp  Arg Pro Trp
    1115                1120                1125


Ser Ala  Asp Pro Trp Ser Gly  Gly Thr Pro
```

1130 1135

<210> 48
<211> 1629
<212> PRT
<213> Francisella novicida

<400> 48

Met Asn Phe Lys Ile Leu Pro Ile Ala Ile Asp Leu Gly Val Lys Asn
1 5 10 15

Thr Gly Val Phe Ser Ala Phe Tyr Gln Lys Gly Thr Ser Leu Glu Arg
20 25 30

Leu Asp Asn Lys Asn Gly Lys Val Tyr Glu Leu Ser Lys Asp Ser Tyr
35 40 45

Thr Leu Leu Met Asn Asn Arg Thr Ala Arg Arg His Gln Arg Arg Gly
50 55 60

Ile Asp Arg Lys Gln Leu Val Lys Arg Leu Phe Lys Leu Ile Trp Thr
65 70 75 80

Glu Gln Leu Asn Leu Glu Trp Asp Lys Asp Thr Gln Gln Ala Ile Ser
85 90 95

Phe Leu Phe Asn Arg Arg Gly Phe Ser Phe Ile Thr Asp Gly Tyr Ser
100 105 110

Pro Glu Tyr Leu Asn Ile Val Pro Glu Gln Val Lys Ala Ile Leu Met
115 120 125

Asp Ile Phe Asp Asp Tyr Asn Gly Glu Asp Asp Leu Asp Ser Tyr Leu
130 135 140

Lys Leu Ala Thr Glu Gln Glu Ser Lys Ile Ser Glu Ile Tyr Asn Lys
145 150 155 160

```
Leu Met Gln Lys Ile Leu Glu Phe Lys Leu Met Lys Leu Cys Thr Asp
                165                 170                 175

Ile Lys Asp Asp Lys Val Ser Thr Lys Thr Leu Lys Glu Ile Thr Ser
            180                 185                 190

Tyr Glu Phe Glu Leu Leu Ala Asp Tyr Leu Ala Asn Tyr Ser Glu Ser
        195                 200                 205

Leu Lys Thr Gln Lys Phe Ser Tyr Thr Asp Lys Gln Gly Asn Leu Lys
    210                 215                 220

Glu Leu Ser Tyr Tyr His His Asp Lys Tyr Asn Ile Gln Glu Phe Leu
225                 230                 235                 240

Lys Arg His Ala Thr Ile Asn Asp Arg Ile Leu Asp Thr Leu Leu Thr
                245                 250                 255

Asp Asp Leu Asp Ile Trp Asn Phe Asn Phe Glu Lys Phe Asp Phe Asp
            260                 265                 270

Lys Asn Glu Glu Lys Leu Gln Asn Gln Glu Asp Lys Asp His Ile Gln
        275                 280                 285

Ala His Leu His His Phe Val Phe Ala Val Asn Lys Ile Lys Ser Glu
    290                 295                 300

Met Ala Ser Gly Gly Arg His Arg Ser Gln Tyr Phe Gln Glu Ile Thr
305                 310                 315                 320

Asn Val Leu Asp Glu Asn Asn His Gln Glu Gly Tyr Leu Lys Asn Phe
                325                 330                 335

Cys Glu Asn Leu His Asn Lys Lys Tyr Ser Asn Leu Ser Val Lys Asn
            340                 345                 350

Leu Val Asn Leu Ile Gly Asn Leu Ser Asn Leu Glu Leu Lys Pro Leu
        355                 360                 365
```

```
Arg Lys Tyr Phe Asn Asp Lys Ile His Ala Lys Ala Asp His Trp Asp
    370                 375                 380

Glu Gln Lys Phe Thr Glu Thr Tyr Cys His Trp Ile Leu Gly Glu Trp
385                 390                 395                 400

Arg Val Gly Val Lys Asp Gln Asp Lys Lys Asp Gly Ala Lys Tyr Ser
                405                 410                 415

Tyr Lys Asp Leu Cys Asn Glu Leu Lys Gln Lys Val Thr Lys Ala Gly
            420                 425                 430

Leu Val Asp Phe Leu Leu Glu Leu Asp Pro Cys Arg Thr Ile Pro Pro
        435                 440                 445

Tyr Leu Asp Asn Asn Asn Arg Lys Pro Pro Lys Cys Gln Ser Leu Ile
    450                 455                 460

Leu Asn Pro Lys Phe Leu Asp Asn Gln Tyr Pro Asn Trp Gln Gln Tyr
465                 470                 475                 480

Leu Gln Glu Leu Lys Lys Leu Gln Ser Ile Gln Asn Tyr Leu Asp Ser
                485                 490                 495

Phe Glu Thr Asp Leu Lys Val Leu Lys Ser Ser Lys Asp Gln Pro Tyr
            500                 505                 510

Phe Val Glu Tyr Lys Ser Ser Asn Gln Gln Ile Ala Ser Gly Gln Arg
        515                 520                 525

Asp Tyr Lys Asp Leu Asp Ala Arg Ile Leu Gln Phe Ile Phe Asp Arg
    530                 535                 540

Val Lys Ala Ser Asp Glu Leu Leu Leu Asn Glu Ile Tyr Phe Gln Ala
545                 550                 555                 560
```

```
Lys Lys Leu Lys Gln Lys Ala Ser Ser Glu Leu Glu Lys Leu Glu Ser
                565                 570                 575

Ser Lys Lys Leu Asp Glu Val Ile Ala Asn Ser Gln Leu Ser Gln Ile
            580                 585                 590

Leu Lys Ser Gln His Thr Asn Gly Ile Phe Glu Gln Gly Thr Phe Leu
        595                 600                 605

His Leu Val Cys Lys Tyr Tyr Lys Gln Arg Gln Arg Ala Arg Asp Ser
    610                 615                 620

Arg Leu Tyr Ile Met Pro Glu Tyr Arg Tyr Asp Lys Lys Leu His Lys
625                 630                 635                 640

Tyr Asn Asn Thr Gly Arg Phe Asp Asp Asp Asn Gln Leu Leu Thr Tyr
                645                 650                 655

Cys Asn His Lys Pro Arg Gln Lys Arg Tyr Gln Leu Leu Asn Asp Leu
            660                 665                 670

Ala Gly Val Leu Gln Val Ser Pro Asn Phe Leu Lys Asp Lys Ile Gly
        675                 680                 685

Ser Asp Asp Asp Leu Phe Ile Ser Lys Trp Leu Val Glu His Ile Arg
    690                 695                 700

Gly Phe Lys Lys Ala Cys Glu Asp Ser Leu Lys Ile Gln Lys Asp Asn
705                 710                 715                 720

Arg Gly Leu Leu Asn His Lys Ile Asn Ile Ala Arg Asn Thr Lys Gly
                725                 730                 735

Lys Cys Glu Lys Glu Ile Phe Asn Leu Ile Cys Lys Ile Glu Gly Ser
            740                 745                 750

Glu Asp Lys Lys Gly Asn Tyr Lys His Gly Leu Ala Tyr Glu Leu Gly
        755                 760                 765
```

```
Val Leu Leu Phe Gly Glu Pro Asn Glu Ala Ser Lys Pro Glu Phe Asp
    770                 775                 780

Arg Lys Ile Lys Lys Phe Asn Ser Ile Tyr Ser Phe Ala Gln Ile Gln
785                 790                 795                 800

Gln Ile Ala Phe Ala Glu Arg Lys Gly Asn Ala Asn Thr Cys Ala Val
                805                 810                 815

Cys Ser Ala Asp Asn Ala His Arg Met Gln Gln Ile Lys Ile Thr Glu
            820                 825                 830

Pro Val Glu Asp Asn Lys Asp Lys Ile Ile Leu Ser Ala Lys Ala Gln
        835                 840                 845

Arg Leu Pro Ala Ile Pro Thr Arg Ile Val Asp Gly Ala Val Lys Lys
    850                 855                 860

Met Ala Thr Ile Leu Ala Lys Asn Ile Val Asp Asp Asn Trp Gln Asn
865                 870                 875                 880

Ile Lys Gln Val Leu Ser Ala Lys His Gln Leu His Ile Pro Ile Ile
                885                 890                 895

Thr Glu Ser Asn Ala Phe Glu Phe Glu Pro Ala Leu Ala Asp Val Lys
            900                 905                 910

Gly Lys Ser Leu Lys Asp Arg Arg Lys Lys Ala Leu Glu Arg Ile Ser
        915                 920                 925

Pro Glu Asn Ile Phe Lys Asp Lys Asn Asn Arg Ile Lys Glu Phe Ala
    930                 935                 940

Lys Gly Ile Ser Ala Tyr Ser Gly Ala Asn Leu Thr Asp Gly Asp Phe
945                 950                 955                 960
```

```
Asp Gly Ala Lys Glu Glu Leu Asp His Ile Ile Pro Arg Ser His Lys
               965                 970                 975

Lys Tyr Gly Thr Leu Asn Asp Glu Ala Asn Leu Ile Cys Val Thr Arg
           980                 985                 990

Gly Asp Asn Lys Asn Lys Gly Asn  Arg Ile Phe Cys Leu  Arg Asp Leu
        995                1000                1005

Ala Asp  Asn Tyr Lys Leu Lys  Gln Phe Glu Thr Thr  Asp Asp Leu
    1010                1015                1020

Glu Ile  Glu Lys Lys Ile Ala  Asp Thr Ile Trp Asp  Ala Asn Lys
    1025                1030                1035

Lys Asp  Phe Lys Phe Gly Asn  Tyr Arg Ser Phe Ile  Asn Leu Thr
    1040                1045                1050

Pro Gln  Glu Gln Lys Ala Phe  Arg His Ala Leu Phe  Leu Ala Asp
    1055                1060                1065

Glu Asn  Pro Ile Lys Gln Ala  Val Ile Arg Ala Ile  Asn Asn Arg
    1070                1075                1080

Asn Arg  Thr Phe Val Asn Gly  Thr Gln Arg Tyr Phe  Ala Glu Val
    1085                1090                1095

Leu Ala  Asn Asn Ile Tyr Leu  Arg Ala Lys Lys Glu  Asn Leu Asn
    1100                1105                1110

Thr Asp  Lys Ile Ser Phe Asp  Tyr Phe Gly Ile Pro  Thr Ile Gly
    1115                1120                1125

Asn Gly  Arg Gly Ile Ala Glu  Ile Arg Gln Leu Tyr  Glu Lys Val
    1130                1135                1140

Asp Ser  Asp Ile Gln Ala Tyr  Ala Lys Gly Asp Lys  Pro Gln Ala
    1145                1150                1155
```

```
Ser Tyr  Ser His Leu Ile Asp  Ala Met Leu Ala Phe  Cys Ile Ala
    1160                1165                1170

Ala Asp  Glu His Arg Asn Asp  Gly Ser Ile Gly Leu  Glu Ile Asp
    1175                1180                1185

Lys Asn  Tyr Ser Leu Tyr Pro  Leu Asp Lys Asn Thr  Gly Glu Val
    1190                1195                1200

Phe Thr  Lys Asp Ile Phe Ser  Gln Ile Lys Ile Thr  Asp Asn Glu
    1205                1210                1215

Phe Ser  Asp Lys Lys Leu Val  Arg Lys Lys Ala Ile  Glu Gly Phe
    1220                1225                1230

Asn Thr  His Arg Gln Met Thr  Arg Asp Gly Ile Tyr  Ala Glu Asn
    1235                1240                1245

Tyr Leu  Pro Ile Leu Ile His  Lys Glu Leu Asn Glu  Val Arg Lys
    1250                1255                1260

Gly Tyr  Thr Trp Lys Asn Ser  Glu Glu Ile Lys Ile  Phe Lys Gly
    1265                1270                1275

Lys Lys  Tyr Asp Ile Gln Gln  Leu Asn Asn Leu Val  Tyr Cys Leu
    1280                1285                1290

Lys Phe  Val Asp Lys Pro Ile  Ser Ile Asp Ile Gln  Ile Ser Thr
    1295                1300                1305

Leu Glu  Glu Leu Arg Asn Ile  Leu Thr Thr Asn Asn  Ile Ala Ala
    1310                1315                1320

Thr Ala  Glu Tyr Tyr Tyr Ile  Asn Leu Lys Thr Gln  Lys Leu His
    1325                1330                1335
```

```
Glu Tyr  Tyr Ile Glu Asn Tyr  Asn Thr Ala Leu Gly  Tyr Lys Lys
    1340                1345                1350

Tyr Ser  Lys Glu Met Glu Phe  Leu Arg Ser Leu Ala  Tyr Arg Ser
    1355                1360                1365

Glu Arg  Val Lys Ile Lys Ser  Ile Asp Asp Val Lys  Gln Val Leu
    1370                1375                1380

Asp Lys  Asp Ser Asn Phe Ile  Ile Gly Lys Ile Thr  Leu Pro Phe
    1385                1390                1395

Lys Lys  Glu Trp Gln Arg Leu  Tyr Arg Glu Trp Gln  Asn Thr Thr
    1400                1405                1410

Ile Lys  Asp Asp Tyr Glu Phe  Leu Lys Ser Phe Phe  Asn Val Lys
    1415                1420                1425

Ser Ile  Thr Lys Leu His Lys  Lys Val Arg Lys Asp  Phe Ser Leu
    1430                1435                1440

Pro Ile  Ser Thr Asn Glu Gly  Lys Phe Leu Val Lys  Arg Lys Thr
    1445                1450                1455

Trp Asp  Asn Asn Phe Ile Tyr  Gln Ile Leu Asn Asp  Ser Asp Ser
    1460                1465                1470

Arg Ala  Asp Gly Thr Lys Pro  Phe Ile Pro Ala Phe  Asp Ile Ser
    1475                1480                1485

Lys Asn  Glu Ile Val Glu Ala  Ile Ile Asp Ser Phe  Thr Ser Lys
    1490                1495                1500

Asn Ile  Phe Trp Leu Pro Lys  Asn Ile Glu Leu Gln  Lys Val Asp
    1505                1510                1515

Asn Lys  Asn Ile Phe Ala Ile  Asp Thr Ser Lys Trp  Phe Glu Val
    1520                1525                1530
```

```
Glu Thr  Pro Ser Asp Leu Arg  Asp Ile Gly Ile Ala  Thr Ile Gln
    1535                1540                1545


Tyr Lys  Ile Asp Asn Asn Ser  Arg Pro Lys Val Arg  Val Lys Leu
    1550                1555                1560


Asp Tyr  Val Ile Asp Asp Asp  Ser Lys Ile Asn Tyr  Phe Met Asn
    1565                1570                1575


His Ser  Leu Leu Lys Ser Arg  Tyr Pro Asp Lys Val  Leu Glu Ile
    1580                1585                1590


Leu Lys  Gln Ser Thr Ile Ile  Glu Phe Glu Ser Ser  Gly Phe Asn
    1595                1600                1605


Lys Thr  Ile Lys Glu Met Leu  Gly Met Lys Leu Ala  Gly Ile Tyr
    1610                1615                1620


Asn Glu  Thr Ser Asn Asn
    1625
```

<210> 49
<211> 1068
<212> PRT
<213> Verminephrobacter eiseniae

<400> 49

```
Met Asn Lys Ala Val Ala Tyr Arg Leu Ala Leu Asp Leu Gly Ser Thr
1               5                  10                  15


Ser Leu Gly Trp Ala Ile Phe Arg Leu Asn Glu Ala Arg Glu Pro Thr
            20                  25                  30


Ala Ile Ile Arg Ala Gly Val Arg Ile Phe Ser Asp Gly Arg Asn Ala
        35                  40                  45


Asn Ser Glu Pro Leu Ala Val His Arg Arg Val Ala Arg Ala Met Arg
```

```
    50                  55                  60

Arg Arg Arg Asp Arg Leu Leu Lys Arg Lys Lys Arg Met His Asp Gln
65                  70                  75                  80

Leu Val Gln His Gly Phe Phe Pro Ala Glu Val Ala Glu Arg Lys Glu
                85                  90                  95

Leu Glu Arg Leu Asn Pro Tyr Gln Leu Arg Ala Lys Gly Leu His Glu
            100                 105                 110

Ala Leu Thr Pro Gly Glu Phe Ala Arg Ala Leu Phe His Ile Asn Gln
        115                 120                 125

Arg Arg Gly Phe Lys Ser Asn Arg Lys Thr Asp Arg Lys Asp Asn Asp
    130                 135                 140

Ser Gly Ala Leu Lys Gln Ala Ile Ser Glu Leu Arg Lys Arg Ile Gln
145                 150                 155                 160

Asp Ser Asp Cys Ala Thr Ala Gly Glu Trp Phe Trp Lys Glu Arg Met
                165                 170                 175

Gln Gln Lys Pro Glu Gly Val Arg Gly Gln Trp Val Arg Ala Arg Tyr
            180                 185                 190

Arg Lys Thr Pro Ser Thr Thr Asp Glu Gly Lys Lys Arg Ile Gly Tyr
        195                 200                 205

Asp Leu Tyr Val Asp Arg Ala Met Val Glu Gln Glu Phe Asp Ala Leu
    210                 215                 220

Trp Ala Ala Gln Ala Ala Leu Gln Pro Gly Leu Phe Thr Glu Ala Ala
225                 230                 235                 240

Arg Ala Glu Leu Lys Asp Thr Leu Leu Tyr Gln Arg Asp Leu Arg Pro
                245                 250                 255
```

```
Val Lys Pro Gly Arg Cys Thr Leu Leu Pro Ala Glu Glu Arg Ala Pro
            260                 265                 270

Leu Ala Leu Pro Ser Thr Gln Arg Phe Arg Ile Leu Gln Glu Val Asn
        275                 280                 285

Asn Leu Arg Leu Leu Asp Glu Ala Leu Arg Glu Val Pro Leu Asn Leu
    290                 295                 300

Ala Gln Arg Asp Ala Val Val Ser Ala Leu Glu Gly Lys Lys Glu Leu
305                 310                 315                 320

Ser Phe Ala Ala Ile Arg Lys Leu Leu Thr Leu Ser Gly Lys Phe Asn
                325                 330                 335

Leu Glu Asp Glu Lys Arg Ala Glu Leu Lys Gly Asn Ala Thr Ser Val
            340                 345                 350

Ile Leu Ala Arg Lys Asp Leu Phe Gly Asp Ala Trp Ala Gly Phe Asp
        355                 360                 365

Ala Ala Val Gln Asp Glu Ile Val Trp Arg Leu Val Ser Gln Glu Ser
    370                 375                 380

Glu Gly Ala Leu Ile Ala Trp Leu Gln Gln His Thr Gly Val Asp Gly
385                 390                 395                 400

Val Cys Ala Glu Ala Ile Val Asn Thr Arg Leu Pro Asp Gly Tyr Gly
                405                 410                 415

Arg Leu Ser Arg Lys Ala Leu Glu Arg Ile Val Pro Ala Leu Gln Arg
            420                 425                 430

Glu Val Cys Thr Tyr Asp Lys Ala Val Gln Ala Ala Gly Phe Ala His
        435                 440                 445

His Ser Asp Leu Gly Phe Asp Phe Asp Tyr Ala Glu Asp Glu Val Gln
```

```
    450                 455                 460

Gln Val Gly Glu His Thr Ile Ala Ser Thr Gly Glu Val Gln Ala Gln
465                 470                 475                 480

Tyr Ala Phe Lys Gln Leu Pro Tyr Tyr Gly Lys Ala Leu Gln Arg His
                485                 490                 495

Val Ala Phe Gly Ser Gly Asp Ala Lys Asp His Glu Glu Lys Cys Tyr
            500                 505                 510

Gly Lys Ile Ala Asn Pro Thr Val His Ile Gly Leu Asn Gln Val Arg
        515                 520                 525

Thr Val Val Asn Ala Leu Ile Arg Arg Tyr Gly His Pro Thr Glu Val
    530                 535                 540

Val Val Glu Leu Ala Arg Asp Leu Lys Gln Ser Arg Glu Gln Lys Gln
545                 550                 555                 560

Gln Thr Gln Arg Glu Gln Ala Asp Asn Gln Lys Arg Asn Glu Asp Ile
                565                 570                 575

Arg Lys Arg Ile Ala Pro Ile Leu Glu Thr Ser Pro Glu Arg Val Arg
            580                 585                 590

Asp Arg Asp Ile Lys Lys Trp Ile Leu Trp Glu Glu Leu Asn Lys Lys
        595                 600                 605

Asp Ile Ala Asp Arg His Cys Pro Tyr Ser Gly Glu Arg Ile Ser Ala
    610                 615                 620

Thr Met Leu Leu Ser Glu Ala Val Glu Ile Glu His Ile Leu Pro Phe
625                 630                 635                 640

Ser Arg Thr Leu Asp Asp Ser Leu Asn Asn Arg Thr Val Ala Met Arg
                645                 650                 655
```

```
Arg Ala Asn Arg Ile Lys Gly Asp Arg Thr Pro Trp Glu Ala Arg Ala
            660                 665                 670

Asp Phe Glu Ala Gln Gly Trp Arg Tyr Glu Ala Ile Leu Gln Arg Ala
        675                 680                 685

Glu Gly Met Pro Pro Arg Lys Arg Tyr Arg Phe Ala Glu Asp Gly Tyr
    690                 695                 700

Gln Arg Trp Leu Gly Lys Asp Arg Asn Phe Leu Ala Arg Ala Leu Asn
705                 710                 715                 720

Asp Thr Ser Tyr Leu Ser Arg Leu Ala Ala Asn Tyr Leu Arg Leu Val
                725                 730                 735

Cys Pro Gln Gly Val Arg Val Ile Pro Gly Gln Met Thr Asp Lys Leu
            740                 745                 750

Arg Gly Lys Phe Gly Leu Asn Ser Val Leu Gly Leu Asp Gly Lys Lys
        755                 760                 765

Asn Arg Asn Asp His Arg His His Ala Val Asp Ala Cys Val Ile Gly
    770                 775                 780

Val Thr Asp Gln Gly Leu Met Gln Arg Phe Ala Asn Ala Ser Lys Gln
785                 790                 795                 800

Ala Arg Glu Asn Gly Leu Thr Arg Leu Val Gln Asp Met Leu Leu Pro
                805                 810                 815

Trp Trp Pro Ser Tyr Tyr Asp His Val Glu Arg Ala Val Arg His Ile
            820                 825                 830

Arg Val Ser His Arg Pro Asp His Gly Phe Glu Gly Ala Met Met Lys
        835                 840                 845

Gly Thr Ala His Gly Ile Arg Glu Asp Gly Ile Arg Glu Asp Gly Arg
```

```
    850                 855                 860

Ile Lys Gln Arg Pro Lys Ala Lys Gly Ser Ala Asp His Lys Thr Ile
865                 870                 875                 880

Thr Leu Ile Pro Ile Asp Glu Pro Arg Gln Leu Ala Arg His Gly Val
                885                 890                 895

Asp Ala Glu Gly Lys Pro Leu Pro Tyr Lys Gly Tyr Ala Ser Gly Ser
            900                 905                 910

Asn Tyr Cys Ile Glu Ile Thr Lys Asn Gly Lys Gly Lys Trp Glu Gly
        915                 920                 925

Gln Val Ile Ser Thr Phe Asp Ala Tyr Arg Ile Lys Ala Ala Ala Asp
    930                 935                 940

Ala Ala Ala Arg Ala Gly Gln Val Ile Ser Thr Val Glu Ala Asp Ser
945                 950                 955                 960

Ile Val Arg Lys Ser Gly Trp Glu Arg Leu Arg Gly Ala Gln Ser Gln
                965                 970                 975

Asn Gly Gln Pro Leu Val Met Arg Leu Val Ile Gly Asp Ser Val Arg
            980                 985                 990

Met Glu Val Asp Gly Arg Asp Glu  Val Met Arg Val Val  Lys Met Ser
        995                 1000                1005

Gly Lys  Glu Met Val Phe Ala  Pro Val Arg Glu Ala  Asn Val Asp
    1010                1015                1020

Lys Arg  Asn Asn Met Pro Asp  Glu Gln Asp Pro Phe  Thr Tyr Thr
    1025                1030                1035

Tyr Lys  Arg Ala Asp Gln Leu  Arg Lys Ala Lys Ala  Arg Gln Val
    1040                1045                1050
```

Thr Ile Ser Pro Ile Gly Glu Leu Arg Asp Pro Gly Phe Lys Gly
    1055   1060   1065

<210> 50
<211> 1125
<212> PRT
<213> Francisella tularensis

<400> 50

Met Asn Val Lys Ile Leu Pro Ile Ala Ile Asp Leu Asp Val Lys Asn
1   5   10   15

Thr Gly Val Phe Ser Ala Phe Tyr Gln Lys Gly Thr Ser Leu Glu Lys
            20   25   30

Leu Asp Asn Lys Asn Gly Lys Val Tyr Glu Leu Ser Lys Asp Ser Tyr
        35   40   45

Thr Leu Leu Met Asn Asn Arg Thr Ala Arg Arg His Gln Arg Arg Gly
    50   55   60

Ile Asp Arg Lys Gln Leu Val Lys Arg Leu Phe Lys Leu Val Trp Thr
65   70   75   80

Glu Gln Leu Asn Leu Glu Trp Asp Lys Asp Thr Gln Gln Ala Ile Ser
                85   90   95

Phe Leu Phe Asn Arg Arg Gly Phe Ser Phe Ile Thr Asp Gly Tyr Ser
            100   105   110

Thr Glu Tyr Leu Asn Ile Val Pro Glu Gln Val Lys Ala Ile Leu Met
        115   120   125

Asp Ile Phe Asp Asp Tyr Asn Gly Glu Asp Asp Leu Asp Ser Tyr Leu
    130   135   140

Lys Leu Ala Thr Glu Gln Glu Ser Lys Ile Ser Glu Ile Tyr Asn Lys
145   150   155   160

```
Leu Met Gln Lys Ile Leu Glu Phe Lys Leu Arg Lys Leu Cys Thr Asp
                165                 170                 175

Ile Lys Asp Asp Lys Val Ser Thr Lys Thr Leu Lys Glu Ile Thr Ser
            180                 185                 190

Tyr Glu Phe Glu Leu Leu Ala Asp Tyr Leu Ala Asn Tyr Ser Glu Ser
        195                 200                 205

Leu Lys Ile Gln Lys Phe Ser Tyr Thr Asp Lys Gln Gly Asn Leu Lys
    210                 215                 220

Glu Leu Ser Tyr Tyr His His Asp Lys Tyr Asn Ile Gln Glu Phe Leu
225                 230                 235                 240

Lys Arg His Ala Thr Ile Asn Asp Glu Ile Leu Asp Thr Leu Leu Thr
                245                 250                 255

Asp Asp Phe Asp Ile Trp Asn Phe Asn Phe Glu Lys Phe Asp Phe Asp
            260                 265                 270

Lys Asn Glu Glu Lys Leu Gln Asn Gln Glu Asp Lys Asp His Thr Gln
        275                 280                 285

Ala His Leu His His Phe Val Phe Ala Val Asn Lys Ile Lys Ser Glu
    290                 295                 300

Met Ala Ser Gly Gly Arg His Arg Ser Gln Tyr Phe Gln Glu Ile Thr
305                 310                 315                 320

Asn Val Leu Asp Glu Asn Asn His Gln Glu Gly Tyr Leu Lys Asn Phe
                325                 330                 335

Cys Glu Asn Leu His Asn Lys Lys Tyr Ser Asn Leu Ser Val Lys Asn
            340                 345                 350
```

```
Leu Val Asn Leu Val Gly Asn Leu Ser Asn Leu Glu Leu Lys Pro Leu
        355                 360                 365

Arg Lys Tyr Phe Asn Asp Lys Ile His Ala Lys Ala Asp His Trp Asp
    370                 375                 380

Glu Gln Lys Phe Thr Glu Thr Tyr Cys His Trp Ile Leu Gly Glu Trp
385                 390                 395                 400

Arg Val Gly Val Lys Asp Gln Asp Lys Lys Asp Gly Ala Lys Tyr Ser
                405                 410                 415

Tyr Lys Asp Leu Cys Asn Glu Leu Lys Gln Lys Val Thr Lys Ala Gly
            420                 425                 430

Leu Ile Asp Phe Leu Leu Glu Leu Asp Pro Cys Arg Thr Ile Pro Pro
        435                 440                 445

Tyr Leu Asp Asn Asn Asn Arg Lys Pro Pro Lys Cys Gln Ser Leu Ile
    450                 455                 460

Leu Asn Pro Lys Phe Leu Asp Asn Gln Tyr Pro Asn Trp Gln Gln Tyr
465                 470                 475                 480

Leu Gln Glu Leu Lys Lys Leu Gln Ser Ile Gln Asp Tyr Leu Asp Ser
                485                 490                 495

Phe Glu Thr Asp Leu Lys Asp Leu Lys Ser Ser Lys Asp Gln Pro Tyr
            500                 505                 510

Phe Val Glu Tyr Lys Ser Ser Asn Gln Gln Met Ala Ser Gly Gln Arg
        515                 520                 525

Asp Tyr Lys Asp Leu Asp Ala Arg Ile Leu Gln Phe Ile Phe Asp Arg
    530                 535                 540

Val Lys Ala Ser Asp Glu Leu Leu Leu Asn Glu Ile Tyr Phe Gln Ala
545                 550                 555                 560
```

```
Lys Lys Leu Lys Gln Lys Ala Ser Ser Glu Leu Glu Lys Leu Glu Ser
               565                 570                 575

Ser Lys Lys Leu Asp Glu Val Ile Ala Asn Ser Gln Leu Ser Gln Ile
            580                 585                 590

Leu Lys Ser Gln His Thr Asn Gly Ile Phe Glu Gln Gly Thr Phe Leu
        595                 600                 605

His Leu Val Cys Lys Tyr Tyr Lys Gln Arg Gln Arg Ala Arg Asp Ser
    610                 615                 620

Arg Leu Tyr Ile Met Pro Glu Tyr Arg Tyr Asp Lys Lys Leu Asp Lys
625                 630                 635                 640

Tyr Asn Asn Thr Gly Arg Phe Asp Asp Asn Asn Gln Leu Leu Thr Tyr
               645                 650                 655

Cys Asn His Lys Pro Arg Gln Lys Arg Tyr Gln Leu Leu Asn Asp Leu
            660                 665                 670

Ala Gly Val Leu Gln Val Ser Arg Asn Gln Leu Leu Ser Ser Val Glu
        675                 680                 685

Glu Trp Phe Gln Gln Ala Gln Arg Val Gly Glu Ile Ser Lys Ser Gln
    690                 695                 700

Asp Glu Gln Ile Phe Glu Trp Leu Lys Ser Phe Lys Ile Ala Ser Tyr
705                 710                 715                 720

Cys Lys Ala Ala Val Glu Met Gln Lys Gln Tyr Arg Gly Thr Leu Lys
               725                 730                 735

Asn Ala Ile Gln Thr Ala Ile Phe Arg Gln Ser Glu Asn Ile Asn Lys
            740                 745                 750
```

```
Asn Lys Asn Lys Asn Thr Gly Asn Gln Gln Gln Ala Leu Ser Glu Asn
        755                 760                 765

Ser Lys Asp Val Lys Ser Leu Thr Ala Asp Glu Lys Lys Leu Leu Lys
    770                 775                 780

Leu Ile Glu Asn Ile Ala Lys Ala Ser Gln Lys Ile Gly Glu Ser Leu
785                 790                 795                 800

Gly Leu Asn Asp Lys Gln Ile Lys Lys Phe Asn Ser Ile Tyr Ser Phe
                805                 810                 815

Ala Gln Ile Gln Gln Ile Ala Phe Ala Glu Arg Lys Gly Asn Ala Asn
            820                 825                 830

Thr Cys Ala Val Cys Ser Ala Asp Asn Ala His Arg Met Gln Gln Ile
        835                 840                 845

Lys Ile Thr Glu Leu Val Glu Asp Asn Lys Asp Asn Ile Ile Leu Ser
    850                 855                 860

Ala Lys Ala Gln Arg Leu Pro Ala Ile Pro Thr Arg Ile Val Asp Gly
865                 870                 875                 880

Ala Val Lys Lys Met Ala Thr Ile Leu Ala Lys Asn Ile Val Asp Asp
                885                 890                 895

Asn Trp Gln Asn Ile Lys Gln Val Leu Ser Ala Lys His Gln Leu His
            900                 905                 910

Ile Pro Ile Ile Thr Glu Ser Asn Ala Phe Glu Phe Glu Pro Ala Leu
        915                 920                 925

Ala Asp Val Lys Gly Lys Ser Leu Lys Asp Arg Arg Lys Lys Ala Leu
    930                 935                 940

Glu Arg Ile Ser Pro Glu Asn Ile Phe Lys Asp Lys Asn Asn Arg Ile
945                 950                 955                 960
```

```
Lys Glu Phe Ala Lys Gly Ile Ser Ala Tyr Ser Gly Ala Asn Leu Thr
               965                 970                 975

Asp Gly Asp Phe Asp Gly Ala Lys Glu Glu Leu Asp His Ile Ile Pro
           980                 985                 990

Arg Ser His Lys Lys Tyr Gly Thr  Leu Asn Asp Glu Ala  Asn Leu Ile
        995                 1000                1005

Cys Val  Thr Arg Asp Asp Asn  Lys Asn Ile Phe Ala  Ile Asp Thr
    1010                1015                1020

Ser Lys  Trp Phe Glu Ile Glu  Thr Pro Ser Asp Leu  Arg Asp Ile
    1025                1030                1035

Gly Val  Ala Thr Ile Gln Tyr  Lys Ile Asp Asn Asn  Ser Arg Pro
    1040                1045                1050

Lys Val  Arg Val Lys Leu Asp  Tyr Val Ile Asp Asp  Asp Ser Lys
    1055                1060                1065

Ile Asn  Tyr Phe Met Asn His  Ser Leu Leu Lys Ser  Arg Tyr Pro
    1070                1075                1080

Asp Lys  Val Leu Glu Ile Leu  Lys Gln Ser Thr Ile  Ile Glu Phe
    1085                1090                1095

Glu Ser  Ser Gly Phe Asn Lys  Thr Ile Lys Glu Met  Leu Gly Met
    1100                1105                1110

Thr Leu  Ala Gly Ile Tyr Asn  Glu Thr Ser Asn Asn
    1115                1120                1125
```

<210> 51
<211> 1064
<212> PRT
<213> Bradyrhizobium sp.

<400> 51

```
Met Lys Arg Thr Ser Leu Arg Ala Tyr Arg Leu Gly Val Asp Leu Gly
1               5                   10                  15

Ala Asn Ser Leu Gly Trp Phe Val Val Trp Leu Asp Asp His Gly Gln
            20                  25                  30

Pro Glu Gly Leu Gly Pro Gly Gly Val Arg Ile Phe Pro Asp Gly Arg
        35                  40                  45

Asn Pro Gln Ser Lys Gln Ser Asn Ala Ala Gly Arg Arg Leu Ala Arg
    50                  55                  60

Ser Ala Arg Arg Arg Arg Asp Arg Tyr Leu Gln Arg Arg Gly Lys Leu
65                  70                  75                  80

Met Gly Leu Leu Val Lys His Gly Leu Met Pro Ala Asp Glu Pro Ala
                85                  90                  95

Arg Lys Arg Leu Glu Cys Leu Asp Pro Tyr Gly Leu Arg Ala Lys Ala
            100                 105                 110

Leu Asp Glu Val Leu Pro Leu His His Val Gly Arg Ala Leu Phe His
        115                 120                 125

Leu Asn Gln Arg Arg Gly Leu Phe Ala Asn Arg Ala Ile Glu Gln Gly
    130                 135                 140

Asp Lys Asp Ala Ser Ala Ile Lys Ala Ala Ala Gly Arg Leu Gln Thr
145                 150                 155                 160

Ser Met Gln Ala Cys Gly Ala Arg Thr Leu Gly Glu Phe Leu Asn Arg
                165                 170                 175

Arg His Gln Leu Arg Ala Thr Val Arg Ala Arg Ser Pro Val Gly Gly
            180                 185                 190
```

```
Asp Val Gln Ala Arg Tyr Glu Phe Tyr Pro Thr Arg Ala Met Val Asp
        195                 200                 205

Ala Glu Phe Glu Ala Ile Trp Ala Ala Gln Ala Pro His His Pro Thr
    210                 215                 220

Met Thr Ala Glu Ala His Asp Thr Ile Arg Glu Ala Ile Phe Ser Gln
225                 230                 235                 240

Arg Ala Met Lys Arg Pro Ser Ile Gly Lys Cys Ser Leu Asp Pro Ala
                245                 250                 255

Thr Ser Gln Asp Asp Val Asp Gly Phe Arg Cys Ala Trp Ser His Pro
            260                 265                 270

Leu Ala Gln Arg Phe Arg Ile Trp Gln Asp Val Arg Asn Leu Ala Val
        275                 280                 285

Val Glu Thr Gly Pro Thr Ser Ser Arg Leu Gly Lys Glu Asp Gln Asp
    290                 295                 300

Lys Val Ala Arg Ala Leu Leu Gln Thr Asp Gln Leu Ser Phe Asp Glu
305                 310                 315                 320

Ile Arg Gly Leu Leu Gly Leu Pro Ser Asp Ala Arg Phe Asn Leu Glu
                325                 330                 335

Ser Asp Arg Arg Asp His Leu Lys Gly Asp Ala Thr Gly Ala Ile Leu
            340                 345                 350

Ser Ala Arg Arg His Phe Gly Pro Ala Trp His Asp Arg Ser Leu Asp
        355                 360                 365

Arg Gln Ile Asp Ile Val Ala Leu Leu Glu Ser Ala Leu Asp Glu Ala
    370                 375                 380

Ala Ile Ile Ala Ser Leu Gly Thr Thr His Ser Leu Asp Glu Ala Ala
```

385 390 395 400

Ala Gln Arg Ala Leu Ser Ala Leu Leu Pro Asp Gly Tyr Cys Arg Leu
405 410 415

Gly Leu Arg Ala Ile Lys Arg Val Leu Pro Leu Met Glu Ala Gly Arg
420 425 430

Thr Tyr Ala Glu Ala Ala Ser Ala Ala Gly Tyr Asp His Ala Leu Leu
435 440 445

Pro Gly Gly Lys Leu Ser Pro Thr Gly Tyr Leu Pro Tyr Tyr Gly Gln
450 455 460

Trp Leu Gln Asn Asp Val Val Gly Ser Asp Asp Glu Arg Asp Thr Asn
465 470 475 480

Glu Arg Arg Trp Gly Arg Leu Pro Asn Pro Thr Val His Ile Gly Ile
485 490 495

Gly Gln Leu Arg Arg Val Val Asn Glu Leu Ile Arg Trp His Gly Pro
500 505 510

Pro Ala Glu Ile Thr Val Glu Leu Thr Arg Asp Leu Lys Leu Ser Pro
515 520 525

Arg Arg Leu Ala Glu Leu Glu Arg Glu Gln Ala Glu Asn Gln Arg Lys
530 535 540

Asn Asp Lys Arg Thr Ser Leu Leu Arg Lys Leu Gly Leu Pro Ala Ser
545 550 555 560

Thr His Asn Leu Leu Lys Leu Arg Leu Trp Asp Glu Gln Gly Asp Val
565 570 575

Ala Ser Glu Cys Pro Tyr Thr Gly Glu Ala Ile Gly Leu Glu Arg Leu
580 585 590

```
Val Ser Asp Asp Val Asp Ile Asp His Leu Ile Pro Phe Ser Ile Ser
        595                 600                 605

Trp Asp Asp Ser Ala Ala Asn Lys Val Val Cys Met Arg Tyr Ala Asn
    610                 615                 620

Arg Glu Lys Gly Asn Arg Thr Pro Phe Glu Ala Phe Gly His Arg Gln
625                 630                 635                 640

Gly Arg Pro Tyr Asp Trp Ala Asp Ile Ala Glu Arg Ala Ala Arg Leu
                645                 650                 655

Pro Arg Gly Lys Arg Trp Arg Phe Gly Pro Gly Ala Arg Ala Gln Phe
            660                 665                 670

Glu Glu Leu Gly Asp Phe Gln Ala Arg Leu Leu Asn Glu Thr Ser Trp
        675                 680                 685

Leu Ala Arg Val Ala Lys Gln Tyr Leu Ala Ala Val Thr His Pro His
    690                 695                 700

Arg Ile His Val Leu Pro Gly Arg Leu Thr Ala Leu Leu Arg Ala Thr
705                 710                 715                 720

Trp Glu Leu Asn Asp Leu Leu Pro Gly Ser Asp Asp Arg Ala Ala Lys
                725                 730                 735

Ser Arg Lys Asp His Arg His His Ala Ile Asp Ala Leu Val Ala Ala
            740                 745                 750

Leu Thr Asp Gln Ala Leu Leu Arg Arg Met Ala Asn Ala His Asp Asp
        755                 760                 765

Thr Arg Arg Lys Ile Glu Val Leu Leu Pro Trp Pro Thr Phe Arg Ile
    770                 775                 780

Asp Leu Glu Thr Arg Leu Lys Ala Met Leu Val Ser His Lys Pro Asp
```

```
785                 790                 795                 800

His Gly Leu Gln Ala Arg Leu His Glu Asp Thr Ala Tyr Gly Thr Val
                805                 810                 815

Glu His Pro Glu Thr Glu Asp Gly Ala Asn Leu Val Tyr Arg Lys Thr
            820                 825                 830

Phe Val Asp Ile Ser Glu Lys Glu Ile Asp Arg Ile Arg Asp Arg Arg
        835                 840                 845

Leu Arg Asp Leu Val Arg Ala His Val Ala Gly Glu Arg Gln Gln Gly
    850                 855                 860

Lys Thr Leu Lys Ala Ala Val Leu Ser Phe Ala Gln Arg Arg Asp Ile
865                 870                 875                 880

Ala Gly His Pro Asn Gly Ile Arg His Val Arg Leu Thr Lys Ser Ile
                885                 890                 895

Lys Pro Asp Tyr Leu Val Pro Ile Arg Asp Lys Ala Gly Arg Ile Tyr
            900                 905                 910

Lys Ser Tyr Asn Ala Gly Glu Asn Ala Phe Val Asp Ile Leu Gln Ala
        915                 920                 925

Glu Ser Gly Arg Trp Ile Ala Arg Ala Thr Thr Val Phe Gln Ala Asn
    930                 935                 940

Gln Ala Asn Glu Ser His Asp Ala Pro Ala Ala Gln Pro Ile Met Arg
945                 950                 955                 960

Val Phe Lys Gly Asp Met Leu Arg Ile Asp His Ala Gly Ala Glu Lys
                965                 970                 975

Phe Val Lys Ile Val Arg Leu Ser Pro Ser Asn Asn Leu Leu Tyr Leu
            980                 985                 990
```

Val Glu His His Gln Ala Gly Val Phe Gln Thr Arg His Asp Asp Pro
        995   1000   1005

Glu Asp Ser Phe Arg Trp Leu Phe Ala Ser Phe Asp Lys Leu Arg
    1010   1015   1020

Glu Trp Asn Ala Glu Leu Val Arg Ile Asp Thr Leu Gly Gln Pro
    1025   1030   1035

Trp Arg Arg Lys Arg Gly Leu Glu Thr Gly Ser Glu Asp Ala Thr
    1040   1045   1050

Arg Ile Gly Trp Thr Arg Pro Lys Lys Trp Pro
    1055   1060

<210> 52
<211> 1354
<212> PRT
<213> Flavobacterium psychrophilum

<400> 52

Met Lys Lys Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1   5   10   15

Ala Phe Ile Asn Glu Ala Glu Asn Glu Ile Glu Val Ser Ser Ile Val
            20   25   30

Asn Thr Gly Val Arg Ile Val Pro Leu Thr Thr Asp Glu Glu Ser Asp
        35   40   45

Phe Lys Lys Gly Asn Thr Ile Ser Ile Asn Ala Asp Arg Thr Leu Lys
    50   55   60

Arg Gly Ala Arg Arg Gly Leu Gln Arg Phe Lys Gln Arg Arg Glu Ala
65   70   75   80

Leu Leu Glu Thr Phe Asn Arg Ile Lys Phe Ile Ala Thr Asp Phe Val
                85   90   95

```
Tyr Ala Glu Thr Gly Ala Ala Thr Thr Phe Ser Ser Tyr Gln Leu Arg
            100                 105                 110

Ala Lys Ser Ala Val Glu Ala Val Thr Lys Glu Glu Leu Val Lys Val
        115                 120                 125

Leu Leu Met Leu Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Ala
    130                 135                 140

Lys Thr Ala Glu Glu Gly Asp Ala Ile Asp Gly Met Lys Ile Ala Lys
145                 150                 155                 160

Glu Ile Phe Glu Asn Asn Leu Thr Pro Gly Gln Trp Val Tyr Asn Ser
                165                 170                 175

Leu Ser Lys Gly Gly Lys Phe Ile Pro Asp Phe Tyr His Ser Asp Leu
            180                 185                 190

Gln Lys Glu Leu Glu Lys Ile Val Arg Phe Gln Asn Gln Phe His Ser
        195                 200                 205

Glu Gln Ile Asn Asp Lys Leu Leu Ala Asp Ile Gln Gly Lys Ser Arg
    210                 215                 220

Thr Gln Thr Ser Gln His Phe Ser Lys Thr Leu Asn Ile Pro Leu Ala
225                 230                 235                 240

Glu Asn Lys Gly Thr Arg Glu Glu Thr Lys Leu Gln His Tyr Gln Trp
                245                 250                 255

Arg Asn Glu Ala Leu Ala Asn Glu Leu Asp Met Lys Ile Leu Ala Phe
            260                 265                 270

Ile Ile Thr Glu Ile Asn Asn Gln Ile Asn Gln Ser Ser Gly Tyr Leu
        275                 280                 285
```

```
Gly Ala Ile Ser Asp Arg Ser Lys Glu Leu Tyr Phe Asn Gln Glu Thr
    290                 295                 300

Val Gly Gln Tyr Gln Tyr Lys Gln Leu Gln Glu Asn Val His Ala Lys
305                 310                 315                 320

Leu Lys Asn Gln Val Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe Glu
                325                 330                 335

Lys Ile Trp Glu Thr Gln Ala Lys Phe His Ser Glu Leu Asn Glu Lys
            340                 345                 350

Leu Lys Ala Glu Ile Arg Asp Ile Thr Ile Phe Tyr Gln Arg Lys Leu
        355                 360                 365

Lys Ser Gln Lys His Leu Val Ser Phe Cys Glu Phe Glu Lys Gly His
    370                 375                 380

Lys Ala Ile Pro Lys Ser Ser Pro Leu Phe Gln Glu Phe Arg Ile Trp
385                 390                 395                 400

Gln Asn Leu Asn Asn Val Val Val Lys Asn Glu Thr Thr Lys Glu Val
                405                 410                 415

Phe Glu Leu Ser Glu Glu Leu Lys Gln Leu Ile Ala Glu Glu Leu Gln
            420                 425                 430

Phe Lys Glu Ser Met Thr Asp Val Gln Met Leu Thr Phe Cys Glu Leu
        435                 440                 445

Lys Lys Gly Thr His Thr Val Asn Phe Lys Lys Ile Glu Gly Asn Arg
    450                 455                 460

Thr Asn Thr Ser Ile Tyr Lys Ala Phe Glu Lys Ile Leu Glu Val Glu
465                 470                 475                 480

Gly Tyr Glu Ile Asp Phe Ser Lys Met Lys Pro Leu Glu Ile Lys Glu
                485                 490                 495
```

```
Thr Val Ala Pro Ile Phe Glu Thr Leu Asn Ile Asn Thr Val Ile Leu
            500                 505                 510

Asp Phe Asp Pro Thr Ile Gln Gly Asn Asp Phe Asp Lys Gln Pro Tyr
        515                 520                 525

Tyr Gln Leu Trp His Leu Leu Tyr Ser Ala Glu Asp Asp Asp Lys Leu
    530                 535                 540

Lys Glu Thr Leu Lys Thr Lys Phe Gly Phe Lys Glu Asn His Leu Pro
545                 550                 555                 560

Phe Ile Leu Asn Ile Asn Leu Gln Ala Asp Tyr Gly Ser Leu Ser Ala
                565                 570                 575

Lys Ala Ile Lys Lys Ile Leu Pro His Leu Met Asp Gly His Ile Tyr
            580                 585                 590

Asp Lys Ala Cys Leu Met Val Gly Tyr Asn His Ser Ser Ser Leu Thr
        595                 600                 605

Thr Ala Gln Asn Asn Asp Arg Val Leu Lys Asp Thr Leu Glu Leu Leu
    610                 615                 620

Lys Lys Asn Ser Leu Arg Asn Pro Val Val Glu Lys Ile Leu Asn Gln
625                 630                 635                 640

Met Ile Asn Val Ile Asn Ala Ile Met Lys Asp Pro Ala Met Gly Lys
                645                 650                 655

Pro Asp Glu Ile Arg Val Glu Leu Ala Arg Glu Leu Lys Ala Asn Asn
            660                 665                 670

Glu Gln Arg Lys Lys Ala Thr Ser Asp Ile Asn Thr Ala Thr Thr Glu
        675                 680                 685
```

```
His Glu Arg Ile Arg Lys Leu Leu His Ser Glu Phe Asn Ile Pro Arg
    690                 695                 700

Val Thr Arg Asn Asp Ile Ile Arg Tyr Lys Leu Trp Leu Glu Thr Gly
705                 710                 715                 720

Gly Ile Ser Leu Tyr Thr Gly Asn Pro Ile Lys Ala Ser Asp Leu Phe
                725                 730                 735

Ser Lys Asn Tyr Asp Ile Glu His Ile Ile Pro Lys Ser Arg Leu Phe
            740                 745                 750

Asp Asp Ser Phe Ser Asn Lys Thr Leu Cys Glu Arg Gln Leu Asn Ile
        755                 760                 765

Asp Lys Ser Asn Lys Thr Ala Tyr Ser Phe Leu Gln Glu Lys Leu Ser
    770                 775                 780

Glu Asn Asp Phe Ala Ala Tyr Glu Asn Arg Val Lys Asp Leu Phe Lys
785                 790                 795                 800

Thr Gly Lys Ile Lys Ser Tyr Thr Lys Tyr Lys Lys Leu Leu Met Ala
                805                 810                 815

Asp Asn Glu Ile Pro Glu Gly Phe Ile Asp Arg Gln Leu Arg Glu Thr
            820                 825                 830

Gln Tyr Ile Ala Lys Lys Ala Lys Glu Ile Leu Leu Glu Val Ser Arg
        835                 840                 845

Asn Val Thr Ala Thr Ile Gly Ser Val Thr Asp Lys Leu Arg Gln Asp
    850                 855                 860

Trp Glu Leu Val Asp Val Met Lys Glu Leu Asn Trp Glu Lys Tyr Asp
865                 870                 875                 880

Lys Leu Gly Leu Thr His Ile Glu Glu Gly Lys Asn Gly Glu Arg Leu
                885                 890                 895
```

```
Ser Lys Ile Lys Asp Trp Thr Lys Arg Asn Asp His Arg His His Ala
            900                 905                 910

Met Asp Ala Ile Thr Val Ala Phe Thr Lys Pro Ala Tyr Ile Gln Tyr
        915                 920                 925

Leu Asn Asn Leu Asn Ala Lys Thr Gln Gly Glu Asn Lys Ala Asn Ser
    930                 935                 940

Ile Ile Gly Ile Glu Asn Lys His Leu Tyr Arg Asp Lys Asn Asn Lys
945                 950                 955                 960

Leu Arg Phe Ile Ser Pro Met Lys Asn Phe Arg Glu Glu Ala Lys Lys
                965                 970                 975

Gln Leu Glu Ser Ile Leu Ile Ser Tyr Lys Ala Lys Asn Lys Val Val
            980                 985                 990

Thr Lys Asn Lys Asn Thr Thr Lys  Lys Ser Gly Gly Thr  Asn Gln Lys
        995                 1000                1005

Ile Gln  Leu Thr Pro Arg Gly  Arg Leu His Lys Glu  Thr Val Tyr
    1010                1015                1020

Gly Lys  Leu Gln Gln Tyr Ala  Thr Lys Glu Glu Lys  Val Asn Ala
    1025                1030                1035

Ser Phe  Thr Glu Asp Tyr Ile  Gln Lys Val Ala Lys  Lys Glu Tyr
    1040                1045                1050

Arg Glu  Ala Leu Leu Lys Arg  Leu Glu Glu Asn Asp  Asn Asp Pro
    1055                1060                1065

Lys Lys  Ala Phe Thr Gly Lys  Asn Ala Leu Asn Lys  Thr Pro Ile
    1070                1075                1080
```

```
Tyr Ile  Ser Leu Lys Asp Asn  Ile Ile Val Pro Glu  Lys Val Lys
    1085                1090                1095

Thr Val  Trp Leu Glu Thr Asp  Tyr Thr Ile Arg Lys  Asp Ile Thr
    1100                1105                1110

Pro Asp  Leu Lys Ile Asp Lys  Val Ile Asp Val Gly  Ile Lys Arg
    1115                1120                1125

Ile Leu  Gln Asn Arg Leu Asn  Glu Phe Asn Gly Asp  Pro Lys Lys
    1130                1135                1140

Ala Phe  Val Asn Leu Gly Glu  Ser Pro Ile Trp Leu  Asn Lys Glu
    1145                1150                1155

Lys Gly  Ile Ala Ile Lys Arg  Val Thr Ile Ser Gly  Val Ser Asn
    1160                1165                1170

Ala Gln  Ala Leu His Thr Lys  Lys Asp His Leu Gly  Asn Glu Ile
    1175                1180                1185

Leu Asp  Lys Asn Gly Asn Pro  Ile Pro Val Asp Phe  Ile Ser Thr
    1190                1195                1200

Gly Asn  Asn His His Val Ala  Ile Tyr Arg Asp Glu  Lys Gly Asn
    1205                1210                1215

Leu Gln  Glu Glu Val Val Ser  Phe Tyr Asp Ala Val  Ile Arg Arg
    1220                1225                1230

Asn Leu  Gly Leu Ser Val Ile  Asn Lys Asn His Glu  Lys Gly Trp
    1235                1240                1245

Glu Phe  Leu Phe Ser Met Lys  Gln Asn Glu Phe Phe  Ile Phe Pro
    1250                1255                1260

Ser Asp  Gly Phe Asn Pro His  Glu Ile Asp Leu Leu  Asn Pro Asn
    1265                1270                1275
```

Asn Tyr His Leu Ile Ser Pro Asn Ile Phe Arg Val Gln Lys Ile
    1280   1285   1290

Ser Thr Lys Asn Tyr Met Phe Asn His His Leu Glu Thr Lys Ala
    1295   1300   1305

Val Asp Gly Glu Met Leu Lys Ser Lys Lys Glu Leu Ser Lys Thr
    1310   1315   1320

Ser Tyr His Phe Ile Gln Thr Pro Thr Asn Leu Asn Gly Ile Ile
    1325   1330   1335

Lys Val Arg Ile Asn His Leu Gly Lys Ile Val His Leu Gly Glu
    1340   1345   1350

Tyr

<210> 53
<211> 1062
<212> PRT
<213> Actinobacillus succinogenes

<400> 53

Met Asn Leu Asn Tyr Ile Leu Gly Leu Asp Leu Gly Ile Ala Ser Val
1   5   10   15

Gly Trp Ala Val Val Glu Ile Asp Glu Gln Glu Asn Pro Gln Arg Leu
            20   25   30

Ile Asp Val Gly Val Arg Thr Phe Asp Arg Ala Glu Val Leu Lys Thr
        35   40   45

Gly Glu Ser Leu Ala Leu Ala Arg Arg Leu Ala Arg Ser Ser Arg Arg
    50   55   60

Leu Val Lys Arg Arg Ala Glu Arg Ile Lys Lys Ala Lys Arg Leu Leu

```
65                  70                  75                  80

Lys Ala Glu Asn Leu Leu Leu Ser Ala Asp Glu Ile Leu Pro Asn Glu
                85                  90                  95

Ala Trp Gln Leu Arg Val Lys Gly Leu Asp Gln Lys Leu Glu Arg Gln
            100                 105                 110

Glu Trp Ala Ala Val Leu Leu His Leu Leu Lys His Arg Gly Tyr Leu
        115                 120                 125

Ser Gln Arg Lys Asn Glu Ser Lys Ser Glu Asn Lys Glu Leu Gly Ala
    130                 135                 140

Leu Leu Ser Gly Val Ala Ile Asn His Gln Ile Leu Gln Ser Ala Glu
145                 150                 155                 160

Tyr Arg Thr Pro Ala Glu Ile Ala Val Asn Lys Phe Gln Ala Glu Glu
                165                 170                 175

Gly His Ile Arg Asn Gln Arg Gly Ala Tyr Thr His Thr Phe Ser Arg
            180                 185                 190

Leu Asp Leu Leu Ala Glu Met Glu Leu Leu Phe Gln Arg Gln Ala Thr
        195                 200                 205

Leu Gly Asn Pro His Thr Ser Thr Lys Leu Leu Glu Asn Leu Thr Ala
    210                 215                 220

Leu Leu Met Trp Gln Lys Pro Ala Leu Ala Gly Glu Ala Ile Leu Lys
225                 230                 235                 240

Met Leu Gly Lys Cys Thr Phe Glu Pro Thr Glu Tyr Lys Ala Ala Lys
                245                 250                 255

Asn Ser Tyr Ser Ala Glu Arg Phe Val Trp Leu Thr Lys Leu Asn Asn
            260                 265                 270
```

```
Leu Arg Ile Leu Glu Gln Gly Ala Glu Arg Ala Leu Thr Asp Asn Glu
        275                 280                 285

Arg Phe Ala Leu Leu Asp Gln Pro Tyr Glu Lys Ala Lys Leu Thr Tyr
    290                 295                 300

Ala Gln Val Arg Thr Leu Leu Gly Leu Ser Asp Glu Ala Ile Phe Lys
305                 310                 315                 320

Gly Leu Arg Tyr Gln Gly Glu Asp Lys Lys Ala Val Glu Thr Lys Thr
                325                 330                 335

Thr Leu Met Glu Val Lys Ala Tyr His Gln Ile Arg Lys Ala Leu Glu
            340                 345                 350

Gly Leu Asp Leu Lys Ala Glu Trp Asn Glu Leu Lys Asn Asn Pro Ala
        355                 360                 365

Leu Leu Asp Glu Ile Gly Thr Ala Phe Ser Leu Tyr Lys Thr Asp Asp
    370                 375                 380

Asp Ile His Arg Tyr Leu Asp Gly Lys Leu Ser Glu Ser Val Leu Asn
385                 390                 395                 400

Ala Leu Leu Glu Asn Leu Asn Phe Asp Lys Phe Ile Gln Leu Ser Leu
                405                 410                 415

Lys Ala Leu Gln Gln Ile Leu Pro Leu Met Leu Gln Gly Gln Arg Tyr
            420                 425                 430

Asp Glu Ala Val Ser Ala Ile Tyr Gly Asp His Tyr Gly Lys Lys Ser
        435                 440                 445

Asp Glu Ile Asp Arg Leu Leu Pro Asn Ile Pro Thr Asp Glu Ile Arg
    450                 455                 460

Asn Pro Val Val Leu Arg Thr Leu Thr Gln Ala Arg Lys Val Ile Asn
```

```
465                 470                 475                 480

Ala Val Val Arg Leu Tyr Gly Ser Pro Ala Arg Ile His Ile Glu Thr
                485                 490                 495

Gly Arg Glu Val Gly Lys Ser Tyr Gln Asp Arg Lys Lys Leu Glu Lys
            500                 505                 510

Gln Gln Glu Glu Asn Arg Lys Gln Arg Glu Asn Ala Val Lys Lys Phe
        515                 520                 525

Lys Glu Tyr Phe Pro Asn Phe Val Gly Glu Pro Lys Gly Lys Asp Ile
    530                 535                 540

Leu Lys Met Arg Leu Tyr Glu Leu Gln Gln Ala Lys Cys Leu Tyr Ser
545                 550                 555                 560

Gly Lys Ser Leu Glu Leu Tyr Arg Leu Leu Glu Lys Gly Tyr Val Glu
                565                 570                 575

Val Asp His Ala Leu Pro Phe Ser Arg Thr Trp Asp Asp Ser Phe Asn
            580                 585                 590

Asn Lys Val Leu Val Leu Ala Asn Glu Asn Gln Asn Lys Gly Asn Ala
        595                 600                 605

Thr Pro Tyr Glu Trp Leu Asp Gly Lys Asn Asn Ser Glu Gly Trp Gln
    610                 615                 620

His Phe Val Ala Arg Val Gln Thr Ser Gly Phe Ser Tyr Ala Lys Lys
625                 630                 635                 640

Gln Arg Val Leu Ile Gln Glu Leu Asp Glu Lys Ser Phe Ile Glu Arg
                645                 650                 655

Asn Leu Asn Asp Thr Arg Tyr Val Ala Arg Phe Leu Cys Asn His Ile
            660                 665                 670
```

```
Ala Asp Asn Met Leu Leu Thr Gly Lys Gly Lys Arg Lys Val Phe Ala
        675                 680                 685

Ser Asn Gly Gln Ile Thr Ala Leu Leu Arg Gly Cys Trp Gly Leu Gln
    690                 695                 700

Lys Val Arg Glu Asn Asn Asp Arg His His Ala Leu Asp Ala Val Val
705                 710                 715                 720

Val Ala Cys Ser Thr Lys Ser Met Gln Asp Lys Ile Thr Lys Phe Val
                725                 730                 735

Lys Tyr Lys Glu Gly Arg Leu Phe Lys Asp Lys Lys Asp Gly Val Tyr
            740                 745                 750

Lys Gly Glu Arg Ile Asn Arg Glu Thr Gly Glu Ile Ile Ser Leu His
        755                 760                 765

Phe Pro Thr Pro Trp Lys Phe Phe Lys Glu Asn Val Glu Ile Arg Ile
    770                 775                 780

Phe Ser Glu Asn Pro Lys Leu Glu Leu Glu Asn Arg Leu Pro Asp Tyr
785                 790                 795                 800

Pro Gln Tyr Asn His Glu Phe Val Gln Pro Leu Phe Val Ser Arg Met
                805                 810                 815

Pro Thr Arg Lys Met Thr Gly Gln Gly His Met Glu Thr Val Lys Ser
            820                 825                 830

Ala Lys Arg Leu Asp Lys Gly Leu Ser Val Leu Lys Val Pro Leu Thr
        835                 840                 845

Gln Leu Lys Leu Ser Asp Leu Glu Arg Met Val Asn Arg Glu Arg Glu
    850                 855                 860

Met Ala Leu Tyr Glu Ala Leu Lys Glu Cys Leu Glu Gln Phe Gly Asn
```

```
865                 870                 875                 880

Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Lys Gly Gly Ala
                885                 890                 895

Leu Val Lys Ala Val Arg Val Glu Gln Thr Gln Lys Ser Gly Val Leu
            900                 905                 910

Val Arg Asn Gly Asn Gly Val Ala Asp Asn Ala Thr Gly Ser Ile Val
        915                 920                 925

Arg Val Asp Val Phe Thr Lys Gly Gly Lys Tyr Phe Leu Val Pro Ile
    930                 935                 940

Tyr Thr Trp Gln Val Ala Lys Gly Ile Leu Pro Asn Lys Ala Val Ile
945                 950                 955                 960

Gln Gly Lys Asp Glu Ser Glu Trp Glu Glu Met Asp Glu Asn Ala Val
                965                 970                 975

Phe Gln Phe Ser Met His Lys Asn Asp Leu Ile Lys Val Lys Thr Lys
            980                 985                 990

Lys Gly Glu Ile Phe Gly Tyr Phe  Asn Gly Leu Asp Arg  Ala Thr Gly
        995                 1000                1005

Ser Ile  Glu Ile Glu Glu His  Asp Leu Glu Lys Ser  Lys Gly Lys
    1010                1015                1020

Asn Gly  Ser His Arg Gly Leu  Gly Val Lys Thr Ala  Phe Phe Leu
    1025                1030                1035

Glu Lys  Tyr Gln Val Asp Glu  Leu Gly Lys Asn Ile  Arg Pro Cys
    1040                1045                1050

Arg Pro  Thr Lys Arg Gln His  Val Arg
    1055                1060
```

<210> 54
<211> 1340
<212> PRT
<213> Dorea longicatena

<400> 54

Met Glu Gln Glu Tyr Tyr Leu Gly Leu Asp Met Gly Thr Gly Ser Val
1 5 10 15

Gly Trp Ala Val Thr Asp Ser Glu Tyr His Val Leu Arg Lys His Gly
20 25 30

Lys Ala Leu Trp Gly Val Arg Leu Phe Glu Ser Ala Ser Thr Ala Glu
35 40 45

Glu Arg Arg Met Phe Arg Thr Ser Arg Arg Arg Leu Asp Arg Arg Asn
50 55 60

Trp Arg Ile Glu Ile Leu Gln Glu Ile Phe Ala Glu Glu Ile Ser Lys
65 70 75 80

Lys Asp Pro Gly Phe Phe Leu Arg Met Lys Glu Ser Lys Tyr Tyr Pro
85 90 95

Glu Asp Lys Arg Asp Ile Asn Gly Asn Cys Pro Glu Leu Pro Tyr Ala
100 105 110

Leu Phe Val Asp Asp Asp Phe Thr Asp Lys Asp Tyr His Lys Lys Phe
115 120 125

Pro Thr Ile Tyr His Leu Arg Lys Met Leu Met Asn Thr Glu Glu Thr
130 135 140

Pro Asp Ile Arg Leu Val Tyr Leu Ala Ile His His Met Met Lys His
145 150 155 160

Arg Gly His Phe Leu Leu Ser Gly Asp Ile Asn Glu Ile Lys Glu Phe
165 170 175

```
Gly Thr Thr Phe Ser Lys Leu Leu Glu Asn Ile Lys Asn Glu Glu Leu
            180                 185                 190

Asp Trp Asn Leu Glu Leu Gly Lys Glu Glu Tyr Ala Val Val Glu Ser
        195                 200                 205

Ile Leu Lys Asp Asn Met Leu Asn Arg Ser Thr Lys Lys Thr Arg Leu
    210                 215                 220

Ile Lys Ala Leu Lys Ala Lys Ser Ile Cys Glu Lys Ala Val Leu Asn
225                 230                 235                 240

Leu Leu Ala Gly Gly Thr Val Lys Leu Ser Asp Ile Phe Gly Leu Glu
                245                 250                 255

Glu Leu Asn Glu Thr Glu Arg Pro Lys Ile Ser Phe Ala Asp Asn Gly
            260                 265                 270

Tyr Asp Asp Tyr Ile Gly Glu Val Glu Asn Glu Leu Gly Glu Gln Phe
        275                 280                 285

Tyr Ile Ile Glu Thr Ala Lys Ala Val Tyr Asp Trp Ala Val Leu Val
    290                 295                 300

Glu Ile Leu Gly Lys Tyr Thr Ser Ile Ser Glu Ala Lys Val Ala Thr
305                 310                 315                 320

Tyr Glu Lys His Lys Ser Asp Leu Gln Phe Leu Lys Lys Ile Val Arg
                325                 330                 335

Lys Tyr Leu Thr Lys Glu Glu Tyr Lys Asp Ile Phe Val Ser Thr Ser
            340                 345                 350

Asp Lys Leu Lys Asn Tyr Ser Ala Tyr Ile Gly Met Thr Lys Ile Asn
        355                 360                 365
```

```
Gly Lys Lys Val Asp Leu Gln Ser Lys Arg Cys Ser Lys Glu Glu Phe
    370                 375                 380

Tyr Asp Phe Ile Lys Lys Asn Val Leu Lys Lys Leu Glu Gly Gln Pro
385                 390                 395                 400

Glu Tyr Glu Tyr Leu Lys Glu Glu Leu Glu Arg Glu Thr Phe Leu Pro
                405                 410                 415

Lys Gln Val Asn Arg Asp Asn Gly Val Ile Pro Tyr Gln Ile His Leu
            420                 425                 430

Tyr Glu Leu Lys Lys Ile Leu Gly Asn Leu Arg Asp Lys Ile Asp Leu
        435                 440                 445

Ile Lys Glu Asn Glu Asp Lys Leu Val Gln Leu Phe Glu Phe Arg Ile
    450                 455                 460

Pro Tyr Tyr Val Gly Pro Leu Asn Lys Ile Asp Asp Gly Lys Glu Gly
465                 470                 475                 480

Lys Phe Thr Trp Ala Val Arg Lys Ser Asn Glu Lys Ile Tyr Pro Trp
                485                 490                 495

Asn Phe Glu Asn Val Val Asp Ile Glu Ala Ser Ala Glu Lys Phe Ile
            500                 505                 510

Arg Arg Met Thr Asn Lys Cys Thr Tyr Leu Met Gly Glu Asp Val Leu
        515                 520                 525

Pro Lys Asp Ser Leu Leu Tyr Ser Lys Tyr Met Val Leu Asn Glu Leu
    530                 535                 540

Asn Asn Val Lys Leu Asp Gly Glu Lys Leu Ser Val Glu Leu Lys Gln
545                 550                 555                 560

Arg Leu Tyr Thr Asp Val Phe Cys Lys Tyr Arg Lys Val Thr Val Lys
                565                 570                 575
```

```
Lys Ile Lys Asn Tyr Leu Lys Cys Glu Gly Ile Ile Ser Gly Asn Val
            580                 585                 590

Glu Ile Thr Gly Ile Asp Gly Asp Phe Lys Ala Ser Leu Thr Ala Tyr
        595                 600                 605

His Asp Phe Lys Glu Ile Leu Thr Gly Thr Glu Leu Ala Lys Lys Asp
    610                 615                 620

Lys Glu Asn Ile Ile Thr Asn Ile Val Leu Phe Gly Asp Asp Lys Lys
625                 630                 635                 640

Leu Leu Lys Lys Arg Leu Asn Arg Leu Tyr Pro Gln Ile Thr Pro Asn
                645                 650                 655

Gln Leu Lys Lys Ile Cys Ala Leu Ser Tyr Thr Gly Trp Gly Arg Phe
            660                 665                 670

Ser Lys Lys Phe Leu Glu Glu Ile Thr Ala Pro Asp Pro Glu Thr Gly
        675                 680                 685

Glu Val Trp Asn Ile Ile Thr Ala Leu Trp Glu Ser Asn Asn Asn Leu
    690                 695                 700

Met Gln Leu Leu Ser Asn Glu Tyr Arg Phe Met Glu Glu Val Glu Thr
705                 710                 715                 720

Tyr Asn Met Gly Lys Gln Thr Lys Thr Leu Ser Tyr Glu Thr Val Glu
                725                 730                 735

Asn Met Tyr Val Ser Pro Ser Val Lys Arg Gln Ile Trp Gln Thr Leu
            740                 745                 750

Lys Ile Val Lys Glu Leu Glu Lys Val Met Lys Glu Ser Pro Lys Arg
        755                 760                 765
```

```
Val Phe Ile Glu Met Ala Arg Glu Lys Gln Glu Ser Lys Arg Thr Glu
    770                 775                 780

Ser Arg Lys Lys Gln Leu Ile Asp Leu Tyr Lys Ala Cys Lys Asn Glu
785                 790                 795                 800

Glu Lys Asp Trp Val Lys Glu Leu Gly Asp Gln Glu Glu Gln Lys Leu
                805                 810                 815

Arg Ser Asp Lys Leu Tyr Leu Tyr Tyr Thr Gln Lys Gly Arg Cys Met
            820                 825                 830

Tyr Ser Gly Glu Val Ile Glu Leu Lys Asp Leu Trp Asp Asn Thr Lys
        835                 840                 845

Tyr Asp Ile Asp His Ile Tyr Pro Gln Ser Lys Thr Met Asp Asp Ser
    850                 855                 860

Leu Asn Asn Arg Val Leu Val Lys Lys Lys Tyr Asn Ala Thr Lys Ser
865                 870                 875                 880

Asp Lys Tyr Pro Leu Asn Glu Asn Ile Arg His Glu Arg Lys Gly Phe
                885                 890                 895

Trp Lys Ser Leu Leu Asp Gly Gly Phe Ile Ser Lys Glu Lys Tyr Glu
            900                 905                 910

Arg Leu Ile Arg Asn Thr Glu Leu Ser Pro Glu Glu Leu Ala Gly Phe
        915                 920                 925

Ile Glu Arg Gln Ile Val Glu Thr Arg Gln Ser Thr Lys Ala Val Ala
    930                 935                 940

Glu Ile Leu Lys Gln Val Phe Pro Glu Ser Glu Ile Val Tyr Val Lys
945                 950                 955                 960

Ala Gly Thr Val Ser Arg Phe Arg Lys Asp Phe Glu Leu Leu Lys Val
                965                 970                 975
```

```
Arg Glu Val Asn Asp Leu His His Ala Lys Asp Ala Tyr Leu Asn Ile
            980                 985                 990


Val Val Gly Asn Ser Tyr Tyr Val  Lys Phe Thr Lys Asn  Ala Ser Trp
        995                 1000                1005


Phe Ile  Lys Glu Asn Pro Gly  Arg Thr Tyr Asn Leu  Lys Lys Met
    1010                1015                1020


Phe Thr  Ser Gly Trp Asn Ile  Glu Arg Asn Gly Glu  Val Ala Trp
    1025                1030                1035


Glu Val  Gly Lys Lys Gly Thr  Ile Val Thr Val Lys  Gln Ile Met
    1040                1045                1050


Asn Lys  Asn Asn Ile Leu Val  Thr Arg Gln Val His  Glu Ala Lys
    1055                1060                1065


Gly Gly  Leu Phe Asp Gln Gln  Ile Met Lys Lys Gly  Lys Gly Gln
    1070                1075                1080


Ile Ala  Ile Lys Glu Thr Asp  Glu Arg Leu Ala Ser  Ile Glu Lys
    1085                1090                1095


Tyr Gly  Gly Tyr Asn Lys Ala  Ala Gly Ala Tyr Phe  Met Leu Val
    1100                1105                1110


Glu Ser  Lys Asp Lys Lys Gly  Lys Thr Ile Arg Thr  Ile Glu Phe
    1115                1120                1125


Ile Pro  Leu Tyr Leu Lys Asn  Lys Ile Glu Ser Asp  Glu Ser Ile
    1130                1135                1140


Ala Leu  Asn Phe Leu Glu Lys  Gly Arg Gly Leu Lys  Glu Pro Lys
    1145                1150                1155
```

```
Ile Leu  Leu Lys Lys Ile Lys  Ile Asp Thr Leu Phe  Asp Val Asp
    1160                1165                1170

Gly Phe  Lys Met Trp Leu Ser  Gly Arg Thr Gly Asp  Arg Leu Leu
    1175                1180                1185

Phe Lys  Cys Ala Asn Gln Leu  Ile Leu Asp Glu Lys  Ile Ile Val
    1190                1195                1200

Thr Met  Lys Lys Ile Val Lys  Phe Ile Gln Arg Arg  Gln Glu Asn
    1205                1210                1215

Arg Glu  Leu Lys Leu Ser Asp  Lys Asp Gly Ile Asp  Asn Glu Val
    1220                1225                1230

Leu Met  Glu Ile Tyr Asn Thr  Phe Val Asp Lys Leu  Glu Asn Thr
    1235                1240                1245

Val Tyr  Arg Ile Arg Leu Ser  Glu Gln Ala Lys Thr  Leu Ile Asp
    1250                1255                1260

Lys Gln  Lys Glu Phe Glu Arg  Leu Ser Leu Glu Asp  Lys Ser Ser
    1265                1270                1275

Thr Leu  Phe Glu Ile Leu His  Ile Phe Gln Cys Gln  Ser Ser Ala
    1280                1285                1290

Ala Asn  Leu Lys Met Ile Gly  Gly Pro Gly Lys Ala  Gly Ile Leu
    1295                1300                1305

Val Met  Asn Asn Asn Ile Ser  Lys Cys Asn Lys Ile  Ser Ile Ile
    1310                1315                1320

Asn Gln  Ser Pro Thr Gly Ile  Phe Glu Asn Glu Ile  Asp Leu Leu
    1325                1330                1335

Lys Ile
    1340
```

<210> 55
<211> 984
<212> PRT
<213> Campylobacter jejuni

<400> 55

Met Ala Lys Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1 5 10 15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
20 25 30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
35 40 45

Arg Ile Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
50 55 60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65 70 75 80

Glu Asp Tyr Gln Ser Phe Asp Glu Ile Leu Ala Lys Ala Tyr Lys Gly
85 90 95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
100 105 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
115 120 125

Arg Gly Tyr Asp Asp Ile Lys Asn Asn Gly Asp Glu Glu Lys Gly Lys
130 135 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145 150 155 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu

```
                165                 170                 175

Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Leu Tyr Thr Lys Asp Asp Leu
        275                 280                 285

Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu Thr Tyr Lys
    290                 295                 300

Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu Phe Lys Gly
305                 310                 315                 320

Glu Lys Gly Asn Tyr Phe Ile Glu Phe Lys Lys Tyr Lys Glu Phe Ile
                325                 330                 335

Lys Ala Leu Gly Glu His Ser Leu Ser Gln Asp Asp Leu Asn Glu Ile
            340                 345                 350

Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu Lys Lys Ala
        355                 360                 365
```

```
Leu Ala Lys Tyr Asp Leu Asn Glu Asn Gln Ile Asp Asn Leu Ser Lys
    370                 375                 380

Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala Leu Lys Leu
385                 390                 395                 400

Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu Ala Cys Asn
                405                 410                 415

Glu Leu Thr Leu Lys Val Ala Ile Asn Glu Asp Lys Lys Asp Phe Leu
            420                 425                 430

Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr Asn Pro Val
        435                 440                 445

Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn Ala Leu Leu
    450                 455                 460

Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu Ala Arg Glu
465                 470                 475                 480

Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys Glu Gln Asn
                485                 490                 495

Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys Glu Lys Leu
            500                 505                 510

Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg Leu Phe Lys
        515                 520                 525

Glu Gln Lys Glu Phe Cys Val Tyr Ser Gly Glu Lys Ile Lys Leu Ser
    530                 535                 540

Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile Tyr Pro Tyr
545                 550                 555                 560

Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu Val Phe Thr
```

```
                565                 570                 575

Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu Ala Phe Gly
            580                 585                 590

Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala Lys Asn Leu
        595                 600                 605

Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr Lys Asp Lys
    610                 615                 620

Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr Arg Tyr Ile
625                 630                 635                 640

Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp Phe Leu Pro
                645                 650                 655

Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln Lys Gly Ser
            660                 665                 670

Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser Ala Leu Arg
        675                 680                 685

His Thr Trp Gly Phe Ser Thr Lys Asp Arg Asn Asn His Leu His His
    690                 695                 700

Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser Ile Val Lys
705                 710                 715                 720

Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Thr Ala Glu Leu
                725                 730                 735

Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys Arg Lys Phe
            740                 745                 750

Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp Lys Ile Asp
        755                 760                 765
```

```
Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser Gly Ala Leu
    770                 775                 780

His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln Ser Tyr Gly
785                 790                 795                 800

Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys Ile Arg Lys
                805                 810                 815

Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg Val Asp Ile
            820                 825                 830

Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro Ile Tyr Thr
        835                 840                 845

Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val Ala Arg Ser
    850                 855                 860

Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu Asn Tyr Glu
865                 870                 875                 880

Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile Gln Thr Lys
                885                 890                 895

Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe Thr Ser Ser
            900                 905                 910

Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe Glu Thr Leu
        915                 920                 925

Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu Lys Glu Val
    930                 935                 940

Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe Glu Lys Tyr
945                 950                 955                 960

Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe Arg Gln Arg
```

965 970 975

Glu Glu Phe Lys Asn Glu Leu Arg
980

<210> 56
<211> 1037
<212> PRT
<213> Parvibaculum lavamentivorans

<400> 56

Met Glu Arg Ile Phe Gly Phe Asp Ile Gly Thr Thr Ser Ile Gly Phe
1 5 10 15

Ser Val Ile Asp Tyr Ser Ser Thr Gln Ser Ala Gly Asn Ile Gln Arg
20 25 30

Leu Gly Val Arg Ile Phe Pro Glu Ala Arg Asp Pro Asp Gly Thr Pro
35 40 45

Leu Asn Gln Gln Arg Arg Gln Lys Arg Met Met Arg Arg Gln Leu Arg
50 55 60

Arg Arg Arg Ile Arg Arg Lys Ala Leu Asn Glu Thr Leu His Glu Ala
65 70 75 80

Gly Phe Leu Pro Ala Tyr Gly Ser Ala Asp Trp Pro Val Val Met Ala
85 90 95

Asp Glu Pro Tyr Glu Leu Arg Arg Arg Gly Leu Glu Glu Gly Leu Ser
100 105 110

Ala Tyr Glu Phe Gly Arg Ala Ile Tyr His Leu Ala Gln His Arg His
115 120 125

Phe Lys Gly Arg Glu Leu Glu Glu Ser Asp Thr Pro Asp Pro Asp Val
130 135 140

```
Asp Asp Glu Lys Glu Ala Ala Asn Glu Arg Ala Ala Thr Leu Lys Ala
145                 150                 155                 160

Leu Lys Asn Glu Gln Thr Thr Leu Gly Ala Trp Leu Ala Arg Arg Pro
                165                 170                 175

Pro Ser Asp Arg Lys Arg Gly Ile His Ala His Arg Asn Val Val Ala
            180                 185                 190

Glu Glu Phe Glu Arg Leu Trp Glu Val Gln Ser Lys Phe His Pro Ala
        195                 200                 205

Leu Lys Ser Glu Glu Met Arg Ala Arg Ile Ser Asp Thr Ile Phe Ala
    210                 215                 220

Gln Arg Pro Val Phe Trp Arg Lys Asn Thr Leu Gly Glu Cys Arg Phe
225                 230                 235                 240

Met Pro Gly Glu Pro Leu Cys Pro Lys Gly Ser Trp Leu Ser Gln Gln
                245                 250                 255

Arg Arg Met Leu Glu Lys Leu Asn Asn Leu Ala Ile Ala Gly Gly Asn
            260                 265                 270

Ala Arg Pro Leu Asp Ala Glu Glu Arg Asp Ala Ile Leu Ser Lys Leu
        275                 280                 285

Gln Gln Gln Ala Ser Met Ser Trp Pro Gly Val Arg Ser Ala Leu Lys
    290                 295                 300

Ala Leu Tyr Lys Gln Arg Gly Glu Pro Gly Ala Glu Lys Ser Leu Lys
305                 310                 315                 320

Phe Asn Leu Glu Leu Gly Gly Glu Ser Lys Leu Leu Gly Asn Ala Leu
                325                 330                 335

Glu Ala Lys Leu Ala Asp Met Phe Gly Pro Asp Trp Pro Ala His Pro
            340                 345                 350
```

```
Arg Lys Gln Glu Ile Arg His Ala Val His Glu Arg Leu Trp Ala Ala
        355                 360                 365

Asp Tyr Gly Glu Thr Pro Asp Lys Lys Arg Val Ile Ile Leu Ser Glu
    370                 375                 380

Lys Asp Arg Lys Ala His Arg Glu Ala Ala Ala Asn Ser Phe Val Ala
385                 390                 395                 400

Asp Phe Gly Ile Thr Gly Glu Gln Ala Ala Gln Leu Gln Ala Leu Lys
                405                 410                 415

Leu Pro Thr Gly Trp Glu Pro Tyr Ser Ile Pro Ala Leu Asn Leu Phe
            420                 425                 430

Leu Ala Glu Leu Glu Lys Gly Glu Arg Phe Gly Ala Leu Val Asn Gly
        435                 440                 445

Pro Asp Trp Glu Gly Trp Arg Arg Thr Asn Phe Pro His Arg Asn Gln
    450                 455                 460

Pro Thr Gly Glu Ile Leu Asp Lys Leu Pro Ser Pro Ala Ser Lys Glu
465                 470                 475                 480

Glu Arg Glu Arg Ile Ser Gln Leu Arg Asn Pro Thr Val Val Arg Thr
                485                 490                 495

Gln Asn Glu Leu Arg Lys Val Val Asn Asn Leu Ile Gly Leu Tyr Gly
            500                 505                 510

Lys Pro Asp Arg Ile Arg Ile Glu Val Gly Arg Asp Val Gly Lys Ser
        515                 520                 525

Lys Arg Glu Arg Glu Glu Ile Gln Ser Gly Ile Arg Arg Asn Glu Lys
    530                 535                 540
```

```
Gln Arg Lys Lys Ala Thr Glu Asp Leu Ile Lys Asn Gly Ile Ala Asn
545                 550                 555                 560

Pro Ser Arg Asp Asp Val Glu Lys Trp Ile Leu Trp Lys Glu Gly Gln
                565                 570                 575

Glu Arg Cys Pro Tyr Thr Gly Asp Gln Ile Gly Phe Asn Ala Leu Phe
            580                 585                 590

Arg Glu Gly Arg Tyr Glu Val Glu His Ile Trp Pro Arg Ser Arg Ser
        595                 600                 605

Phe Asp Asn Ser Pro Arg Asn Lys Thr Leu Cys Arg Lys Asp Val Asn
    610                 615                 620

Ile Glu Lys Gly Asn Arg Met Pro Phe Glu Ala Phe Gly His Asp Glu
625                 630                 635                 640

Asp Arg Trp Ser Ala Ile Gln Ile Arg Leu Gln Gly Met Val Ser Ala
                645                 650                 655

Lys Gly Gly Thr Gly Met Ser Pro Gly Lys Val Lys Arg Phe Leu Ala
            660                 665                 670

Lys Thr Met Pro Glu Asp Phe Ala Ala Arg Gln Leu Asn Asp Thr Arg
        675                 680                 685

Tyr Ala Ala Lys Gln Ile Leu Ala Gln Leu Lys Arg Leu Trp Pro Asp
    690                 695                 700

Met Gly Pro Glu Ala Pro Val Lys Val Glu Ala Val Thr Gly Gln Val
705                 710                 715                 720

Thr Ala Gln Leu Arg Lys Leu Trp Thr Leu Asn Asn Ile Leu Ala Asp
                725                 730                 735

Asp Gly Glu Lys Thr Arg Ala Asp His Arg His His Ala Ile Asp Ala
            740                 745                 750
```

```
Leu Thr Val Ala Cys Thr His Pro Gly Met Thr Asn Lys Leu Ser Arg
        755                 760                 765

Tyr Trp Gln Leu Arg Asp Asp Pro Arg Ala Glu Lys Pro Ala Leu Thr
    770                 775                 780

Pro Pro Trp Asp Thr Ile Arg Ala Asp Ala Glu Lys Ala Val Ser Glu
785                 790                 795                 800

Ile Val Val Ser His Arg Val Arg Lys Lys Val Ser Gly Pro Leu His
                805                 810                 815

Lys Glu Thr Thr Tyr Gly Asp Thr Gly Thr Asp Ile Lys Thr Lys Ser
            820                 825                 830

Gly Thr Tyr Arg Gln Phe Val Thr Arg Lys Lys Ile Glu Ser Leu Ser
        835                 840                 845

Lys Gly Glu Leu Asp Glu Ile Arg Asp Pro Arg Ile Lys Glu Ile Val
    850                 855                 860

Ala Ala His Val Ala Gly Arg Gly Gly Asp Pro Lys Lys Ala Phe Pro
865                 870                 875                 880

Pro Tyr Pro Cys Val Ser Pro Gly Gly Pro Glu Ile Arg Lys Val Arg
                885                 890                 895

Leu Thr Ser Lys Gln Gln Leu Asn Leu Met Ala Gln Thr Gly Asn Gly
            900                 905                 910

Tyr Ala Asp Leu Gly Ser Asn His His Ile Ala Ile Tyr Arg Leu Pro
        915                 920                 925

Asp Gly Lys Ala Asp Phe Glu Ile Val Ser Leu Phe Asp Ala Ser Arg
    930                 935                 940
```

```
Arg Leu Ala Gln Arg Asn Pro Ile Val Gln Arg Thr Arg Ala Asp Gly
945                 950                 955                 960


Ala Ser Phe Val Met Ser Leu Ala Ala Gly Glu Ala Ile Met Ile Pro
                965                 970                 975


Glu Gly Ser Lys Lys Gly Ile Trp Ile Val Gln Gly Val Trp Ala Ser
            980                 985                 990


Gly Gln Val Val Leu Glu Arg Asp  Thr Asp Ala Asp His  Ser Thr Thr
        995                 1000                1005


Thr Arg  Pro Met Pro Asn Pro  Ile Leu Lys Asp Asp  Ala Lys Lys
    1010                1015                1020


Val Ser  Ile Asp Pro Ile Gly  Arg Val Arg Pro Ser  Asn Asp
    1025                1030                1035


<210>  57
<211>  1107
<212>  PRT
<213>  Eubacterium ventriosum

<400>  57

Met Gly Tyr Thr Val Gly Leu Asp Ile Gly Val Ala Ser Val Gly Val
1               5                   10                  15


Ala Val Leu Asp Glu Asn Asp Asn Ile Val Glu Ala Val Ser Asn Ile
            20                  25                  30


Phe Asp Glu Ala Asp Thr Ser Asn Asn Lys Val Arg Arg Thr Leu Arg
        35                  40                  45


Glu Gly Arg Arg Thr Lys Arg Arg Gln Lys Thr Arg Ile Glu Asp Phe
    50                  55                  60


Lys Gln Leu Trp Glu Thr Ser Gly Tyr Ile Ile Pro His Lys Leu His
65                  70                  75                  80
```

```
Leu Asn Ile Ile Glu Leu Arg Asn Lys Gly Leu Thr Glu Leu Leu Ser
                85                  90                  95

Leu Asp Glu Leu Tyr Cys Val Leu Leu Ser Met Leu Lys His Arg Gly
            100                 105                 110

Ile Ser Tyr Leu Glu Asp Ala Asp Asp Gly Glu Lys Gly Asn Ala Tyr
        115                 120                 125

Lys Lys Gly Leu Ala Phe Asn Glu Lys Gln Leu Lys Glu Lys Met Pro
    130                 135                 140

Cys Glu Ile Gln Leu Glu Arg Met Lys Lys Tyr Gly Lys Tyr His Gly
145                 150                 155                 160

Glu Phe Ile Ile Glu Ile Asn Asp Glu Lys Glu Tyr Gln Ser Asn Val
                165                 170                 175

Phe Thr Thr Lys Ala Tyr Lys Lys Glu Leu Glu Lys Ile Phe Glu Thr
            180                 185                 190

Gln Arg Cys Asn Gly Asn Lys Ile Asn Thr Lys Phe Ile Lys Lys Tyr
        195                 200                 205

Met Glu Ile Tyr Glu Arg Lys Arg Glu Tyr Tyr Ile Gly Pro Gly Asn
    210                 215                 220

Glu Lys Ser Arg Thr Asp Tyr Gly Ile Tyr Thr Thr Arg Thr Asp Glu
225                 230                 235                 240

Glu Gly Asn Phe Ile Asp Glu Lys Asn Ile Phe Gly Lys Leu Ile Gly
                245                 250                 255

Lys Cys Ser Val Tyr Pro Glu Glu Tyr Arg Ala Ser Ser Ala Ser Tyr
            260                 265                 270

Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Lys Ile
```

```
        275                 280                 285

Asn Asn Glu Lys Leu Thr Glu Phe Gln Lys Lys Glu Ile Val Glu Ile
    290                 295                 300

Ile Lys Asp Ala Ser Ser Val Asn Met Arg Lys Ile Ile Lys Lys Val
305                 310                 315                 320

Ile Asp Glu Asp Ile Glu Gln Tyr Ser Gly Ala Arg Ile Asp Lys Lys
                325                 330                 335

Gly Lys Glu Ile Tyr His Thr Phe Glu Ile Tyr Arg Lys Leu Lys Lys
            340                 345                 350

Glu Leu Lys Thr Ile Asn Val Asp Ile Asp Ser Phe Thr Arg Glu Glu
        355                 360                 365

Leu Asp Lys Thr Met Asp Ile Leu Thr Leu Asn Thr Glu Arg Glu Ser
    370                 375                 380

Ile Val Lys Ala Phe Asp Glu Gln Lys Phe Val Tyr Glu Glu Asn Leu
385                 390                 395                 400

Ile Lys Lys Leu Ile Glu Phe Arg Lys Asn Asn Gln Arg Leu Phe Ser
                405                 410                 415

Gly Trp His Ser Phe Ser Tyr Lys Ala Met Leu Gln Leu Ile Pro Val
            420                 425                 430

Met Tyr Lys Glu Pro Lys Glu Gln Met Gln Leu Leu Thr Glu Met Asn
        435                 440                 445

Val Phe Lys Ser Lys Lys Glu Lys Tyr Val Asn Tyr Lys Tyr Ile Pro
    450                 455                 460

Glu Asn Glu Val Val Lys Glu Ile Tyr Asn Pro Val Val Val Lys Ser
465                 470                 475                 480
```

```
Ile Arg Thr Thr Val Lys Ile Leu Asn Ala Leu Ile Lys Lys Tyr Gly
                485                 490                 495

Tyr Pro Glu Ser Val Val Ile Glu Met Pro Arg Asp Lys Asn Ser Asp
            500                 505                 510

Asp Glu Lys Glu Lys Ile Asp Met Asn Gln Lys Lys Asn Gln Glu Glu
        515                 520                 525

Tyr Glu Lys Ile Leu Asn Lys Ile Tyr Asp Glu Lys Gly Ile Glu Ile
    530                 535                 540

Thr Asn Lys Asp Tyr Lys Lys Gln Lys Lys Leu Val Leu Lys Leu Lys
545                 550                 555                 560

Leu Trp Asn Glu Gln Glu Gly Leu Cys Leu Tyr Ser Gly Lys Lys Ile
                565                 570                 575

Ala Ile Glu Asp Leu Leu Asn His Pro Glu Phe Phe Glu Ile Asp His
            580                 585                 590

Ile Ile Pro Lys Ser Ile Ser Leu Asp Asp Ser Arg Ser Asn Lys Val
        595                 600                 605

Leu Val Tyr Lys Thr Glu Asn Ser Ile Lys Glu Asn Asp Thr Pro Tyr
    610                 615                 620

His Tyr Leu Thr Arg Ile Asn Gly Lys Trp Gly Phe Asp Glu Tyr Lys
625                 630                 635                 640

Ala Asn Val Leu Glu Leu Arg Arg Arg Gly Lys Ile Asp Asp Lys Lys
                645                 650                 655

Val Asn Asn Leu Leu Cys Met Glu Asp Ile Thr Lys Ile Asp Val Val
            660                 665                 670

Lys Gly Phe Ile Asn Arg Asn Leu Asn Asp Thr Arg Tyr Ala Ser Arg
```

```
        675                 680                 685

Val Val Leu Asn Glu Met Gln Ser Phe Phe Glu Ser Arg Lys Tyr Cys
    690                 695                 700

Asn Thr Lys Val Lys Val Ile Arg Gly Ser Leu Thr Tyr Gln Met Arg
705                 710                 715                 720

Gln Asp Leu His Leu Lys Lys Asn Arg Glu Glu Ser Tyr Ser His His
                725                 730                 735

Ala Val Asp Ala Met Leu Ile Ala Phe Ser Gln Lys Gly Tyr Glu Ala
            740                 745                 750

Tyr Arg Lys Ile Gln Lys Asp Cys Tyr Asp Phe Glu Thr Gly Glu Ile
        755                 760                 765

Leu Asp Lys Glu Lys Trp Asn Lys Tyr Ile Asp Asp Asp Glu Phe Asp
    770                 775                 780

Asp Ile Leu Tyr Lys Glu Arg Met Asn Glu Ile Arg Lys Lys Ile Ile
785                 790                 795                 800

Glu Ala Glu Glu Lys Val Lys Tyr Asn Tyr Lys Ile Asp Lys Lys Cys
                805                 810                 815

Asn Arg Gly Leu Cys Asn Gln Thr Ile Tyr Gly Thr Arg Glu Lys Asp
            820                 825                 830

Gly Lys Ile His Lys Ile Ser Ser Tyr Asn Ile Tyr Asp Asp Lys Glu
        835                 840                 845

Cys Asn Ser Leu Lys Lys Met Ile Asn Ser Gly Lys Gly Ser Asp Leu
    850                 855                 860

Leu Met Tyr Asn Asn Asp Pro Lys Thr Tyr Arg Asp Met Leu Lys Ile
865                 870                 875                 880
```

```
Leu Glu Thr Tyr Ser Ser Glu Lys Asn Pro Phe Val Ala Tyr Asn Lys
               885                 890                 895


Glu Thr Gly Asp Tyr Phe Arg Lys Tyr Ser Lys Asn His Asn Gly Pro
            900                 905                 910


Lys Val Glu Lys Val Lys Tyr Tyr Ser Gly Gln Ile Asn Ser Cys Ile
        915                 920                 925


Asp Ile Ser His Lys Tyr Gly His Ala Lys Asn Ser Lys Lys Val Val
    930                 935                 940


Leu Val Ser Leu Asn Pro Tyr Arg Thr Asp Val Tyr Tyr Asp Asn Asp
945                 950                 955                 960


Thr Gly Lys Tyr Tyr Leu Val Gly Val Lys Tyr Asn His Ile Lys Cys
               965                 970                 975


Val Gly Asn Lys Tyr Val Ile Asp Ser Glu Thr Tyr Asn Glu Leu Leu
            980                 985                 990


Arg Lys Glu Gly Val Leu Asn Ser  Asp Glu Asn Leu Glu  Asp Leu Asn
        995                 1000                1005


Ser Lys  Asn Ile Thr Tyr Lys  Phe Ser Leu Tyr Lys  Asn Asp Ile
    1010                1015                1020


Ile Gln  Tyr Glu Lys Gly Gly  Glu Tyr Tyr Thr Glu  Arg Phe Leu
    1025                1030                1035


Ser Arg  Ile Lys Glu Gln Lys  Asn Leu Ile Glu Thr  Lys Pro Ile
    1040                1045                1050


Asn Lys  Pro Asn Phe Gln Arg  Lys Asn Lys Lys Gly  Glu Trp Glu
    1055                1060                1065


Asn Thr  Arg Asn Gln Ile Ala  Leu Ala Lys Thr Lys  Tyr Val Gly
```

```
    1070                1075                1080

Lys Leu  Val Thr Asp Val Leu  Gly Asn Cys Tyr Ile  Val Asn Met
    1085                1090                1095

Glu Lys  Phe Ser Leu Val Val  Asp Lys
    1100                1105
```

<210> 58
<211> 1136
<212> PRT
<213> Streptococcus gordonii

<400> 58

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Met Asn Gly Leu Val Leu Gly Leu Asp Ile Gly Ile Ala Ser Val Gly
1               5                   10                  15

Val Gly Ile Leu Glu Lys Asp Thr Gly Lys Ile Ile His Ala Ser Ser
            20                  25                  30

Arg Leu Phe Pro Ala Ala Thr Ala Asp Asn Asn Val Glu Arg Arg Ser
        35                  40                  45

Asn Arg Gln Gly Arg Arg Leu Asn Arg Arg Lys Lys His Arg Ser Val
    50                  55                  60

Arg Leu Gln Asp Leu Phe Glu Gly Tyr Gly Leu Leu Thr Asp Phe Ser
65                  70                  75                  80

Lys Val Ser Met Asn Leu Asn Pro Tyr Gln Leu Arg Val Gln Gly Met
                85                  90                  95

Glu Asn Gln Leu Thr Asn Glu Glu Leu Phe Val Ala Leu Lys Asn Ile
            100                 105                 110

Val Lys Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Glu Asp Gly
        115                 120                 125
```

```
Gly Thr Val Ser Ser Asp Tyr Gly Lys Ala Val Glu Glu Asn Arg Lys
    130                 135                 140

Leu Leu Ala Glu Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Phe Glu
145                 150                 155                 160

Lys Tyr Gly Gln Leu Arg Gly Asp Phe Thr Val Glu Glu Asn Gly Glu
                165                 170                 175

Lys His Arg Leu Ile Asn Val Phe Ser Thr Ser Ala Tyr Arg Lys Glu
            180                 185                 190

Ala Glu Arg Ile Leu Arg Lys Gln Gln Glu Phe Asn Ser Lys Ile Thr
        195                 200                 205

Asp Glu Phe Ile Glu Asp Tyr Leu Ile Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240

Phe Arg Thr Asp Gly Thr Thr Leu Asp Asn Ile Phe Gly Ile Leu Ile
                245                 250                 255

Gly Lys Cys Thr Phe Tyr Thr Glu Glu Tyr Arg Ala Ser Lys Ala Ser
            260                 265                 270

Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285

Val Pro Thr Glu Thr Lys Lys Leu Ser Glu Glu Gln Lys Lys Leu Ile
    290                 295                 300

Ile Glu Tyr Ala Lys Ser Ala Lys Thr Leu Gly Ala Ser Thr Leu Leu
305                 310                 315                 320

Lys Tyr Ile Ala Lys Met Ile Asp Ala Ser Val Asp Gln Ile Arg Gly
                325                 330                 335
```

```
Tyr Arg Val Asp Val Asn Asn Lys Pro Glu Met His Thr Phe Glu Val
            340                 345                 350

Tyr Arg Lys Met Gln Ser Leu Glu Thr Ile Lys Val Glu Glu Leu Pro
        355                 360                 365

Arg Lys Val Leu Asp Glu Leu Ala His Ile Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Glu Glu Ala Ile Asn Ser Lys Leu Lys Asp Ile Phe
385                 390                 395                 400

Asn Arg Asp Gln Val Leu Glu Leu Val Gln Phe Arg Lys Asn Asn Ser
                405                 410                 415

Ser Leu Phe Ser Lys Gly Trp His Asn Phe Ser Ile Lys Leu Met Met
            420                 425                 430

Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr Ile
        435                 440                 445

Leu Thr Arg Leu Gly Lys Gln Arg Ser Lys Glu Thr Ser Lys Arg Thr
    450                 455                 460

Lys Tyr Ile Asp Glu Lys Glu Leu Thr Glu Glu Ile Tyr Asn Pro Val
465                 470                 475                 480

Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Ile Asn Glu Ala Thr
                485                 490                 495

Lys Lys Tyr Gly Ile Phe Asp Asn Ile Val Ile Glu Met Ala Arg Glu
            500                 505                 510

Asn Asn Glu Glu Asp Ala Lys Lys Asp Tyr Ile Lys Arg Gln Lys Ala
        515                 520                 525
```

```
Asn Gln Asp Glu Lys Asn Ala Ala Met Glu Lys Ala Ala Phe Gln Tyr
    530                 535                 540

Asn Gly Lys Lys Glu Leu Pro Asp Asn Ile Phe His Gly His Lys Glu
545                 550                 555                 560

Leu Thr Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Lys Cys Leu
                565                 570                 575

Tyr Thr Gly Lys Asn Ile Pro Ile Ser Asp Leu Ile His Asn Gln Tyr
            580                 585                 590

Lys Tyr Glu Ile Asp His Ile Leu Pro Leu Ser Leu Ser Phe Asp Asp
        595                 600                 605

Ser Leu Ser Asn Lys Val Leu Val Leu Ala Thr Ala Asn Gln Glu Lys
    610                 615                 620

Gly Gln Arg Thr Pro Phe Gln Ala Leu Asp Ser Met Asp Asp Ala Trp
625                 630                 635                 640

Ser Tyr Arg Glu Phe Lys Ser Tyr Val Lys Asp Ser Lys Leu Leu Ser
                645                 650                 655

Asn Lys Lys Lys Asp Tyr Leu Leu Thr Glu Glu Asp Ile Ser Lys Ile
            660                 665                 670

Glu Val Lys Gln Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg Tyr
        675                 680                 685

Ser Ser Arg Val Val Leu Asn Ala Leu Gln Asp Phe Tyr Lys Ser His
    690                 695                 700

Gln Leu Asp Thr Thr Ile Ser Val Val Arg Gly Gln Phe Thr Ser Gln
705                 710                 715                 720

Leu Arg Arg Lys Trp Gly Ile Glu Lys Ser Arg Glu Thr Tyr His His
                725                 730                 735
```

```
His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Arg Leu
            740                 745                 750

Trp Lys Lys His Ser Asn Pro Leu Ile Ala Tyr Lys Glu Gly Gln Phe
        755                 760                 765

Val Asp Ser Glu Thr Gly Glu Ile Val Ser Leu Ser Asp Glu Glu Tyr
    770                 775                 780

Lys Glu Leu Val Phe Lys Ala Pro Tyr Asp His Phe Val Asp Thr Leu
785                 790                 795                 800

Arg Ser Lys Lys Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln Val Asp
                805                 810                 815

Ser Lys Tyr Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg
            820                 825                 830

Lys Ala Lys Leu Asp Lys Glu Lys Lys Glu Tyr Thr Tyr Thr Leu Gly
        835                 840                 845

Lys Ile Lys Asp Ile Tyr Ala Leu Gly Thr Lys Thr Pro Ser Lys Thr
    850                 855                 860

Gly Phe Tyr Lys Phe Leu Asp Leu Tyr Lys Thr Asp Lys Ser Gln Phe
865                 870                 875                 880

Leu Met Tyr Gln Lys Asp Arg Lys Thr Trp Asp Glu Val Ile Glu Lys
                885                 890                 895

Ile Ile Glu Gln Tyr Arg Pro Phe Lys Glu Tyr Asp Lys Asn Gly Lys
            900                 905                 910

Glu Val Asp Phe Asn Pro Phe Glu Lys Tyr Arg Ile Gly Asn Gly Pro
        915                 920                 925
```

```
Ile Arg Lys Tyr Ser Lys Lys Gly Asn Gly Pro Glu Ile Lys Ser Leu
    930                 935                 940

Lys Tyr Tyr Asp Ile Leu Leu Gly Lys His Lys Asn Ile Thr Pro Asp
945                 950                 955                 960

Gly Ser Arg Asn Thr Val Ala Leu Leu Ser Leu Asn Pro Trp Arg Thr
                965                 970                 975

Asp Val Tyr Tyr Asn Ser Glu Thr Lys Lys Tyr Glu Phe Leu Gly Leu
            980                 985                 990

Lys Tyr Ala Asp Leu Cys Phe Glu  Glu Gly Gly Ala Tyr  Gly Ile Ser
        995                 1000                1005

Glu Val  Lys Tyr Lys Lys Ile  Arg Glu Lys Glu Gly  Ile Gly Lys
    1010                1015                1020

Asn Ser  Glu Phe Lys Phe Thr  Leu Tyr Lys Asn Asp  Leu Ile Leu
    1025                1030                1035

Ile Lys  Asp Thr Glu Thr Asn  Cys Gln Gln Phe Phe  Arg Phe Trp
    1040                1045                1050

Ser Arg  Thr Gly Lys Asp Asn  Pro Lys Ser Phe Glu  Lys His Lys
    1055                1060                1065

Ile Glu  Leu Lys Pro Tyr Glu  Lys Ala Lys Phe Glu  Lys Gly Glu
    1070                1075                1080

Glu Leu  Lys Val Leu Gly Lys  Val Pro Pro Ser Ser  Asn Gln Phe
    1085                1090                1095

Gln Lys  Asn Met Gln Ile Glu  Asn Leu Ser Ile Tyr  Lys Val Lys
    1100                1105                1110

Thr Asp  Ile Leu Gly Asn Lys  His Phe Ile Lys Lys  Glu Gly Asp
    1115                1120                1125
```

Glu Pro Lys Leu Lys Phe Lys Lys
    1130   1135

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<212> PRT
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<400> 59

Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1   5   10   15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20   25   30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35   40   45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50   55   60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65   70   75   80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85   90   95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100   105   110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115   120   125

Arg Gly Tyr Asp Asp Ile Lys Asn Asn Gly Asp Glu Glu Lys Ser Glu
    130   135   140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Val Asn Tyr Gln

```
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Thr Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Gln Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Ile Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350
```

```
Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Ile Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Ile Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Leu Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
```

```
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Lys Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Thr Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Glu Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Ala Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Val Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750
```

```
Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Leu Val Tyr Phe Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
```

945 950 955 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
965 970 975

Arg Gln Arg Glu Asp Phe Lys Lys
980

<210> 60
<211> 1079
<212> PRT
<213> Dinoroseobacter shibae

<400> 60

Met Arg Leu Gly Leu Asp Ile Gly Thr Ser Ser Ile Gly Trp Trp Leu
1 5 10 15

Tyr Glu Thr Asp Gly Ala Gly Ser Asp Ala Arg Ile Thr Gly Val Val
20 25 30

Asp Gly Gly Val Arg Ile Phe Ser Asp Gly Arg Asp Pro Lys Ser Gly
35 40 45

Ala Ser Leu Ala Val Asp Arg Arg Ala Ala Arg Ala Met Arg Arg Arg
50 55 60

Arg Asp Arg Tyr Leu Arg Arg Arg Ala Thr Leu Met Lys Val Leu Ala
65 70 75 80

Glu Thr Gly Leu Met Pro Ala Asp Pro Ala Glu Ala Lys Ala Leu Glu
85 90 95

Ala Leu Asp Pro Phe Ala Leu Arg Ala Ala Gly Leu Asp Glu Pro Leu
100 105 110

Pro Leu Pro His Leu Gly Arg Ala Leu Phe His Leu Asn Gln Arg Arg
115 120 125

```
Gly Phe Lys Ser Asn Arg Lys Thr Asp Arg Gly Asp Asn Glu Ser Gly
    130                 135                 140

Lys Ile Lys Asp Ala Thr Ala Arg Leu Asp Met Glu Met Met Ala Asn
145                 150                 155                 160

Gly Ala Arg Thr Tyr Gly Glu Phe Leu His Lys Arg Arg Gln Lys Ala
                165                 170                 175

Thr Asp Pro Arg His Val Pro Ser Val Arg Thr Arg Leu Ser Ile Ala
            180                 185                 190

Asn Arg Gly Gly Pro Asp Gly Lys Glu Glu Ala Gly Tyr Asp Phe Tyr
        195                 200                 205

Pro Asp Arg Arg His Leu Glu Glu Glu Phe His Lys Leu Trp Ala Ala
    210                 215                 220

Gln Gly Ala His His Pro Glu Leu Thr Glu Thr Leu Arg Asp Leu Leu
225                 230                 235                 240

Phe Glu Lys Ile Phe Phe Gln Arg Pro Leu Lys Glu Pro Glu Val Gly
                245                 250                 255

Leu Cys Leu Phe Ser Gly His His Gly Val Pro Pro Lys Asp Pro Arg
            260                 265                 270

Leu Pro Lys Ala His Pro Leu Thr Gln Arg Arg Val Leu Tyr Glu Thr
        275                 280                 285

Val Asn Gln Leu Arg Val Thr Ala Asp Gly Arg Glu Ala Arg Pro Leu
    290                 295                 300

Thr Arg Glu Glu Arg Asp Gln Val Ile His Ala Leu Asp Asn Lys Lys
305                 310                 315                 320

Pro Thr Lys Ser Leu Ser Ser Met Val Leu Lys Leu Pro Ala Leu Ala
                325                 330                 335
```

```
Lys Val Leu Lys Leu Arg Asp Gly Glu Arg Phe Thr Leu Glu Thr Gly
            340                 345                 350

Val Arg Asp Ala Ile Ala Cys Asp Pro Leu Arg Ala Ser Pro Ala His
        355                 360                 365

Pro Asp Arg Phe Gly Pro Arg Trp Ser Ile Leu Asp Ala Asp Ala Gln
    370                 375                 380

Trp Glu Val Ile Ser Arg Ile Arg Arg Val Gln Ser Asp Ala Glu His
385                 390                 395                 400

Ala Ala Leu Val Asp Trp Leu Thr Glu Ala His Gly Leu Asp Arg Ala
                405                 410                 415

His Ala Glu Ala Thr Ala His Ala Pro Leu Pro Asp Gly Tyr Gly Arg
            420                 425                 430

Leu Gly Leu Thr Ala Thr Thr Arg Ile Leu Tyr Gln Leu Thr Ala Asp
        435                 440                 445

Val Val Thr Tyr Ala Asp Ala Val Lys Ala Cys Gly Trp His His Ser
    450                 455                 460

Asp Gly Arg Thr Gly Glu Cys Phe Asp Arg Leu Pro Tyr Tyr Gly Glu
465                 470                 475                 480

Val Leu Glu Arg His Val Ile Pro Gly Ser Tyr His Pro Asp Asp Asp
                485                 490                 495

Asp Ile Thr Arg Phe Gly Arg Ile Thr Asn Pro Thr Val His Ile Gly
            500                 505                 510

Leu Asn Gln Leu Arg Arg Leu Val Asn Arg Ile Ile Glu Thr His Gly
        515                 520                 525
```

```
Lys Pro His Gln Ile Val Val Glu Leu Ala Arg Asp Leu Lys Lys Ser
    530                 535                 540

Glu Glu Gln Lys Arg Ala Asp Ile Lys Arg Ile Arg Asp Thr Thr Glu
545                 550                 555                 560

Ala Ala Lys Lys Arg Ser Glu Lys Leu Glu Glu Leu Glu Ile Glu Asp
                565                 570                 575

Asn Gly Arg Asn Arg Met Leu Leu Arg Leu Trp Glu Asp Leu Asn Pro
            580                 585                 590

Asp Asp Ala Met Arg Arg Phe Cys Pro Tyr Thr Gly Thr Arg Ile Ser
        595                 600                 605

Ala Ala Met Ile Phe Asp Gly Ser Cys Asp Val Asp His Ile Leu Pro
    610                 615                 620

Tyr Ser Arg Thr Leu Asp Asp Ser Phe Pro Asn Arg Thr Leu Cys Leu
625                 630                 635                 640

Arg Glu Ala Asn Arg Gln Lys Arg Asn Gln Thr Pro Trp Gln Ala Trp
                645                 650                 655

Gly Asp Thr Pro His Trp His Ala Ile Ala Ala Asn Leu Lys Asn Leu
            660                 665                 670

Pro Glu Asn Lys Arg Trp Arg Phe Ala Pro Asp Ala Met Thr Arg Phe
        675                 680                 685

Glu Gly Glu Asn Gly Phe Leu Asp Arg Ala Leu Lys Asp Thr Gln Tyr
    690                 695                 700

Leu Ala Arg Ile Ser Arg Ser Tyr Leu Asp Thr Leu Phe Thr Lys Gly
705                 710                 715                 720

Gly His Val Trp Val Val Pro Gly Arg Phe Thr Glu Met Leu Arg Arg
                725                 730                 735
```

```
His Trp Gly Leu Asn Ser Leu Leu Ser Asp Ala Gly Arg Gly Ala Val
            740                 745                 750

Lys Ala Lys Asn Arg Thr Asp His Arg His His Ala Ile Asp Ala Ala
        755                 760                 765

Val Ile Ala Ala Thr Asp Pro Gly Leu Leu Asn Arg Ile Ser Arg Ala
    770                 775                 780

Ala Gly Gln Gly Glu Ala Ala Gly Gln Ser Ala Glu Leu Ile Ala Arg
785                 790                 795                 800

Asp Thr Pro Pro Pro Trp Glu Gly Phe Arg Asp Asp Leu Arg Val Arg
                805                 810                 815

Leu Asp Arg Ile Ile Val Ser His Arg Ala Asp His Gly Arg Ile Asp
            820                 825                 830

His Ala Ala Arg Lys Gln Gly Arg Asp Ser Thr Ala Gly Gln Leu His
        835                 840                 845

Gln Glu Thr Ala Tyr Ser Ile Val Asp Asp Ile His Val Ala Ser Arg
    850                 855                 860

Thr Asp Leu Leu Ser Leu Lys Pro Ala Gln Leu Leu Asp Glu Pro Gly
865                 870                 875                 880

Arg Ser Gly Gln Val Arg Asp Pro Gln Leu Arg Lys Ala Leu Arg Val
                885                 890                 895

Ala Thr Gly Gly Lys Thr Gly Lys Asp Phe Glu Asn Ala Leu Arg Tyr
            900                 905                 910

Phe Ala Ser Lys Pro Gly Pro Tyr Gln Ala Ile Arg Arg Val Arg Ile
        915                 920                 925
```

```
Ile Lys Pro Leu Gln Ala Gln Ala Arg Val Pro Val Pro Ala Gln Asp
    930                 935                 940

Pro Ile Lys Ala Tyr Gln Gly Gly Ser Asn His Leu Phe Glu Ile Trp
945                 950                 955                 960

Arg Leu Pro Asp Gly Glu Ile Glu Ala Gln Val Ile Thr Ser Phe Glu
                965                 970                 975

Ala His Thr Leu Glu Gly Glu Lys Arg Pro His Pro Ala Ala Lys Arg
            980                 985                 990

Leu Leu Arg Val His Lys Gly Asp  Met Val Ala Leu Glu  Arg Asp Gly
        995                 1000                1005

Arg Arg  Val Val Gly His Val  Gln Lys Met Asp Ile  Ala Asn Gly
    1010                1015                1020

Leu Phe  Ile Val Pro His Asn  Glu Ala Asn Ala Asp  Thr Arg Asn
    1025                1030                1035

Asn Asp  Lys Ser Asp Pro Phe  Lys Trp Ile Gln Ile  Gly Ala Arg
    1040                1045                1050

Pro Ala  Ile Ala Ser Gly Ile  Arg Arg Val Ser Val  Asp Glu Ile
    1055                1060                1065

Gly Arg  Leu Arg Asp Gly Gly  Thr Arg Pro Ile
    1070                1075
```

<210> 61
<211> 1096
<212> PRT
<213> Eubacterium dolichum

<400> 61

```
Met Met Glu Val Phe Met Gly Arg Leu Val Leu Gly Leu Asp Ile Gly
1               5                   10                  15
```

```
Ile Thr Ser Val Gly Phe Gly Ile Ile Asp Leu Asp Glu Ser Glu Ile
            20                  25                  30

Val Asp Tyr Gly Val Arg Leu Phe Lys Glu Gly Thr Ala Ala Glu Asn
        35                  40                  45

Glu Thr Arg Arg Thr Lys Arg Gly Gly Arg Arg Leu Lys Arg Arg Arg
    50                  55                  60

Val Thr Arg Arg Glu Asp Met Leu His Leu Leu Lys Gln Ala Gly Ile
65                  70                  75                  80

Ile Ser Thr Ser Phe His Pro Leu Asn Asn Pro Tyr Asp Val Arg Val
                85                  90                  95

Lys Gly Leu Asn Glu Arg Leu Asn Gly Glu Glu Leu Ala Thr Ala Leu
            100                 105                 110

Leu His Leu Cys Lys His Arg Gly Ser Ser Val Glu Thr Ile Glu Asp
        115                 120                 125

Asp Glu Ala Lys Ala Lys Glu Ala Gly Glu Thr Lys Lys Val Leu Ser
    130                 135                 140

Met Asn Asp Gln Leu Leu Lys Ser Gly Lys Tyr Val Cys Glu Ile Gln
145                 150                 155                 160

Lys Glu Arg Leu Arg Thr Asn Gly His Ile Arg Gly His Glu Asn Asn
                165                 170                 175

Phe Lys Thr Arg Ala Tyr Val Asp Glu Ala Phe Gln Ile Leu Ser His
            180                 185                 190

Gln Asp Leu Ser Asn Glu Leu Lys Ser Ala Ile Ile Thr Ile Ile Ser
        195                 200                 205

Arg Lys Arg Met Tyr Tyr Asp Gly Pro Gly Gly Pro Leu Ser Pro Thr
```

```
    210                 215                 220

Pro Tyr Gly Arg Tyr Thr Tyr Phe Gly Gln Lys Glu Pro Ile Asp Leu
225                 230                 235                 240

Ile Glu Lys Met Arg Gly Lys Cys Ser Leu Phe Pro Asn Glu Pro Arg
                245                 250                 255

Ala Pro Lys Leu Ala Tyr Ser Ala Glu Leu Phe Asn Leu Leu Asn Asp
            260                 265                 270

Leu Asn Asn Leu Ser Ile Glu Gly Glu Lys Leu Thr Ser Glu Gln Lys
        275                 280                 285

Ala Met Ile Leu Lys Ile Val His Glu Lys Gly Lys Ile Thr Pro Lys
    290                 295                 300

Gln Leu Ala Lys Glu Val Gly Val Ser Leu Glu Gln Ile Arg Gly Phe
305                 310                 315                 320

Arg Ile Asp Thr Lys Gly Ser Pro Leu Leu Ser Glu Leu Thr Gly Tyr
                325                 330                 335

Lys Met Ile Arg Glu Val Leu Glu Lys Ser Asn Asp Glu His Leu Glu
            340                 345                 350

Asp His Val Phe Tyr Asp Glu Ile Ala Glu Ile Leu Thr Lys Thr Lys
        355                 360                 365

Asp Ile Glu Gly Arg Lys Lys Gln Ile Ser Glu Leu Ser Ser Asp Leu
    370                 375                 380

Asn Glu Glu Ser Val His Gln Leu Ala Gly Leu Thr Lys Phe Thr Ala
385                 390                 395                 400

Tyr His Ser Leu Ser Phe Lys Ala Leu Arg Leu Ile Asn Glu Glu Met
                405                 410                 415
```

```
Leu Lys Thr Glu Leu Asn Gln Met Gln Ser Ile Thr Leu Phe Gly Leu
            420                 425                 430

Lys Gln Asn Asn Glu Leu Ser Val Lys Gly Met Lys Asn Ile Gln Ala
        435                 440                 445

Asp Asp Thr Ala Ile Leu Ser Pro Val Ala Lys Arg Ala Gln Arg Glu
    450                 455                 460

Thr Phe Lys Val Val Asn Arg Leu Arg Glu Ile Tyr Gly Glu Phe Asp
465                 470                 475                 480

Ser Ile Val Val Glu Met Ala Arg Glu Lys Asn Ser Glu Glu Gln Arg
                485                 490                 495

Lys Ala Ile Arg Glu Arg Gln Lys Phe Phe Glu Met Arg Asn Lys Gln
            500                 505                 510

Val Ala Asp Ile Ile Gly Asp Asp Arg Lys Ile Asn Ala Lys Leu Arg
        515                 520                 525

Glu Lys Leu Val Leu Tyr Gln Glu Gln Asp Gly Lys Thr Ala Tyr Ser
    530                 535                 540

Leu Glu Pro Ile Asp Leu Lys Leu Leu Ile Asp Asp Pro Asn Ala Tyr
545                 550                 555                 560

Glu Val Asp His Ile Ile Pro Ile Ser Ile Ser Leu Asp Asp Ser Ile
                565                 570                 575

Thr Asn Lys Val Leu Val Thr His Arg Glu Asn Gln Glu Lys Gly Asn
            580                 585                 590

Leu Thr Pro Ile Ser Ala Phe Val Lys Gly Arg Phe Thr Lys Gly Ser
        595                 600                 605

Leu Ala Gln Tyr Lys Ala Tyr Cys Leu Lys Leu Lys Glu Lys Asn Ile
```

```
    610                 615                 620

Lys Thr Asn Lys Gly Tyr Arg Lys Lys Val Glu Gln Tyr Leu Leu Asn
625                 630                 635                 640

Glu Asn Asp Ile Tyr Lys Tyr Asp Ile Gln Lys Glu Phe Ile Asn Arg
                645                 650                 655

Asn Leu Val Asp Thr Ser Tyr Ala Ser Arg Val Val Leu Asn Thr Leu
            660                 665                 670

Thr Thr Tyr Phe Lys Gln Asn Glu Ile Pro Thr Lys Val Phe Thr Val
        675                 680                 685

Lys Gly Ser Leu Thr Asn Ala Phe Arg Arg Lys Ile Asn Leu Lys Lys
    690                 695                 700

Asp Arg Asp Glu Asp Tyr Gly His His Ala Ile Asp Ala Leu Ile Ile
705                 710                 715                 720

Ala Ser Met Pro Lys Met Arg Leu Leu Ser Thr Ile Phe Ser Arg Tyr
                725                 730                 735

Lys Ile Glu Asp Ile Tyr Asp Glu Ser Thr Gly Glu Val Phe Ser Ser
            740                 745                 750

Gly Asp Asp Ser Met Tyr Tyr Asp Asp Arg Tyr Phe Ala Phe Ile Ala
        755                 760                 765

Ser Leu Lys Ala Ile Lys Val Arg Lys Phe Ser His Lys Ile Asp Thr
    770                 775                 780

Lys Pro Asn Arg Ser Val Ala Asp Glu Thr Ile Tyr Ser Thr Arg Val
785                 790                 795                 800

Ile Asp Gly Lys Glu Lys Val Val Lys Lys Tyr Lys Asp Ile Tyr Asp
                805                 810                 815
```

```
Pro Lys Phe Thr Ala Leu Ala Glu Asp Ile Leu Asn Asn Ala Tyr Gln
            820                 825                 830

Glu Lys Tyr Leu Met Ala Leu His Asp Pro Gln Thr Phe Asp Gln Ile
        835                 840                 845

Val Lys Val Val Asn Tyr Tyr Phe Glu Glu Met Ser Lys Ser Glu Lys
    850                 855                 860

Tyr Phe Thr Lys Asp Lys Lys Gly Arg Ile Lys Ile Ser Gly Met Asn
865                 870                 875                 880

Pro Leu Ser Leu Tyr Arg Asp Glu His Gly Met Leu Lys Lys Tyr Ser
                885                 890                 895

Lys Lys Gly Asp Gly Pro Ala Ile Thr Gln Met Lys Tyr Phe Asp Gly
            900                 905                 910

Val Leu Gly Asn His Ile Asp Ile Ser Ala His Tyr Gln Val Arg Asp
        915                 920                 925

Lys Lys Val Val Leu Gln Gln Ile Ser Pro Tyr Arg Thr Asp Phe Tyr
    930                 935                 940

Tyr Ser Lys Glu Asn Gly Tyr Lys Phe Val Thr Ile Arg Tyr Lys Asp
945                 950                 955                 960

Val Arg Trp Ser Glu Lys Lys Lys Lys Tyr Val Ile Asp Gln Gln Asp
                965                 970                 975

Tyr Ala Met Lys Lys Ala Glu Lys Lys Ile Asp Asp Thr Tyr Glu Phe
            980                 985                 990

Gln Phe Ser Met His Arg Asp Glu  Leu Ile Gly Ile Thr  Lys Ala Glu
        995                 1000                1005

Gly Glu  Ala Leu Ile Tyr Pro  Asp Glu Thr Trp His  Asn Phe Asn
```

1010 1015 1020

Phe Phe Phe His Ala Gly Glu Thr Pro Glu Ile Leu Lys Phe Thr
1025 1030 1035

Ala Thr Asn Asn Asp Lys Ser Asn Lys Ile Glu Val Lys Pro Ile
1040 1045 1050

His Cys Tyr Cys Lys Met Arg Leu Met Pro Thr Ile Ser Lys Lys
1055 1060 1065

Ile Val Arg Ile Asp Lys Tyr Ala Thr Asp Val Val Gly Asn Leu
1070 1075 1080

Tyr Lys Val Lys Lys Asn Thr Leu Lys Phe Glu Phe Asp
1085 1090 1095

<210> 62
<211> 1082
<212> PRT
<213> Neisseria meningitidis

<400> 62

Met Ala Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
1 5 10 15

Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Asp
20 25 30

Glu Asn Pro Ile Cys Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
35 40 45

Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Met Ala Arg Arg Leu
50 55 60

Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65 70 75 80

```
Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
                85                  90                  95

Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100                 105                 110

Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
        115                 120                 125

Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160

Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Asn Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Ile Ser Asp Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285
```

```
Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Thr Thr
    290                 295                 300

Leu Ile Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Glu Leu Asp Asn Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Val Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys Ile Asp Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480
```

```
Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
                485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Thr Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Gly
                565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655

Phe Asp Glu Glu Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp His Met Leu Leu Thr
        675                 680                 685
```

```
Gly Lys Gly Lys Arg Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700

Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala Glu Asn Asp
705                 710                 715                 720

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
                725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765

Lys Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
                805                 810                 815

Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
        835                 840                 845

Ser Ala Lys Arg Leu Asp Glu Gly Val Ser Val Leu Arg Val Pro Leu
    850                 855                 860

Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Glu Arg
865                 870                 875                 880
```

```
Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
                885                 890                 895


Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910


Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Val Glu Gln Val
        915                 920                 925


Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940


Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Gly Asp Lys Tyr Tyr
945                 950                 955                 960


Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
                965                 970                 975


Arg Ala Val Val Gln Gly Lys Asp Glu Glu Asp Trp Gln Leu Ile Asp
            980                 985                 990


Asp Ser Phe Asn Phe Lys Phe Ser  Leu His Pro Asn Asp  Leu Val Glu
        995                 1000                1005


Val Ile  Thr Lys Lys Ala Arg  Met Phe Gly Tyr Phe  Ala Ser Cys
    1010                1015                1020


His Arg  Gly Thr Gly Asn Ile  Asn Ile Arg Ile His  Asp Leu Asp
    1025                1030                1035


His Lys  Ile Gly Lys Asn Gly  Ile Leu Glu Gly Ile  Gly Val Lys
    1040                1045                1050


Thr Ala  Leu Ser Phe Gln Lys  Tyr Gln Ile Asp Glu  Leu Gly Lys
    1055                1060                1065


Glu Ile  Arg Pro Cys Arg Leu  Lys Lys Arg Pro Pro  Val Arg
    1070                1075                1080
```

<210> 63
<211> 1050
<212> PRT
<213> Gluconacetobacter diazotrophicus

<400> 63

Met Gly Glu Asn Met Ile Asp Glu Ser Leu Thr Phe Gly Ile Asp Leu
1 5 10 15

Gly Ile Gly Ser Cys Gly Trp Ala Val Leu Arg Arg Pro Ser Ala Phe
20 25 30

Gly Arg Lys Gly Val Ile Glu Gly Met Gly Ser Trp Cys Phe Asp Val
35 40 45

Pro Glu Thr Ser Lys Glu Arg Thr Pro Thr Asn Gln Ile Arg Arg Ser
50 55 60

Asn Arg Leu Leu Arg Arg Val Ile Arg Arg Arg Arg Asn Arg Met Ala
65 70 75 80

Ala Ile Arg Arg Leu Leu His Ala Ala Gly Leu Leu Pro Ser Thr Asp
85 90 95

Ser Asp Ala Leu Lys Arg Pro Gly His Asp Pro Trp Glu Leu Arg Ala
100 105 110

Arg Gly Leu Asp Lys Pro Leu Lys Pro Val Glu Phe Ala Val Val Leu
115 120 125

Gly His Ile Ala Lys Arg Arg Gly Phe Lys Ser Ala Ala Lys Arg Lys
130 135 140

Ala Thr Asn Ile Ser Ser Asp Asp Lys Lys Met Leu Thr Ala Leu Glu
145 150 155 160

Ala Thr Arg Glu Arg Leu Gly Arg Tyr Arg Thr Val Gly Glu Met Phe

```
                165                 170                 175

Ala Arg Asp Pro Asp Phe Ala Ser Arg Arg Arg Asn Arg Glu Gly Lys
            180                 185                 190

Tyr Asp Arg Thr Thr Ala Arg Asp Asp Leu Glu His Glu Val His Ala
        195                 200                 205

Leu Phe Ala Ala Gln Arg Arg Leu Gly Gln Gly Phe Ala Ser Pro Glu
    210                 215                 220

Leu Glu Glu Ala Phe Thr Ala Ser Ala Phe His Gln Arg Pro Met Gln
225                 230                 235                 240

Asp Ser Glu Arg Leu Val Gly Phe Cys Pro Phe Glu Arg Thr Glu Lys
                245                 250                 255

Arg Ala Ala Lys Leu Thr Pro Ser Phe Glu Arg Phe Arg Leu Leu Ala
            260                 265                 270

Arg Leu Leu Asn Leu Arg Ile Thr Thr Pro Asp Gly Glu Arg Pro Leu
        275                 280                 285

Thr Val Asp Glu Ile Ala Leu Val Thr Arg Asp Leu Gly Lys Thr Ala
    290                 295                 300

Lys Leu Ser Ile Lys Arg Val Arg Thr Leu Ile Gly Leu Glu Asp Asn
305                 310                 315                 320

Gln Arg Phe Thr Thr Ile Arg Pro Glu Asp Glu Asp Arg Asp Ile Val
                325                 330                 335

Ala Arg Thr Gly Gly Ala Met Thr Gly Thr Ala Thr Leu Arg Lys Ala
            340                 345                 350

Leu Gly Glu Ala Leu Trp Thr Asp Met Gln Glu Arg Pro Glu Gln Leu
        355                 360                 365
```

```
Asp Ala Ile Val Gln Val Leu Ser Phe Phe Glu Ala Asn Glu Thr Ile
    370                 375                 380

Thr Glu Lys Leu Arg Glu Ile Gly Leu Thr Leu Ala Val Leu Asp Val
385                 390                 395                 400

Leu Leu Thr Ala Leu Asp Ala Gly Val Phe Ala Lys Phe Lys Gly Ala
                405                 410                 415

Ala His Ile Ser Thr Lys Ala Ala Arg Asn Leu Leu Pro His Leu Glu
            420                 425                 430

Gln Gly Arg Arg Tyr Asp Glu Ala Cys Thr Met Ala Gly Tyr Asp His
        435                 440                 445

Ala Ala Ser Arg Leu Ser His His Gly Gln Ile Val Ala Lys Thr Gln
    450                 455                 460

Phe Asn Ala Leu Val Thr Glu Ile Gly Glu Ser Ile Ala Asn Pro Ile
465                 470                 475                 480

Ala Arg Lys Ala Leu Ile Glu Gly Leu Lys Gln Ile Trp Ala Met Arg
                485                 490                 495

Asn His Trp Gly Leu Pro Gly Ser Ile His Val Glu Leu Ala Arg Asp
            500                 505                 510

Val Gly Asn Ser Ile Glu Lys Arg Arg Glu Ile Glu Lys His Ile Glu
        515                 520                 525

Lys Asn Thr Ala Leu Arg Ala Arg Glu Arg Arg Glu Val His Asp Leu
    530                 535                 540

Leu Asp Leu Glu Asp Val Asn Gly Asp Thr Leu Leu Arg Tyr Arg Leu
545                 550                 555                 560

Trp Lys Glu Gln Gly Gly Lys Cys Leu Tyr Thr Gly Lys Ala Ile His
```

```
                565                 570                 575

Ile Arg Gln Ile Ala Ala Thr Asp Asn Ser Val Gln Val Asp His Ile
            580                 585                 590

Leu Pro Trp Ser Arg Phe Gly Asp Asp Ser Phe Asn Asn Lys Thr Leu
        595                 600                 605

Cys Leu Ala Ser Ala Asn Gln Gln Lys Lys Arg Ser Thr Pro Tyr Glu
    610                 615                 620

Trp Leu Ser Gly Gln Thr Gly Asp Ala Trp Asn Ala Phe Val Gln Arg
625                 630                 635                 640

Ile Glu Thr Asn Lys Glu Leu Arg Gly Phe Lys Lys Arg Asn Tyr Leu
                645                 650                 655

Leu Lys Asn Ala Lys Glu Ala Glu Glu Lys Phe Arg Ser Arg Asn Leu
            660                 665                 670

Asn Asp Thr Arg Tyr Ala Ala Arg Leu Phe Ala Glu Ala Val Lys Leu
        675                 680                 685

Leu Tyr Ala Phe Gly Glu Arg Gln Glu Lys Gly Gly Asn Arg Arg Val
    690                 695                 700

Phe Thr Arg Pro Gly Ala Leu Thr Ala Ala Leu Arg Gln Ala Trp Gly
705                 710                 715                 720

Val Glu Ser Leu Lys Lys Gln Asp Gly Lys Arg Ile Asn Asp Asp Arg
                725                 730                 735

His His Ala Leu Asp Ala Leu Thr Val Ala Ala Val Asp Glu Ala Glu
            740                 745                 750

Ile Gln Arg Leu Thr Lys Ser Phe His Glu Trp Glu Gln Gln Gly Leu
        755                 760                 765
```

```
Gly Arg Pro Leu Arg Arg Val Glu Pro Pro Trp Glu Ser Phe Arg Ala
    770                 775                 780

Asp Val Glu Ala Thr Tyr Pro Glu Val Phe Val Ala Arg Pro Glu Arg
785                 790                 795                 800

Arg Arg Ala Arg Gly Glu Gly His Ala Ala Thr Ile Arg Gln Val Lys
                805                 810                 815

Glu Arg Glu Cys Thr Pro Ile Val Phe Glu Arg Lys Ala Val Ser Ser
            820                 825                 830

Leu Lys Glu Ala Asp Leu Glu Arg Ile Lys Asp Gly Glu Arg Asn Glu
        835                 840                 845

Ala Ile Val Glu Ala Ile Arg Ser Trp Ile Ala Thr Gly Arg Pro Ala
    850                 855                 860

Asp Ala Pro Pro Arg Ser Pro Arg Gly Asp Ile Ile Thr Lys Ile Arg
865                 870                 875                 880

Leu Ala Thr Thr Ile Lys Ala Ala Val Pro Val Arg Gly Gly Thr Ala
                885                 890                 895

Gly Arg Gly Glu Met Val Arg Ala Asp Val Phe Ser Lys Pro Asn Arg
            900                 905                 910

Arg Gly Lys Asp Glu Trp Tyr Leu Val Pro Val Tyr Pro His Gln Ile
        915                 920                 925

Met Asn Arg Lys Ala Trp Pro Lys Pro Pro Met Arg Ser Ile Val Ala
    930                 935                 940

Asn Lys Asp Glu Asp Glu Trp Thr Glu Val Gly Pro Glu His Gln Phe
945                 950                 955                 960

Arg Phe Ser Leu Tyr Pro Arg Ser Asn Ile Glu Ile Ile Arg Pro Ser
```

```
               965                 970                 975

Gly Glu Val Ile Glu Gly Tyr Phe Val Gly Leu His Arg Asn Thr Gly
            980                 985                 990

Ala Leu Thr Ile Ser Ala His Asn  Asp Pro Lys Ser Ile  His Ser Gly
        995                 1000                1005

Ile Gly  Thr Lys Thr Leu Leu  Ala Ile Ser Lys Tyr  Gln Val Asp
    1010                1015                1020

Arg Phe  Gly Arg Lys Ser Pro  Val Arg Lys Glu Val  Arg Thr Trp
    1025                1030                1035

His Gly  Glu Ala Cys Ile Ser  Pro Thr Pro Pro Gly
    1040                1045                1050
```

<210> 64
<211> 1391
<212> PRT
<213> Kordia algicida

<400> 64

```
Met Lys Lys Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15

Ala Leu Val Asn Glu Ala Glu His Glu His Glu Gln Ser Ser Ile Val
            20                  25                  30

Lys Leu Gly Val Arg Val Asn Pro Leu Ser Val Asp Glu Lys Thr Asn
        35                  40                  45

Phe Glu Lys Gly Arg Pro Leu Ser Ile Asn Ala Asp Arg Thr Ser Lys
    50                  55                  60

Arg Ser Ala Arg Arg Asn Leu Gln Arg Phe Lys Leu Arg Arg Lys Asn
65                  70                  75                  80
```

```
Leu Ile Asn Leu Leu Leu Lys His His Ile Ile Ser Asn Glu Thr Ile
                85                  90                  95

Leu Thr Glu Val Gly Lys Asn Thr Thr His Gln Thr Leu Lys Leu Arg
            100                 105                 110

Ser Lys Ala Thr Gln Glu Lys Ile Ser Leu Glu Glu Phe Ala Arg Ile
        115                 120                 125

Leu Leu Ser Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Glu
    130                 135                 140

Lys Asn Glu Asp Glu Gly Phe Thr Ile Asp Gly Met Ala Ile Ala Lys
145                 150                 155                 160

Glu Leu Tyr Asp Asn Gln Leu Thr Pro Gly Gln Tyr Val Tyr Asn Ile
                165                 170                 175

Leu Gln Asp Gly Lys Asn Tyr Ile Pro Asp Phe Tyr Arg Ser Asp Leu
            180                 185                 190

Gln Ala Glu Phe Asp Asp Val Trp Gln Phe Gln Lys Lys Phe Tyr Ser
        195                 200                 205

Ser Ile Leu Thr Asp Glu Phe Tyr Leu Lys Leu Lys Gly Gln Gly Lys
    210                 215                 220

Glu Asn Thr Arg Lys Leu Phe Leu Ala Ile His Gln Val Tyr Thr Ala
225                 230                 235                 240

Glu Asn Lys Gly Lys Arg Asp Ala Val Lys Leu Gln Tyr Tyr Lys Trp
                245                 250                 255

Arg Ser Glu Ala Val Lys Lys Gln Leu Ser Ile Glu Glu Val Ala Tyr
            260                 265                 270

Val Leu Val Glu Ile Asn Asn Asn Ile Asn Lys Ser Ser Gly Tyr Leu
        275                 280                 285
```

```
Gly Ala Ile Ser Asp Arg Ser Lys Ala Leu Tyr Phe Asn Asn Glu Thr
    290                 295                 300

Val Gly Glu Tyr Leu Tyr Gly Gln Leu Val Lys Asn Arg His Asn Ser
305                 310                 315                 320

Leu Arg Asn Gln Val Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe Glu
                325                 330                 335

Lys Ile Trp Glu Thr Gln Ala Lys Phe Tyr Asp Glu Leu Thr Asn Glu
            340                 345                 350

Leu Lys Gln Glu Ile Arg Asp Val Val Ile Phe Tyr Gln Arg Lys Leu
        355                 360                 365

Lys Ser Gln Lys His Leu Ile Ser Asp Cys Leu Phe Glu Lys His His
    370                 375                 380

Lys Ala Ile Pro Lys Ser Ser Pro Leu Phe Gln Glu Phe Lys Ile Trp
385                 390                 395                 400

Gln Asn Leu Asn Tyr Leu Glu Phe Val His Thr Gln Ser Lys Glu Lys
                405                 410                 415

Ile Phe Phe Ser Glu Leu Asp Asp Glu Thr Arg Gln Phe Val Phe Ala
            420                 425                 430

Glu Leu Asn Ile Arg Gly Thr Leu Lys Ile Lys Glu Ile Lys Lys Leu
        435                 440                 445

Ile Gly Leu Glu Thr Pro Val Tyr Trp Lys Ser Asn Phe Asp Glu Ile
    450                 455                 460

Glu Gly Asn Arg Thr Asn Gln Val Leu Tyr Asn Val Tyr Gln Asn Ile
465                 470                 475                 480
```

```
Ala Asp Asp Leu Gly Tyr Gly Phe Asp Trp Ser Lys Lys His Ala Phe
                485                 490                 495

Glu Ile Asn Ala Glu Leu Gln Ala Ile Phe Lys Asp Val Gly Ile Asp
            500                 505                 510

Thr Ala Ile Leu Asn Phe Asp Ala Ser Ile Glu Glu Asn Asp Phe Asp
        515                 520                 525

Lys Gln Lys Ser Tyr Gln Leu Trp His Leu Leu Tyr Ser Ala Glu Asp
    530                 535                 540

Thr Asp Lys Ala Thr Glu Glu Asp Lys Leu Ile Tyr Gly Asn Ile Asn
545                 550                 555                 560

Thr Lys Leu Lys Lys Gln Leu His Gln Lys Tyr Gly Phe Glu Ala Lys
                565                 570                 575

Tyr Gly Asn Leu Leu Ala Asn Ile Ser Leu Gln Gln Asp Tyr Gly Asn
            580                 585                 590

Leu Ser Ala Lys Ala Ile Lys Lys Ile Leu Pro Tyr Leu Glu Ser Gly
        595                 600                 605

Asn Ser Phe Tyr Glu Ala Cys Thr Ile Val Gly Tyr Asn Pro Ser Asn
    610                 615                 620

Ser Leu Thr Lys Glu Gln Gln Gln Asn Arg Lys Leu Lys Asp Lys Leu
625                 630                 635                 640

Glu Leu Leu Pro Lys Asn Ser Leu Arg Asn Pro Val Val Glu Lys Ile
                645                 650                 655

Leu Asn Gln Lys Val Asn Leu Ile Asn Gln Leu Ile Asp Glu Tyr Gly
            660                 665                 670

Lys Pro Asp Glu Val Arg Ile Glu Leu Ala Arg Glu Leu Lys Lys Ser
        675                 680                 685
```

```
Ala Lys Gln Arg Ala Asp Leu Ser Lys His Ile Asn Asp Ala Thr Leu
    690                 695                 700

Lys Asn Gln Asn Ile Arg Lys Thr Leu Gln Lys Asp Phe Gly Ile Gln
705                 710                 715                 720

Asn Pro Ser Lys Asn Asp Val Ile Arg Tyr Lys Leu Tyr Asp Glu Leu
                725                 730                 735

Lys Asp Asn Gly Tyr Lys Thr Leu Phe Thr Asn Lys Tyr Ile Pro Lys
            740                 745                 750

Glu Gln Leu Phe Ser Lys Asp Val Asp Ile Glu His Ile Ile Pro Lys
        755                 760                 765

Ala Ile Leu Phe Asp Asp Ser Phe Ser Asn Lys Thr Leu Ala Tyr Arg
    770                 775                 780

Asn Val Asn Leu Ala Lys Ala Asp Ala Thr Ala Phe Asp Phe Ile Ser
785                 790                 795                 800

Ser Lys His Leu Asp Asp Leu Asp Asn Tyr Lys Ala Arg Val Glu Thr
                805                 810                 815

Leu Phe Gln Ser Lys Arg Ile Ser Lys Gly Lys Tyr Lys Lys Leu Leu
            820                 825                 830

Met Thr Arg Gln Asn Leu Pro Glu Asp Phe Ile Glu Arg Asp Leu Arg
        835                 840                 845

Asn Ser Gln Tyr Ile Ala Lys Lys Ala Thr Ala Met Leu Lys Glu Val
    850                 855                 860

Phe Arg Ser Val Val Pro Thr Ser Gly Arg Ile Thr Asp Lys Leu Arg
865                 870                 875                 880
```

```
Glu Asp Trp Asp Leu Val Asn Val Met Lys Glu Leu Asn Leu Pro Lys
               885                 890                 895


Tyr Arg Thr Leu Gly Leu Thr Glu Phe Ile Glu Arg Lys Asn Gly Asn
            900                 905                 910


Lys Ile Glu Gln Ile Ile Asp Trp Thr Lys Arg Asn Asp His Arg His
        915                 920                 925


His Ala Met Asp Ala Leu Thr Val Ala Phe Thr Thr His Asn His Ile
    930                 935                 940


Gln Tyr Leu Asn Asn Leu Asn Val Thr His Gly Leu Asn Gly Val Asp
945                 950                 955                 960


Thr Asp His Glu Lys Ser Arg Leu Tyr Ala Ile Lys Gln Ala Ile Thr
               965                 970                 975


Lys Val Tyr Ile Val Gly Lys Thr Lys Lys Arg Lys Phe Ile Pro Pro
            980                 985                 990


Met Glu Asn Phe Arg Ser His Ala  Lys Asn His Leu Glu  Gly Ile Leu
        995                 1000                1005


Ile Ser  Phe Lys Asn Lys Asn  Lys Val Val Thr Lys  Asn Lys Asn
    1010                1015                1020


Arg Thr  Lys Thr Lys Thr Lys  Gly Val Phe Asn Glu  Lys Ile Gln
    1025                1030                1035


Leu Thr  Pro Arg Gly Gln Leu  His Lys Glu Thr Ile  Tyr Gly His
    1040                1045                1050


Ala Lys  Lys Val Ile Val Thr  Lys Glu Lys Val Ser  Ser Lys Phe
    1055                1060                1065


Thr His  Glu Lys Ile Leu Gln  Val Thr Lys Pro Ala  Tyr Arg Glu
    1070                1075                1080
```

```
Ala Leu  Leu Lys Arg Leu Ala  Ser Phe Lys Asn Asp  Pro Lys Lys
    1085                1090                1095

Ala Phe  Ser Gly Lys Asn Ala  Leu Ser Lys Asn Pro  Leu Tyr Phe
    1100                1105                1110

Asp Ile  Thr Ser Gly Lys Lys  Val Pro Asp Thr Val  Lys Leu Ser
    1115                1120                1125

Tyr Phe  Glu Asn Ser Tyr Val  Ile Arg Lys Glu Val  Asn Ser Asp
    1130                1135                1140

Asn Phe  Lys Asn Glu Lys Ser  Leu Gln Lys Val Leu  Asp Val Gly
    1145                1150                1155

Ile Arg  Arg Ile Leu Glu Lys  Arg Leu Ala Asp Tyr  Asn Gly Asn
    1160                1165                1170

Ala Lys  Glu Ala Phe Ser Asn  Leu Glu Lys Asn Pro  Ile Trp Lys
    1175                1180                1185

Asp Lys  Glu Lys Gly Val Cys  Ile Lys Lys Val Arg  Ile Glu Ala
    1190                1195                1200

Leu Lys  Asn Ala Glu Pro Leu  His Val Lys Lys Asp  His Leu Gly
    1205                1210                1215

Lys Ile  Ile Leu Asp Asp Glu  Asn Lys Ser Thr Pro  Val Asp Phe
    1220                1225                1230

Ile Ser  Thr Gly Asn Asn His  His Val Ala Ile Tyr  Glu Asp Lys
    1235                1240                1245

Asp Gly  Lys Leu His Asp Lys  Val Val Ser Phe Tyr  Glu Val Val
    1250                1255                1260
```

```
Ser Arg  Val Asn Leu Gly Leu  Pro Ile Ile Asp Lys  Ser Phe Asn
    1265                1270                1275


Ser His  Leu Asp Trp Lys Phe  Leu Phe Ser Met Lys  Gln Asn Glu
    1280                1285                1290


Met Phe  Val Phe Pro Ser Glu  Asp Phe Asn Pro Lys  Glu Ile Asp
    1295                1300                1305


Ile Gly  Asn Pro Lys Asn Asn  Glu Leu Ile Ser Lys  Tyr Leu Phe
    1310                1315                1320


Arg Val  Gln Lys Phe Ser Lys  Val Thr Tyr Gly Asn  Ser Ala Val
    1325                1330                1335


Arg Asp  Tyr Val Phe Arg His  His Leu Glu Thr Glu  Leu Ile Asp
    1340                1345                1350


Lys Lys  Glu Leu Lys Gly Ile  Thr Tyr Tyr Gln Leu  Lys Ser Ile
    1355                1360                1365


Gly Met  Leu Glu Lys Leu Val  Lys Val Arg Ile Asn  His Ile Gly
    1370                1375                1380


Lys Ile  Val His Ile Gly Glu  Tyr
    1385                1390


<210>  65
<211>  1116
<212>  PRT
<213>  Clostridium spiroforme

<400>  65

Met Val Glu Phe Leu Leu Lys Glu Met Lys Ile Met Gly Arg Leu Val
1               5                  10                  15


Leu Gly Leu Asp Ile Gly Ile Thr Ser Val Gly Tyr Gly Val Ile Asp
            20                  25                  30
```

```
Ile Asp Lys Asn Glu Phe Val Asp Tyr Gly Val Arg Leu Phe Lys Glu
        35                  40                  45

Gly Thr Ala Ile Asn Asn Glu Glu Arg Arg Ser Lys Arg Gly Ala Arg
    50                  55                  60

Arg Leu Lys Arg Arg Lys Thr Asn Arg Ile Ala Asp Met Lys Lys Leu
65                  70                  75                  80

Leu Glu Arg Asn Gly Leu Ile Asp Glu Gln Tyr Thr Ala Leu Asn Asn
                85                  90                  95

Pro Tyr Glu Ile Arg Lys Lys Gly Leu Lys Asn Lys Leu Ser Asn Tyr
            100                 105                 110

Glu Leu Ala Thr Ala Ile Leu His Ile Thr Lys Asn Arg Gly Thr Cys
        115                 120                 125

Leu Glu Ser Asn Ala Asp Glu Thr Gln Asp Glu Glu Ser Thr Lys Asn
    130                 135                 140

Ile Leu Ser Lys Asn Ala Leu Glu Leu Lys Asp Lys Tyr Ile Cys Glu
145                 150                 155                 160

Ile Gln Leu Ala Arg Leu Glu Glu Ser Gly Lys Ile Arg Gly Ile Asn
                165                 170                 175

Asn Asn Phe Lys Thr Glu Asp Tyr Leu Lys Glu Leu Ser Lys Ile Leu
            180                 185                 190

Glu Asn Gln Asp Leu Glu Lys Glu Thr Ile Asp Lys Ile Lys Glu Ile
        195                 200                 205

Val Ala Arg Arg Arg Arg Tyr Asp Gln Gly Pro Gly Ser Glu Lys Ser
    210                 215                 220

Pro Thr Pro Tyr Gly Ser Tyr Arg Met Glu Asn Gly Glu Leu Val His
```

```
225                 230                 235                 240

Val Asn Leu Ile Asp Met Met Arg Gly Lys Cys Ser Val Phe Pro Asp
                245                 250                 255

Gln Leu Arg Ala Pro Gln Gln Ser Tyr Ser Ala Glu Leu Phe Asn Leu
            260                 265                 270

Leu Asn Asp Leu Asn Asn Leu Lys Ile Asn Gly Glu Lys Leu Ser Ser
        275                 280                 285

Thr Glu Lys Gln Lys Ile Ile Asp Phe Val Asn Glu Lys Gly Gly Ile
    290                 295                 300

Thr Val Lys Gln Leu Leu Lys Leu Ile Asp Val Gly Ile Thr Glu Ile
305                 310                 315                 320

Ser Gly Phe Arg Ile Asp Lys Asn Glu Lys Pro Leu Ile Thr Glu Phe
                325                 330                 335

Lys Gly Tyr Lys Lys Val Leu Lys Val Phe Lys Asn Tyr Asn Gln Glu
            340                 345                 350

Ser Leu Leu Asn Asp Lys Ser Ile Val Asp Thr Ile Met Asp Ile Asn
        355                 360                 365

Thr Lys Ile Lys Ser Ile Asp Glu Arg Ser Asp Gln Leu Lys Gln Val
    370                 375                 380

Leu Pro Ser Leu Asp Thr Ser Ile Ile Asn Asp Leu Ala Ser Ile Lys
385                 390                 395                 400

Gly Val Ser Gly Tyr His Ser Leu Ser Leu Lys Ala Leu Asn Leu Ile
                405                 410                 415

Asn Asn Glu Met Leu Lys Thr Glu Met Asn Gln Met Gln Val Leu His
            420                 425                 430
```

```
Gln Leu Asp Ile Phe Asp Lys Asn Arg Val Ser Leu Lys Gly Gln Arg
        435                 440                 445

Gln Ile Tyr Ala Asp Asp Asn Ala Ile Leu Ser Pro Val Ala Lys Arg
    450                 455                 460

Ala His Arg Glu Thr Phe Lys Val Ile Asn Lys Leu Arg Ser Ile Tyr
465                 470                 475                 480

Gly Glu Phe Asp Ser Ile Val Ile Glu Thr Thr Arg Asp Lys Asn Thr
                485                 490                 495

Gln Asp Gln Lys Lys Arg Ile Lys Asn Asn Gln Lys Asn Tyr Glu Glu
            500                 505                 510

Arg Asn Thr Glu Val Asn Asn Phe Leu Lys Glu Ala Gly Tyr Asn Pro
        515                 520                 525

Glu Asn Ile Asn Ala Lys Thr Lys Met Lys Ile Arg Leu Tyr Ile Glu
    530                 535                 540

Gln Asp Ala Lys Ser Ala Tyr Thr Leu Gln Asp Ile Asn Leu Lys Glu
545                 550                 555                 560

Leu Ile Glu Asp Glu Lys Ala Tyr Glu Ile Asp His Ile Ile Pro Ile
                565                 570                 575

Ser Ile Ser Leu Asp Asp Ser Phe Asn Asn Lys Val Leu Thr Thr His
            580                 585                 590

Asp Glu Asn Gln Glu Lys Gly Asn Leu Thr Pro Ile Ser Ala Phe Leu
        595                 600                 605

Lys Gly Lys Phe His Asn Gly Asn Leu Asn Thr Tyr Lys Val Phe Ile
    610                 615                 620

Gln Asn Asn Lys Asn Leu Asn Arg Lys Lys Lys Glu Tyr Leu Leu Cys
```

625 630 635 640

Glu Asp Asp Ile Thr Arg Tyr Glu Val Val Gln Asn Phe Ile Asn Arg
645 650 655

Asn Leu Val Asp Thr Ser Tyr Ala Cys Arg Thr Val Met Asn Thr Leu
660 665 670

Val His Tyr Phe Lys Asp Asn Glu Ile Asn Thr Lys Val His Thr Ile
675 680 685

Lys Gly Gln Ala Thr Ser Thr Phe Arg Lys Arg Ile Gly Leu Ile Lys
690 695 700

Asp Arg Glu Glu Asp Tyr Phe His His Ala Ile Asp Ala Leu Ile Val
705 710 715 720

Ala Ser Leu Lys Lys Met Asn Leu Ile Asn Ser Tyr Leu Met Lys Val
725 730 735

Asp Phe Asn Glu Met Tyr Asp Glu Glu Thr Gly Glu Ile Phe Asn Val
740 745 750

Leu Pro Asp Asn Ser Tyr Leu Asp Glu Lys Tyr Ile Ser Phe Val Ser
755 760 765

Asn Leu Lys Asn Ile Tyr Glu Glu Ser Asn Lys Tyr Ile Arg Gly Val
770 775 780

Met Ile Lys Glu Lys Met Thr Tyr Pro Leu Ile Lys Val Ser His Lys
785 790 795 800

Ile Asp Thr Lys Pro Asn Arg Lys Ile Ser Asp Asp Thr Ile Tyr Ser
805 810 815

Thr Arg Asn Val Asp Asn Gln Asp Met Leu Val Glu Arg Ile Lys Asn
820 825 830

```
Ile Tyr Asp Pro Lys Glu Asn Ala Ala Asn Thr Leu Ile Asn Asp Ile
        835                 840                 845

Ile Asn Asp Asn Thr Asp Lys Tyr Ile Met Tyr His Lys Asp Pro Gln
    850                 855                 860

Thr Phe Asp Lys Ile Lys Ala Ile Val Leu Asn His Phe Asn Glu Phe
865                 870                 875                 880

Lys Thr Asp Lys Asn Cys Tyr Ile Val Thr Lys Glu Gly Leu Tyr Lys
                885                 890                 895

Leu Lys Gly Thr Ser Pro Leu Ala Leu Tyr Tyr Glu Glu Phe Gly Pro
            900                 905                 910

Ile Thr Lys Tyr Ala Lys Lys Asn Asn Gly Pro Thr Ile His Ser Met
        915                 920                 925

Lys Phe Tyr Ser Glu Lys Leu Gly Asn His Leu Ser Ile Thr His Lys
    930                 935                 940

Tyr Ser Thr Val Asn Lys Lys Val Ile Thr Lys Gln Ile Ser Pro Tyr
945                 950                 955                 960

Arg Thr Asp Phe Tyr Gln Ser Pro Glu Gly Lys Tyr Lys Phe Val Thr
                965                 970                 975

Val Arg Tyr Lys Asp Val Ala Tyr Asn Ala Lys Lys Asp Lys Tyr Ile
            980                 985                 990

Ile Asp His Ser Trp Tyr Arg Glu  Gln Lys Lys Leu Lys  Lys Ile Ala
        995                 1000                1005

Asp Glu  Trp Ile Phe Val Cys  Ser Val His Arg Asp  Glu Leu Ile
    1010                1015                1020

Gly Ile  Met Lys Ala Asp Gly  Gln Lys Arg Ile Phe  Asp Ser Ser
```

```
    1025                1030                1035

Thr Glu  Ser Asp Gly Glu Thr  Leu Tyr His Asp Ala  Lys Thr Tyr
    1040                1045                1050

Glu Ile  Leu Lys Phe Thr Ala  Thr Asn Asn Asp Ile  Thr Gly Arg
    1055                1060                1065

Phe Glu  Val Lys Pro Ile Tyr  Cys Tyr Cys Lys Lys  Gln Leu Met
    1070                1075                1080

Val Ser  Ile Gly Thr Cys Arg  Lys Ile Gln Lys Phe  Ala Thr Asp
    1085                1090                1095

Val Leu  Gly Asn Leu Tyr Ile  Val Lys Asp Asn Val  Leu Lys Leu
    1100                1105                1110

Glu Phe  Lys
    1115
```

<210> 66
<211> 1348
<212> PRT
<213> Finegoldia magna

<400> 66

```
Met Lys Ser Glu Lys Lys Tyr Tyr Ile Gly Leu Asp Val Gly Thr Asn
1               5                   10                  15

Ser Val Gly Trp Ala Val Thr Asp Glu Phe Tyr Asn Ile Leu Arg Ala
            20                  25                  30

Lys Gly Lys Asp Leu Trp Gly Val Arg Leu Phe Glu Lys Ala Asp Thr
        35                  40                  45

Ala Ala Asn Thr Arg Ile Phe Arg Ser Gly Arg Arg Arg Asn Asp Arg
    50                  55                  60
```

```
Lys Gly Met Arg Leu Gln Ile Leu Arg Glu Ile Phe Glu Asp Glu Ile
65                  70                  75                  80

Lys Lys Val Asp Lys Asp Phe Tyr Asp Arg Leu Asp Glu Ser Lys Phe
                85                  90                  95

Trp Ala Glu Asp Lys Lys Val Ser Gly Lys Tyr Ser Leu Phe Asn Asp
            100                 105                 110

Lys Asn Phe Ser Asp Lys Gln Tyr Phe Glu Lys Phe Pro Thr Ile Phe
        115                 120                 125

His Leu Arg Lys Tyr Leu Met Glu Glu His Gly Lys Val Asp Ile Arg
    130                 135                 140

Tyr Tyr Phe Leu Ala Ile Asn Gln Met Met Lys Arg Arg Gly His Phe
145                 150                 155                 160

Leu Ile Asp Gly Gln Ile Ser His Val Thr Asp Asp Lys Pro Leu Lys
                165                 170                 175

Glu Gln Leu Ile Leu Leu Ile Asn Asp Leu Leu Lys Ile Glu Leu Glu
            180                 185                 190

Glu Glu Leu Met Asp Ser Ile Phe Glu Ile Leu Ala Asp Val Asn Glu
        195                 200                 205

Lys Arg Thr Asp Lys Lys Asn Asn Leu Lys Glu Leu Ile Lys Gly Gln
    210                 215                 220

Asp Phe Asn Lys Gln Glu Gly Asn Ile Leu Asn Ser Ile Phe Glu Ser
225                 230                 235                 240

Ile Val Thr Gly Lys Ala Lys Ile Lys Asn Ile Ile Ser Asp Glu Asp
                245                 250                 255

Ile Leu Glu Lys Ile Lys Glu Asp Asn Lys Glu Asp Phe Val Leu Thr
            260                 265                 270
```

```
Gly Asp Ser Tyr Glu Glu Asn Leu Gln Tyr Phe Glu Glu Val Leu Gln
        275                 280                 285

Glu Asn Ile Thr Leu Phe Asn Thr Leu Lys Ser Thr Tyr Asp Phe Leu
    290                 295                 300

Ile Leu Gln Ser Ile Leu Lys Gly Lys Ser Thr Leu Ser Asp Ala Gln
305                 310                 315                 320

Val Glu Arg Tyr Asp Glu His Lys Lys Asp Leu Glu Ile Leu Lys Lys
                325                 330                 335

Val Ile Lys Lys Tyr Asp Glu Asp Gly Lys Leu Phe Lys Gln Val Phe
            340                 345                 350

Lys Glu Asp Asn Gly Asn Gly Tyr Val Ser Tyr Ile Gly Tyr Tyr Leu
        355                 360                 365

Asn Lys Asn Lys Lys Ile Thr Ala Lys Lys Lys Ile Ser Asn Ile Glu
    370                 375                 380

Phe Thr Lys Tyr Val Lys Gly Ile Leu Glu Lys Gln Cys Asp Cys Glu
385                 390                 395                 400

Asp Glu Asp Val Lys Tyr Leu Leu Gly Lys Ile Glu Gln Glu Asn Phe
                405                 410                 415

Leu Leu Lys Gln Ile Ser Ser Ile Asn Ser Val Ile Pro His Gln Ile
            420                 425                 430

His Leu Phe Glu Leu Asp Lys Ile Leu Glu Asn Leu Ala Lys Asn Tyr
        435                 440                 445

Pro Ser Phe Asn Asn Lys Lys Glu Glu Phe Thr Lys Ile Glu Lys Ile
    450                 455                 460
```

```
Arg Lys Thr Phe Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Asn
465                 470                 475                 480

Asp Tyr His Lys Asn Asn Gly Gly Asn Ala Trp Ile Phe Arg Asn Lys
                485                 490                 495

Gly Glu Lys Ile Arg Pro Trp Asn Phe Glu Lys Ile Val Asp Leu His
            500                 505                 510

Lys Ser Glu Glu Glu Phe Ile Lys Arg Met Leu Asn Gln Cys Thr Tyr
        515                 520                 525

Leu Pro Glu Glu Thr Val Leu Pro Lys Ser Ser Ile Leu Tyr Ser Glu
    530                 535                 540

Tyr Met Val Leu Asn Glu Leu Asn Asn Leu Arg Ile Asn Gly Lys Pro
545                 550                 555                 560

Leu Asp Thr Asp Val Lys Leu Lys Leu Ile Glu Glu Leu Phe Lys Lys
                565                 570                 575

Lys Thr Lys Val Thr Leu Lys Ser Ile Arg Asp Tyr Met Val Arg Asn
            580                 585                 590

Asn Phe Ala Asp Lys Glu Asp Phe Asp Asn Ser Glu Lys Asn Leu Glu
        595                 600                 605

Ile Ala Ser Asn Met Lys Ser Tyr Ile Asp Phe Asn Asn Ile Leu Glu
    610                 615                 620

Asp Lys Phe Asp Val Glu Met Val Glu Asp Leu Ile Glu Lys Ile Thr
625                 630                 635                 640

Ile His Thr Gly Asn Lys Lys Leu Leu Lys Lys Tyr Ile Glu Glu Thr
                645                 650                 655

Tyr Pro Asp Leu Ser Ser Ser Gln Ile Gln Lys Ile Ile Asn Leu Lys
            660                 665                 670
```

```
Tyr Lys Asp Trp Gly Arg Leu Ser Arg Lys Leu Leu Asp Gly Ile Lys
        675                 680                 685

Gly Thr Lys Lys Glu Thr Glu Lys Thr Asp Thr Val Ile Asn Phe Leu
    690                 695                 700

Arg Asn Ser Ser Asp Asn Leu Met Gln Ile Ile Gly Ser Gln Asn Tyr
705                 710                 715                 720

Ser Phe Asn Glu Tyr Ile Asp Lys Leu Arg Lys Lys Tyr Ile Pro Gln
                725                 730                 735

Glu Ile Ser Tyr Glu Val Val Glu Asn Leu Tyr Val Ser Pro Ser Val
            740                 745                 750

Lys Lys Met Ile Trp Gln Val Ile Arg Val Thr Glu Glu Ile Thr Lys
        755                 760                 765

Val Met Gly Tyr Asp Pro Asp Lys Ile Phe Ile Glu Met Ala Lys Ser
    770                 775                 780

Glu Glu Glu Lys Lys Thr Thr Ile Ser Arg Lys Asn Lys Leu Leu Asp
785                 790                 795                 800

Leu Tyr Lys Ala Ile Lys Lys Asp Glu Arg Asp Ser Gln Tyr Glu Lys
                805                 810                 815

Leu Leu Thr Gly Leu Asn Lys Leu Asp Asp Ser Asp Leu Arg Ser Arg
            820                 825                 830

Lys Leu Tyr Leu Tyr Tyr Thr Gln Met Gly Arg Asp Met Tyr Thr Gly
        835                 840                 845

Glu Lys Ile Asp Leu Asp Lys Leu Phe Asp Ser Thr His Tyr Asp Lys
    850                 855                 860
```

```
Asp His Ile Ile Pro Gln Ser Met Lys Lys Asp Asp Ser Ile Ile Asn
865                 870                 875                 880


Asn Leu Val Leu Val Asn Lys Asn Ala Asn Gln Thr Thr Lys Gly Asn
                885                 890                 895


Ile Tyr Pro Val Pro Ser Ser Ile Arg Asn Asn Pro Lys Ile Tyr Asn
            900                 905                 910


Tyr Trp Lys Tyr Leu Met Glu Lys Glu Phe Ile Ser Lys Glu Lys Tyr
        915                 920                 925


Asn Arg Leu Ile Arg Asn Thr Pro Leu Thr Asn Glu Glu Leu Gly Gly
    930                 935                 940


Phe Ile Asn Arg Gln Leu Val Glu Thr Arg Gln Ser Thr Lys Ala Ile
945                 950                 955                 960


Lys Glu Leu Phe Glu Lys Phe Tyr Gln Lys Ser Lys Ile Ile Pro Val
                965                 970                 975


Lys Ala Ser Leu Ala Ser Asp Leu Arg Lys Asp Met Asn Thr Leu Lys
            980                 985                 990


Ser Arg Glu Val Asn Asp Leu His  His Ala His Asp Ala  Phe Leu Asn
        995                 1000                1005


Ile Val  Ala Gly Asp Val Trp  Asn Arg Glu Phe Thr  Ser Asn Pro
    1010                1015                1020


Ile Asn  Tyr Val Lys Glu Asn  Arg Glu Gly Asp Lys  Val Lys Tyr
    1025                1030                1035


Ser Leu  Ser Lys Asp Phe Thr  Arg Pro Arg Lys Ser  Lys Gly Lys
    1040                1045                1050


Val Ile  Trp Thr Pro Glu Lys  Gly Arg Lys Leu Ile  Val Asp Thr
    1055                1060                1065
```

```
Leu Asn  Lys Pro Ser Val Leu  Ile Ser Asn Glu Ser  His Val Lys
    1070                1075                1080

Lys Gly  Glu Leu Phe Asn Ala  Thr Ile Ala Gly Lys  Lys Asp Tyr
    1085                1090                1095

Lys Lys  Gly Lys Ile Tyr Leu  Pro Leu Lys Lys Asp  Asp Arg Leu
    1100                1105                1110

Gln Asp  Val Ser Lys Tyr Gly  Gly Tyr Lys Ala Ile  Asn Gly Ala
    1115                1120                1125

Phe Phe  Phe Leu Val Glu His  Thr Lys Ser Lys Lys  Arg Ile Arg
    1130                1135                1140

Ser Ile  Glu Leu Phe Pro Leu  His Leu Leu Ser Lys  Phe Tyr Glu
    1145                1150                1155

Asp Lys  Asn Thr Val Leu Asp  Tyr Ala Ile Asn Val  Leu Gln Leu
    1160                1165                1170

Gln Asp  Pro Lys Ile Ile Ile  Asp Lys Ile Asn Tyr  Arg Thr Glu
    1175                1180                1185

Ile Ile  Ile Asp Asn Phe Ser  Tyr Leu Ile Ser Thr  Lys Ser Asn
    1190                1195                1200

Asp Gly  Ser Ile Thr Val Lys  Pro Asn Glu Gln Met  Tyr Trp Arg
    1205                1210                1215

Val Asp  Glu Ile Ser Asn Leu  Lys Lys Ile Glu Asn  Lys Tyr Lys
    1220                1225                1230

Lys Asp  Ala Ile Leu Thr Glu  Glu Asp Arg Lys Ile  Met Glu Ser
    1235                1240                1245
```

```
Tyr Ile  Asp Lys Ile Tyr Gln  Gln Phe Lys Ala Gly  Lys Tyr Lys
    1250                1255                1260


Asn Arg  Arg Thr Thr Asp Thr  Ile Ile Glu Lys Tyr  Glu Ile Ile
    1265                1270                1275


Asp Leu  Asp Thr Leu Asp Asn  Lys Gln Leu Tyr Gln  Leu Leu Val
    1280                1285                1290


Ala Phe  Ile Ser Leu Ser Tyr  Lys Thr Ser Asn Asn  Ala Val Asp
    1295                1300                1305


Phe Thr  Val Ile Gly Leu Gly  Thr Glu Cys Gly Lys  Pro Arg Ile
    1310                1315                1320


Thr Asn  Leu Pro Asp Asn Thr  Tyr Leu Val Tyr Lys  Ser Ile Thr
    1325                1330                1335


Gly Ile  Tyr Glu Lys Arg Ile  Arg Ile Lys
    1340                1345
```

<210> 67
<211> 1129
<212> PRT
<213> Streptococcus infantarius

<400> 67

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Met Ser Asn Gly Lys Ile Leu Gly Leu Asp Ile Gly Val Ala Ser Val
1               5                   10                  15


Gly Val Gly Ile Ile Asp Ser Lys Thr Gly Asn Val Ile His Ala Asn
            20                  25                  30


Ser Arg Leu Phe Ser Ala Ala Asn Ala Glu Asn Asn Ala Glu Arg Arg
        35                  40                  45


Gly Phe Arg Gly Ala Arg Arg Leu Thr Arg Arg Lys Lys His Arg Val
    50                  55                  60
```

```
Lys Arg Val Arg Asp Leu Phe Glu Lys Tyr Asp Ile Ser Thr Asp Phe
65                  70                  75                  80

Arg Asn Leu Asn Leu Asn Pro Tyr Glu Leu Arg Val Lys Gly Leu Thr
                85                  90                  95

Glu Gln Leu Thr Asn Glu Glu Leu Phe Ala Ala Leu Arg Thr Ile Ala
            100                 105                 110

Lys Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Glu Asp Asp Ser Thr
        115                 120                 125

Gly Ser Ser Asp Tyr Ala Lys Ser Ile Asp Glu Asn Arg Arg Leu Leu
    130                 135                 140

Lys Thr Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Leu Glu Lys Tyr
145                 150                 155                 160

Gly Gln Leu Arg Gly Asn Phe Thr Val Tyr Asp Glu Asn Gly Glu Ala
                165                 170                 175

His Arg Leu Ile Asn Val Phe Ser Thr Ser Asp Tyr Lys Asn Glu Ala
            180                 185                 190

Arg Lys Ile Leu Glu Thr Gln Ser Asn Tyr Asn Lys Gln Ile Thr Asp
        195                 200                 205

Glu Phe Ile Glu Asp Tyr Ile Glu Ile Leu Thr Gln Lys Arg Lys Tyr
    210                 215                 220

Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg Phe
225                 230                 235                 240

Arg Thr Asp Gly Thr Thr Leu Glu Asn Ile Phe Gly Ile Leu Ile Gly
                245                 250                 255

Lys Cys Ser Phe Tyr Pro Glu Glu Tyr Arg Ala Ser Lys Ala Ser Tyr
```

```
            260                 265                 270

Thr Ala Gln Glu Phe Asn Phe Leu Asn Asp Leu Asn Asn Leu Lys Val
        275                 280                 285

Pro Thr Glu Thr Gly Lys Leu Ser Thr Glu Gln Lys Glu Tyr Leu Val
    290                 295                 300

Asp Phe Ala Lys Lys Ser Lys Ala Leu Gly Ala Ser Lys Leu Leu Lys
305                 310                 315                 320

Glu Ile Ala Lys Ile Val Asp Cys Ser Val Asp Asp Ile Lys Gly Tyr
                325                 330                 335

Arg Val Asp Asn Lys Asp Lys Pro Asp Leu His Thr Phe Glu Pro Tyr
            340                 345                 350

Arg Lys Leu Lys Phe Asn Leu Ser Ser Ile Asp Ile Asp Glu Leu Ser
        355                 360                 365

Arg Glu Thr Leu Asp Lys Leu Ala Asp Ile Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Glu Asp Ala Ile Lys Arg Asn Leu Pro Ser Gln Phe
385                 390                 395                 400

Thr Glu Glu Gln Ile Ser Glu Ile Val Gln Ile Arg Lys Asn Gln Ser
                405                 410                 415

Ser Ala Phe Asn Lys Gly Trp His Ser Phe Ser Ala Lys Leu Met Asn
            420                 425                 430

Glu Leu Ile Pro Glu Leu Tyr Val Thr Ser Glu Glu Gln Met Thr Ile
        435                 440                 445

Leu Thr Arg Leu Glu Lys Phe Lys Val Asn Lys Lys Ser Ser Lys Asn
    450                 455                 460
```

```
Thr Lys Thr Ile Asp Glu Lys Glu Ile Thr Asp Glu Ile Tyr Asn Pro
465                 470                 475                 480

Val Val Ala Lys Ser Val Arg Gln Thr Ile Lys Ile Ile Asn Ala Ala
                485                 490                 495

Val Lys Lys Tyr Gly Asp Phe Asp Lys Ile Val Ile Glu Met Pro Arg
            500                 505                 510

Asp Lys Asn Ala Glu Asp Glu Lys Lys Phe Ile Asp Lys Lys Gln Lys
        515                 520                 525

Glu Asn Lys Lys Glu Lys Asp Asp Ser Leu Lys Arg Ala Ala Phe Leu
    530                 535                 540

Tyr Asn Gly Thr Asp Asn Leu Pro Asp Gly Val Phe His Gly Asn Lys
545                 550                 555                 560

Glu Leu Lys Thr Lys Ile Arg Leu Trp Tyr Gln Gln Gly Glu Arg Cys
                565                 570                 575

Leu Tyr Ser Gly Lys Leu Ile Ser Ile His Asp Leu Val His Asn Ser
            580                 585                 590

Asn Lys Phe Glu Ile Asp His Ile Leu Pro Leu Ser Leu Ser Phe Asp
        595                 600                 605

Asp Ser Leu Ala Asn Lys Val Leu Val Tyr Ala Trp Thr Asn Gln Glu
    610                 615                 620

Lys Gly Gln Lys Thr Pro Tyr Gln Val Ile Asp Ser Met Asp Thr Ala
625                 630                 635                 640

Trp Ser Phe Arg Glu Met Lys Asp Tyr Val Leu Lys Gln Lys Gly Leu
                645                 650                 655

Gly Lys Lys Lys Cys Glu Tyr Leu Leu Thr Thr Glu Asn Ile Asp Lys
```

```
            660                 665                 670

Ile Glu Val Lys Lys Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Ala Ser Arg Val Val Leu Asn Ser Leu Gln Thr Ala Leu Lys Glu
    690                 695                 700

Leu Gly Lys Asp Thr Lys Val Ser Val Val Arg Gly Gln Phe Thr Ser
705                 710                 715                 720

Gln Leu Arg Arg Lys Trp Asn Ile Asp Lys Ser Arg Glu Thr Tyr His
                725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Lys
            740                 745                 750

Leu Trp Gln Lys Gln Glu Asn Pro Met Phe Glu Ser Tyr Gly Glu Asn
        755                 760                 765

Gln Val Val Asn Lys Glu Thr Gly Glu Ile Leu Ser Ile Ser Asp Asp
    770                 775                 780

Lys Tyr Lys Glu Leu Val Phe Gln Pro Pro Tyr Gln Gly Phe Val Asn
785                 790                 795                 800

Thr Ile Ser Ser Lys Gly Phe Glu Asp Glu Ile Leu Phe Ser Tyr Gln
                805                 810                 815

Val Asp Ser Lys Phe Asn Arg Lys Val Ser Asp Ala Thr Ile Tyr Ser
            820                 825                 830

Thr Arg Lys Ala Lys Leu Gly Lys Asp Lys Lys Asp Glu Thr Tyr Val
        835                 840                 845

Leu Gly Lys Ile Lys Asp Ile Tyr Ser Gln Asp Gly Phe Asp Thr Phe
    850                 855                 860
```

```
Ile Lys Arg Tyr Lys Lys Asp Lys Thr Gln Phe Leu Met Tyr Gln Lys
865                 870                 875                 880


Asp Pro Leu Thr Trp Glu Asn Val Ile Glu Val Ile Leu Arg Asp Tyr
                885                 890                 895


Pro Ser Glu Lys Leu Ser Glu Asp Gly Lys Lys Thr Val Lys Cys Asn
            900                 905                 910


Pro Phe Glu Glu Tyr Arg Arg Glu Asn Gly Leu Ile Cys Lys Tyr Ser
        915                 920                 925


Lys Lys Gly Asn Gly Thr Pro Ile Lys Ser Leu Lys Tyr Tyr Asp Lys
    930                 935                 940


Lys Leu Gly Asn Cys Ile Asp Ile Thr Pro Glu Lys Ser Lys Asn Arg
945                 950                 955                 960


Val Val Leu Arg Gln Ile Ser Pro Trp Arg Ala Asp Ile Tyr Phe Asn
                965                 970                 975


Leu Glu Thr Leu Lys Tyr Glu Leu Met Gly Leu Lys Tyr Ser Asp Leu
            980                 985                 990


Ser Phe Glu Lys Gly Thr Gly Lys  Tyr His Ile Ser Gln  Glu Lys Tyr
        995                 1000                1005


Asp Ala  Ile Arg Glu Lys Glu  Gly Ile Gly Lys Lys  Ser Glu Phe
    1010                1015                1020


Lys Phe  Thr Leu Tyr Arg Asn  Asp Leu Ile Leu Ile  Lys Asp Thr
    1025                1030                1035


Leu Asn  Asn Cys Glu Arg Met  Leu Arg Phe Gly Ser  Lys Asn Asp
    1040                1045                1050


Thr Ser  Lys His Tyr Val Glu  Leu Lys Pro Leu Glu  Lys Gly Thr
```

```
    1055                1060                1065

Phe Asp  Ser Glu Glu Glu Ile  Leu Pro Val Leu Gly  Lys Val Ala
    1070                1075                1080

Lys Ser  Gly Gln Phe Ile Lys  Gly Leu Asn Lys Pro  Asn Ile Ser
    1085                1090                1095

Ile Tyr  Lys Val Arg Thr Asp  Val Leu Gly Asn Lys  Phe Phe Ile
    1100                1105                1110

Lys Lys  Glu Gly Asp Lys Pro  Lys Leu Asp Phe Lys  Asn Asn Asn
    1115                1120                1125

Lys
```

<210> 68
<211> 1065
<212> PRT
<213> Clostridium perfringens

<400> 68

```
Met Asn Lys Asp Ile Asn Tyr Ala Leu Gly Leu Asp Ile Gly Ile Thr
1               5                   10                  15

Ser Val Gly Trp Ala Val Ile Asn Leu Asp Leu Asn Arg Ile Glu Asp
            20                  25                  30

Leu Gly Val Arg Ile Phe Asn Ala Ala Glu Asn Leu Lys Asp Gly Ser
        35                  40                  45

Ser Leu Ala Leu Pro Arg Arg Leu Ala Arg Gly Arg Arg Arg Leu Leu
    50                  55                  60

Arg Arg Lys Ala Tyr Arg Val Glu Arg Val Arg Lys Leu Ile Leu Lys
65                  70                  75                  80
```

```
Asn Asn Ile Leu Thr Lys Glu Glu Leu Glu Gly Leu Phe Lys Asn Lys
                85                  90                  95

Glu Val Ile Asp Val Trp Glu Ala Arg Val Lys Gly Leu Asp Tyr Lys
            100                 105                 110

Leu Ser Arg Glu Glu Trp Ala Lys Ile Leu Ile Asn Phe Cys Lys Arg
        115                 120                 125

Arg Gly Phe Lys Ser Asn Arg Lys Asn Glu Ala Lys Asp Lys Glu Ala
    130                 135                 140

Gly Gln Ile Leu Ser Ser Ile Ser Tyr Asn Ile Glu Lys Met Lys Glu
145                 150                 155                 160

Thr Asn Ser Arg Thr Ile Gly Glu Tyr Ile Tyr Asn Glu Val Lys Asn
                165                 170                 175

Ser Glu Asp Ser Tyr Ala Pro Leu Arg Asn Lys Phe Gly Glu Tyr Lys
            180                 185                 190

Met Cys Val Ser Arg Asp Val Ile Arg Glu Glu Ile His Thr Leu Phe
        195                 200                 205

Glu Lys Gln Arg Glu Leu Gly Asn Asn Phe Ala Ser Asp Glu Ile Glu
    210                 215                 220

Asp Lys Tyr Phe Glu Ile Phe Asn Ser Gln Arg Pro Phe Ser Asn Phe
225                 230                 235                 240

Glu Asp Leu Glu Lys Leu Val Gly Phe Cys Thr Phe Glu Arg Lys Lys
                245                 250                 255

His Lys Arg Ala Pro Lys His Cys Ile Ser Ser Glu Glu Phe Thr Leu
            260                 265                 270

Tyr Glu Gly Ile Asn Lys Leu Ser Ile Ile Lys Asp Gly Glu Lys Arg
        275                 280                 285
```

```
Lys Leu Ser Glu Glu Glu Arg Thr Leu Val Val Asn Glu Ala Phe Asn
    290                 295                 300

Lys Lys Glu Ile Lys Tyr Thr Thr Leu Arg Lys Leu Leu Gly Leu Ser
305                 310                 315                 320

Glu Glu Glu Leu Phe Ser Thr Leu Thr Tyr Ser Ile Asp Lys Asp Ile
                325                 330                 335

Ser Lys Thr Glu Asn Thr Lys Phe Val Ser Leu Lys Gly Tyr His Glu
            340                 345                 350

Ile Lys Arg Ala Ile Glu Lys Gly Val Ser Lys Lys Ala Trp Gln Asp
        355                 360                 365

Ile Glu Asn Asn Arg Asn Leu Leu Asn Asp Ile Ala Tyr Val Leu Thr
    370                 375                 380

Leu Gly Lys Thr Asp Asp Glu Ile Glu Lys Gln Leu Arg Leu Arg Asn
385                 390                 395                 400

Val Pro Glu Glu Leu Phe Glu Ser Leu Leu Asp Met Ser Phe Asn Lys
                405                 410                 415

Phe Asn Asn Leu Ser Ile Tyr Ala Leu Glu Lys Ile Leu Pro Phe Met
            420                 425                 430

Lys Glu Gly Tyr Gln Tyr Asn Glu Ala Cys Glu Lys Ala Gly Tyr Asn
        435                 440                 445

Phe Lys Ala Ile Tyr Glu Gly Val Arg Thr Lys Lys Leu Pro Val Ile
    450                 455                 460

Glu Ile Asp Glu Ile Val Asn Pro Val Val Asn Arg Ala Leu Ala Gln
465                 470                 475                 480
```

```
Thr Arg Lys Val Ile Asn Ser Val Ile Asp Lys Tyr Gly Ser Pro Val
                485                 490                 495

Arg Ile Asn Ile Glu Leu Ala Arg Asp Leu Ala Lys Asn Phe Lys Asp
            500                 505                 510

Arg Lys Leu Ile Glu Lys Glu Gln Lys Glu Asn Arg Ala Asn Leu Asp
        515                 520                 525

Lys Ile Arg Glu Asn Leu Arg Glu Leu Met Asp Lys Glu Pro Thr Val
    530                 535                 540

Val Glu Val Leu Lys Tyr Arg Leu Trp Glu Gln Gln Arg Gly Glu Cys
545                 550                 555                 560

Ala Tyr Thr Gln Ser Gln Ile Pro Leu Glu Arg Leu Phe Ser Pro Gly
                565                 570                 575

Tyr Cys Glu Ile Asp His Ile Ile Pro Phe Ser Arg Ser Phe Asp Asp
            580                 585                 590

Ser Leu Ser Asn Lys Ile Leu Val Leu Gly Ser Glu Asn Gln Arg Lys
        595                 600                 605

Gly Asn Arg Thr Pro Tyr Glu Tyr Phe Gly Glu Asp Ser Glu Arg Trp
    610                 615                 620

Asn Ser Phe Glu Ile Trp Val Lys Gly Ser Tyr Leu Asn Tyr Lys Lys
625                 630                 635                 640

Lys Ala Asn Leu Leu Lys Lys Lys Phe Ser Glu Glu Glu Gln Arg Asp
                645                 650                 655

Trp Lys Ala Arg Asn Leu Gln Asp Thr Lys Tyr Ile Cys Arg Tyr Ile
            660                 665                 670

Ser Asn Phe Val Asn Asn Arg Leu Glu Phe Lys Glu Ser Glu Asn Lys
        675                 680                 685
```

```
Gln Lys Val Ile Thr Val Asn Gly Arg Ala Thr Ala Tyr Leu Arg Ser
    690                 695                 700

Arg Trp Gly Leu Asn Lys Val Arg Glu Asp Gly Asp Lys His His Ala
705                 710                 715                 720

Leu Asp Ala Ala Val Val Gly Val Thr Thr Gln Gly Met Val Gln Lys
                725                 730                 735

Ile Ser Lys Tyr Ser Lys Ala His Glu Leu Tyr Thr Val Arg Lys Asn
            740                 745                 750

Asp Glu Phe Val Asp Val Glu Thr Gly Glu Cys Val Asp Val Asp Glu
        755                 760                 765

Tyr Lys Glu Ile Arg Lys Asp Ile Leu Pro Arg Pro Trp Arg Gly Phe
    770                 775                 780

Ser Glu Glu Leu Lys Leu Arg Leu Ser Asp Asn Pro Leu Glu Glu Leu
785                 790                 795                 800

Lys Lys Ser Pro Ile Glu Thr Tyr Asn Glu Glu Phe Ile Lys Glu Asn
                805                 810                 815

Val Lys Pro Ile Phe Val Ser Arg Val Pro Phe Arg Lys Ile Ser Gly
            820                 825                 830

Lys Leu Phe Lys Glu Thr Ile Tyr Ser Glu Arg Ala Phe Lys Asp Gly
        835                 840                 845

Tyr Phe Val Ser Lys Lys Ser Leu Val Asp Leu Lys Arg Gly Asp Leu
    850                 855                 860

Asp Asn Phe Tyr Asn Tyr Glu Cys Asp Lys Lys Leu Tyr Asp Ala Ile
865                 870                 875                 880
```

```
Ser Glu Arg Met Lys Glu Phe Asn Tyr Asn Gly Lys Lys Ala Phe Glu
                885                 890                 895


Ser Pro Phe Arg Lys Pro Thr Lys Ser Gly Lys Glu Gly Pro Val Val
            900                 905                 910


Arg Ser Val Lys Ile Lys Ser Ala Val Pro Phe Lys Asp Gly Ile Pro
        915                 920                 925


Met Asn Glu Gly Leu Val Ala Lys Glu Gly Met Val Arg Ile Asp Ile
    930                 935                 940


Tyr Glu Lys Glu Gly Lys Tyr Phe Val Val Pro Val Tyr Arg Tyr Gln
945                 950                 955                 960


Leu Ala Lys Gly Ile Val Pro Lys Arg Ala Ala Ile Ala Lys Lys Asp
                965                 970                 975


Glu Leu Lys Trp Pro Ile Met Asp Gln Thr Tyr Asn Phe Lys Phe Ser
            980                 985                 990


Ile Tyr Lys Asn Asp Leu Ile Glu  Val Lys Tyr Asp Lys  Lys Gly Val
        995                 1000                1005


Tyr Phe  Gly Tyr Tyr Asp Gly  Phe Asp Arg Asn Ser  Ala Ser Leu
    1010                1015                1020


Thr Ile  Glu Lys His Asp Asn  Ser Glu Arg Tyr Arg  Ser Ile Gly
    1025                1030                1035


Leu Lys  Val Gly Val Leu Glu  Ile Asn Lys Tyr Glu  Val Asp Val
    1040                1045                1050


Leu Gly  Asn Tyr His Lys Val  Lys Leu Gly Gly Asn
    1055                1060                1065


<210>  69
<211>  1195
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<212> PRT
<213> Elusimicrobium minutum

<400> 69

Met Gln Lys Asn Ile Asn Thr Lys Gln Asn His Ile Tyr Ile Lys Gln
1 5 10 15

Ala Gln Lys Ile Lys Glu Lys Leu Gly Asp Lys Pro Tyr Arg Ile Gly
20 25 30

Leu Asp Leu Gly Val Gly Ser Ile Gly Phe Ala Ile Val Ser Met Glu
35 40 45

Glu Asn Asp Gly Asn Val Leu Leu Pro Lys Glu Ile Ile Met Val Gly
50 55 60

Ser Arg Ile Phe Lys Ala Ser Ala Gly Ala Ala Asp Arg Lys Leu Ser
65 70 75 80

Arg Gly Gln Arg Asn Asn His Arg His Thr Arg Glu Arg Met Arg Tyr
85 90 95

Leu Trp Lys Val Leu Ala Glu Gln Lys Leu Ala Leu Pro Val Pro Ala
100 105 110

Asp Leu Asp Arg Lys Glu Asn Ser Ser Glu Gly Glu Thr Ser Ala Lys
115 120 125

Arg Phe Leu Gly Asp Val Leu Gln Lys Asp Ile Tyr Glu Leu Arg Val
130 135 140

Lys Ser Leu Asp Glu Arg Leu Ser Leu Gln Glu Leu Gly Tyr Val Leu
145 150 155 160

Tyr His Ile Ala Gly His Arg Gly Ser Ser Ala Ile Arg Thr Phe Glu
165 170 175

Asn Asp Ser Glu Glu Ala Gln Lys Glu Asn Thr Glu Asn Lys Lys Ile

```
            180                 185                 190

Ala Gly Asn Ile Lys Arg Leu Met Ala Lys Lys Asn Tyr Arg Thr Tyr
        195                 200                 205

Gly Glu Tyr Leu Tyr Lys Glu Phe Phe Glu Asn Lys Glu Lys His Lys
    210                 215                 220

Arg Glu Lys Ile Ser Asn Ala Ala Asn Asn His Lys Phe Ser Pro Thr
225                 230                 235                 240

Arg Asp Leu Val Ile Lys Glu Ala Glu Ala Ile Leu Lys Lys Gln Ala
                245                 250                 255

Gly Lys Asp Gly Phe His Lys Glu Leu Thr Glu Glu Tyr Ile Glu Lys
            260                 265                 270

Leu Thr Lys Ala Ile Gly Tyr Glu Ser Glu Lys Leu Ile Pro Glu Ser
        275                 280                 285

Gly Phe Cys Pro Tyr Leu Lys Asp Glu Lys Arg Leu Pro Ala Ser His
    290                 295                 300

Lys Leu Asn Glu Glu Arg Arg Leu Trp Glu Thr Leu Asn Asn Ala Arg
305                 310                 315                 320

Tyr Ser Asp Pro Ile Val Asp Ile Val Thr Gly Glu Ile Thr Gly Tyr
                325                 330                 335

Tyr Glu Lys Gln Phe Thr Lys Glu Gln Lys Gln Lys Leu Phe Asp Tyr
            340                 345                 350

Leu Leu Thr Gly Ser Glu Leu Thr Pro Ala Gln Thr Lys Lys Leu Leu
        355                 360                 365

Gly Leu Lys Asn Thr Asn Phe Glu Asp Ile Ile Leu Gln Gly Arg Asp
    370                 375                 380
```

```
Lys Lys Ala Gln Lys Ile Lys Gly Tyr Lys Leu Ile Lys Leu Glu Ser
385                 390                 395                 400

Met Pro Phe Trp Ala Arg Leu Ser Glu Ala Gln Gln Asp Ser Phe Leu
                405                 410                 415

Tyr Asp Trp Asn Ser Cys Pro Asp Glu Lys Leu Leu Thr Glu Lys Leu
            420                 425                 430

Ser Asn Glu Tyr His Leu Thr Glu Glu Glu Ile Asp Asn Ala Phe Asn
        435                 440                 445

Glu Ile Val Leu Ser Ser Ser Tyr Ala Pro Leu Gly Lys Ser Ala Met
    450                 455                 460

Leu Ile Ile Leu Glu Lys Ile Lys Asn Asp Leu Ser Tyr Thr Glu Ala
465                 470                 475                 480

Val Glu Glu Ala Leu Lys Glu Gly Lys Leu Thr Lys Glu Lys Gln Ala
                485                 490                 495

Ile Lys Asp Arg Leu Pro Tyr Tyr Gly Ala Val Leu Gln Glu Ser Thr
            500                 505                 510

Gln Lys Ile Ile Ala Lys Gly Phe Ser Pro Gln Phe Lys Asp Lys Gly
        515                 520                 525

Tyr Lys Thr Pro His Thr Asn Lys Tyr Glu Leu Glu Tyr Gly Arg Ile
    530                 535                 540

Ala Asn Pro Val Val His Gln Thr Leu Asn Glu Leu Arg Lys Leu Val
545                 550                 555                 560

Asn Glu Ile Ile Asp Ile Leu Gly Lys Lys Pro Cys Glu Ile Gly Leu
                565                 570                 575

Glu Thr Ala Arg Glu Leu Lys Lys Ser Ala Glu Asp Arg Ser Lys Leu
```

```
            580                 585                 590

Ser Arg Glu Gln Asn Asp Asn Glu Ser Asn Arg Asn Arg Ile Tyr Glu
        595                 600                 605

Ile Tyr Ile Arg Pro Gln Gln Gln Val Ile Ile Thr Arg Arg Glu Asn
    610                 615                 620

Pro Arg Asn Tyr Ile Leu Lys Phe Glu Leu Leu Glu Glu Gln Lys Ser
625                 630                 635                 640

Gln Cys Pro Phe Cys Gly Gly Gln Ile Ser Pro Asn Asp Ile Ile Asn
                645                 650                 655

Asn Gln Ala Asp Ile Glu His Leu Phe Pro Ile Ala Glu Ser Glu Asp
            660                 665                 670

Asn Gly Arg Asn Asn Leu Val Ile Ser His Ser Ala Cys Asn Ala Asp
        675                 680                 685

Lys Ala Lys Arg Ser Pro Trp Ala Ala Phe Ala Ser Ala Ala Lys Asp
    690                 695                 700

Ser Lys Tyr Asp Tyr Asn Arg Ile Leu Ser Asn Val Lys Glu Asn Ile
705                 710                 715                 720

Pro His Lys Ala Trp Arg Phe Asn Gln Gly Ala Phe Glu Lys Phe Ile
                725                 730                 735

Glu Asn Lys Pro Met Ala Ala Arg Phe Lys Thr Asp Asn Ser Tyr Ile
            740                 745                 750

Ser Lys Val Ala His Lys Tyr Leu Ala Cys Leu Phe Glu Lys Pro Asn
        755                 760                 765

Ile Ile Cys Val Lys Gly Ser Leu Thr Ala Gln Leu Arg Met Ala Trp
    770                 775                 780
```

```
Gly Leu Gln Gly Leu Met Ile Pro Phe Ala Lys Gln Leu Ile Thr Glu
785                 790                 795                 800


Lys Glu Ser Glu Ser Phe Asn Lys Asp Val Asn Ser Asn Lys Lys Ile
                805                 810                 815


Arg Leu Asp Asn Arg His His Ala Leu Asp Ala Ile Val Ile Ala Tyr
            820                 825                 830


Ala Ser Arg Gly Tyr Gly Asn Leu Leu Asn Lys Met Ala Gly Lys Asp
        835                 840                 845


Tyr Lys Ile Asn Tyr Ser Glu Arg Asn Trp Leu Ser Lys Ile Leu Leu
    850                 855                 860


Pro Pro Asn Asn Ile Val Trp Glu Asn Ile Asp Ala Asp Leu Glu Ser
865                 870                 875                 880


Phe Glu Ser Ser Val Lys Thr Ala Leu Lys Asn Ala Phe Ile Ser Val
                885                 890                 895


Lys His Asp His Ser Asp Asn Gly Glu Leu Val Lys Gly Thr Met Tyr
            900                 905                 910


Lys Ile Phe Tyr Ser Glu Arg Gly Tyr Thr Leu Thr Thr Tyr Lys Lys
        915                 920                 925


Leu Ser Ala Leu Lys Leu Thr Asp Pro Gln Lys Lys Lys Thr Pro Lys
    930                 935                 940


Asp Phe Leu Glu Thr Ala Leu Leu Lys Phe Lys Gly Arg Glu Ser Glu
945                 950                 955                 960


Met Lys Asn Glu Lys Ile Lys Ser Ala Ile Glu Asn Asn Lys Arg Leu
                965                 970                 975


Phe Asp Val Ile Gln Asp Asn Leu Glu Lys Ala Lys Lys Leu Leu Glu
```

```
            980                 985                 990

Glu Glu Asn Glu Lys Ser Lys Ala  Glu Gly Lys Lys Glu  Lys Asn Ile
        995                 1000                1005

Asn Asp  Ala Ser Ile Tyr Gln  Lys Ala Ile Ser Leu  Ser Gly Asp
    1010                1015                1020

Lys Tyr  Val Gln Leu Ser Lys  Lys Glu Pro Gly Lys  Phe Phe Ala
    1025                1030                1035

Ile Ser  Lys Pro Thr Pro Thr  Thr Thr Gly Tyr Gly  Tyr Asp Thr
    1040                1045                1050

Gly Asp  Ser Leu Cys Val Asp  Leu Tyr Tyr Asp Asn  Lys Gly Lys
    1055                1060                1065

Leu Cys  Gly Glu Ile Ile Arg  Lys Ile Asp Ala Gln  Gln Lys Asn
    1070                1075                1080

Pro Leu  Lys Tyr Lys Glu Gln  Gly Phe Thr Leu Phe  Glu Arg Ile
    1085                1090                1095

Tyr Gly  Gly Asp Ile Leu Glu  Val Asp Phe Asp Ile  His Ser Asp
    1100                1105                1110

Lys Asn  Ser Phe Arg Asn Asn  Thr Gly Ser Ala Pro  Glu Asn Arg
    1115                1120                1125

Val Phe  Ile Lys Val Gly Thr  Phe Thr Glu Ile Thr  Asn Asn Asn
    1130                1135                1140

Ile Gln  Ile Trp Phe Gly Asn  Ile Ile Lys Ser Thr  Gly Gly Gln
    1145                1150                1155

Asp Asp  Ser Phe Thr Ile Asn  Ser Met Gln Gln Tyr  Asn Pro Arg
    1160                1165                1170
```

```
Lys Leu  Ile Leu Ser Ser Cys  Gly Phe Ile Lys Tyr  Arg Ser Pro
    1175                1180                1185


Ile Leu  Lys Asn Lys Glu Gly
    1190                1195


<210>  70
<211>  1101
<212>  PRT
<213>  Akkermansia muciniphila

<400>  70

Met Ser Arg Ser Leu Thr Phe Ser Phe Asp Ile Gly Tyr Ala Ser Ile
1               5                   10                  15


Gly Trp Ala Val Ile Ala Ser Ala Ser His Asp Asp Ala Asp Pro Ser
            20                  25                  30


Val Cys Gly Cys Gly Thr Val Leu Phe Pro Lys Asp Asp Cys Gln Ala
        35                  40                  45


Phe Lys Arg Arg Glu Tyr Arg Arg Leu Arg Arg Asn Ile Arg Ser Arg
    50                  55                  60


Arg Val Arg Ile Glu Arg Ile Gly Arg Leu Leu Val Gln Ala Gln Ile
65                  70                  75                  80


Ile Thr Pro Glu Met Lys Glu Thr Ser Gly His Pro Ala Pro Phe Tyr
                85                  90                  95


Leu Ala Ser Glu Ala Leu Lys Gly His Arg Thr Leu Ala Pro Ile Glu
            100                 105                 110


Leu Trp His Val Leu Arg Trp Tyr Ala His Asn Arg Gly Tyr Asp Asn
        115                 120                 125


Asn Ala Ser Trp Ser Asn Ser Leu Ser Glu Asp Gly Gly Asn Gly Glu
    130                 135                 140
```

```
Asp Thr Glu Arg Val Lys His Ala Gln Asp Leu Met Asp Lys His Gly
145                 150                 155                 160

Thr Ala Thr Met Ala Glu Thr Ile Cys Arg Glu Leu Lys Leu Glu Glu
                165                 170                 175

Gly Lys Ala Asp Ala Pro Met Glu Val Ser Thr Pro Ala Tyr Lys Asn
            180                 185                 190

Leu Asn Thr Ala Phe Pro Arg Leu Ile Val Glu Lys Glu Val Arg Arg
        195                 200                 205

Ile Leu Glu Leu Ser Ala Pro Leu Ile Pro Gly Leu Thr Ala Glu Ile
    210                 215                 220

Ile Glu Leu Ile Ala Gln His His Pro Leu Thr Thr Glu Gln Arg Gly
225                 230                 235                 240

Val Leu Leu Gln His Gly Ile Lys Leu Ala Arg Arg Tyr Arg Gly Ser
                245                 250                 255

Leu Leu Phe Gly Gln Leu Ile Pro Arg Phe Asp Asn Arg Ile Ile Ser
            260                 265                 270

Arg Cys Pro Val Thr Trp Ala Gln Val Tyr Glu Ala Glu Leu Lys Lys
        275                 280                 285

Gly Asn Ser Glu Gln Ser Ala Arg Glu Arg Ala Glu Lys Leu Ser Lys
    290                 295                 300

Val Pro Thr Ala Asn Cys Pro Glu Phe Tyr Glu Tyr Arg Met Ala Arg
305                 310                 315                 320

Ile Leu Cys Asn Ile Arg Ala Asp Gly Glu Pro Leu Ser Ala Glu Ile
                325                 330                 335
```

```
Arg Arg Glu Leu Met Asn Gln Ala Arg Gln Glu Gly Lys Leu Thr Lys
            340                 345                 350

Ala Ser Leu Glu Lys Ala Ile Ser Ser Arg Leu Gly Lys Glu Thr Glu
        355                 360                 365

Thr Asn Val Ser Asn Tyr Phe Thr Leu His Pro Asp Ser Glu Glu Ala
    370                 375                 380

Leu Tyr Leu Asn Pro Ala Val Glu Val Leu Gln Arg Ser Gly Ile Gly
385                 390                 395                 400

Gln Ile Leu Ser Pro Ser Val Tyr Arg Ile Ala Ala Asn Arg Leu Arg
                405                 410                 415

Arg Gly Lys Ser Val Thr Pro Asn Tyr Leu Leu Asn Leu Leu Lys Ser
            420                 425                 430

Arg Gly Glu Ser Gly Glu Ala Leu Glu Lys Lys Ile Glu Lys Glu Ser
        435                 440                 445

Lys Lys Lys Glu Ala Asp Tyr Ala Asp Thr Pro Leu Lys Pro Lys Tyr
    450                 455                 460

Ala Thr Gly Arg Ala Pro Tyr Ala Arg Thr Val Leu Lys Lys Val Val
465                 470                 475                 480

Glu Glu Ile Leu Asp Gly Glu Asp Pro Thr Arg Pro Ala Arg Gly Glu
                485                 490                 495

Ala His Pro Asp Gly Glu Leu Lys Ala His Asp Gly Cys Leu Tyr Cys
            500                 505                 510

Leu Leu Asp Thr Asp Ser Ser Val Asn Gln His Gln Lys Glu Arg Arg
        515                 520                 525

Leu Asp Thr Met Thr Asn Asn His Leu Val Arg His Arg Met Leu Ile
    530                 535                 540
```

```
Leu Asp Arg Leu Leu Lys Asp Leu Ile Gln Asp Phe Ala Asp Gly Gln
545                 550                 555                 560


Lys Asp Arg Ile Ser Arg Val Cys Val Glu Val Gly Lys Glu Leu Thr
                565                 570                 575


Thr Phe Ser Ala Met Asp Ser Lys Lys Ile Gln Arg Glu Leu Thr Leu
            580                 585                 590


Arg Gln Lys Ser His Thr Asp Ala Val Asn Arg Leu Lys Arg Lys Leu
        595                 600                 605


Pro Gly Lys Ala Leu Ser Ala Asn Leu Ile Arg Lys Cys Arg Ile Ala
    610                 615                 620


Met Asp Met Asn Trp Thr Cys Pro Phe Thr Gly Ala Thr Tyr Gly Asp
625                 630                 635                 640


His Glu Leu Glu Asn Leu Glu Leu Glu His Ile Val Pro His Ser Phe
                645                 650                 655


Arg Gln Ser Asn Ala Leu Ser Ser Leu Val Leu Thr Trp Pro Gly Val
            660                 665                 670


Asn Arg Met Lys Gly Gln Arg Thr Gly Tyr Asp Phe Val Glu Gln Glu
        675                 680                 685


Gln Glu Asn Pro Val Pro Asp Lys Pro Asn Leu His Ile Cys Ser Leu
    690                 695                 700


Asn Asn Tyr Arg Glu Leu Val Glu Lys Leu Asp Asp Lys Lys Gly His
705                 710                 715                 720


Glu Asp Asp Arg Arg Arg Lys Lys Lys Arg Lys Ala Leu Leu Met Val
                725                 730                 735
```

```
Arg Gly Leu Ser His Lys His Gln Ser Gln Asn His Glu Ala Met Lys
            740                 745                 750

Glu Ile Gly Met Thr Glu Gly Met Met Thr Gln Ser Ser His Leu Met
        755                 760                 765

Lys Leu Ala Cys Lys Ser Ile Lys Thr Ser Leu Pro Asp Ala His Ile
    770                 775                 780

Asp Met Ile Pro Gly Ala Val Thr Ala Glu Val Arg Lys Ala Trp Asp
785                 790                 795                 800

Val Phe Gly Val Phe Lys Glu Leu Cys Pro Glu Ala Ala Asp Pro Asp
                805                 810                 815

Ser Gly Lys Ile Leu Lys Glu Asn Leu Arg Ser Leu Thr His Leu His
            820                 825                 830

His Ala Leu Asp Ala Cys Val Leu Gly Leu Ile Pro Tyr Ile Ile Pro
        835                 840                 845

Ala His His Asn Gly Leu Leu Arg Arg Val Leu Ala Met Arg Arg Ile
    850                 855                 860

Pro Glu Lys Leu Ile Pro Gln Val Arg Pro Val Ala Asn Gln Arg His
865                 870                 875                 880

Tyr Val Leu Asn Asp Asp Gly Arg Met Met Leu Arg Asp Leu Ser Ala
                885                 890                 895

Ser Leu Lys Glu Asn Ile Arg Glu Gln Leu Met Glu Gln Arg Val Ile
            900                 905                 910

Gln His Val Pro Ala Asp Met Gly Gly Ala Leu Leu Lys Glu Thr Met
        915                 920                 925

Gln Arg Val Leu Ser Val Asp Gly Ser Gly Glu Asp Ala Met Val Ser
    930                 935                 940
```

```
Leu Ser Lys Lys Lys Asp Gly Lys Lys Glu Lys Asn Gln Val Lys Ala
945                 950                 955                 960


Ser Lys Leu Val Gly Val Phe Pro Glu Gly Pro Ser Lys Leu Lys Ala
                965                 970                 975


Leu Lys Ala Ala Ile Glu Ile Asp Gly Asn Tyr Gly Val Ala Leu Asp
            980                 985                 990


Pro Lys Pro Val Val Ile Arg His  Ile Lys Val Phe Lys  Arg Ile Met
        995                 1000                1005


Ala Leu  Lys Glu Gln Asn Gly  Gly Lys Pro Val Arg  Ile Leu Lys
    1010                1015                1020


Lys Gly  Met Leu Ile His Leu  Thr Ser Ser Lys Asp  Pro Lys His
    1025                1030                1035


Ala Gly  Val Trp Arg Ile Glu  Ser Ile Gln Asp Ser  Lys Gly Gly
    1040                1045                1050


Val Lys  Leu Asp Leu Gln Arg  Ala His Cys Ala Val  Pro Lys Asn
    1055                1060                1065


Lys Thr  His Glu Cys Asn Trp  Arg Glu Val Asp Leu  Ile Ser Leu
    1070                1075                1080


Leu Lys  Lys Tyr Gln Met Lys  Arg Tyr Pro Thr Ser  Tyr Thr Gly
    1085                1090                1095


Thr Pro  Arg
    1100
```

<210> 71
<211> 1187
<212> PRT
<213> Bifidobacterium longum

<400> 71

```
Met Leu Ser Arg Gln Leu Leu Gly Ala Ser His Leu Ala Arg Pro Val
1               5                  10                  15

Ser Tyr Ser Tyr Asn Val Gln Asp Asn Asp Val His Cys Ser Tyr Gly
            20                  25                  30

Glu Arg Cys Phe Met Arg Gly Lys Arg Tyr Arg Ile Gly Ile Asp Val
        35                  40                  45

Gly Leu Asn Ser Val Gly Leu Ala Ala Val Glu Val Ser Asp Glu Asn
    50                  55                  60

Ser Pro Val Arg Leu Leu Asn Ala Gln Ser Val Ile His Asp Gly Gly
65                  70                  75                  80

Val Asp Pro Gln Lys Asn Lys Glu Ala Ile Thr Arg Lys Asn Met Ser
                85                  90                  95

Gly Val Ala Arg Arg Thr Arg Arg Met Arg Arg Arg Lys Arg Glu Arg
            100                 105                 110

Leu His Lys Leu Asp Met Leu Leu Gly Lys Phe Gly Tyr Pro Val Ile
        115                 120                 125

Glu Pro Glu Ser Leu Asp Lys Pro Phe Glu Glu Trp His Val Arg Ala
    130                 135                 140

Glu Leu Ala Thr Arg Tyr Ile Glu Asp Asp Glu Leu Arg Arg Glu Ser
145                 150                 155                 160

Ile Ser Ile Ala Leu Arg His Met Ala Arg His Arg Gly Trp Arg Asn
                165                 170                 175

Pro Tyr Arg Gln Val Asp Ser Leu Ile Ser Asp Asn Pro Tyr Ser Lys
            180                 185                 190
```

```
Gln Tyr Gly Glu Leu Lys Glu Lys Ala Lys Ala Tyr Asn Asp Asp Ala
        195                 200                 205

Thr Ala Ala Glu Glu Glu Ser Thr Pro Ala Gln Leu Val Val Ala Met
    210                 215                 220

Leu Asp Ala Gly Tyr Ala Glu Ala Pro Arg Leu Arg Trp Arg Thr Gly
225                 230                 235                 240

Ser Lys Lys Pro Asp Ala Glu Gly Tyr Leu Pro Val Arg Leu Met Gln
                245                 250                 255

Glu Asp Asn Ala Asn Glu Leu Lys Gln Ile Phe Arg Val Gln Arg Val
            260                 265                 270

Pro Ala Asp Glu Trp Lys Pro Leu Phe Arg Ser Val Phe Tyr Ala Val
        275                 280                 285

Ser Pro Lys Gly Ser Ala Glu Gln Arg Val Gly Gln Asp Pro Leu Ala
    290                 295                 300

Pro Glu Gln Ala Arg Ala Leu Lys Ala Ser Leu Ala Phe Gln Glu Tyr
305                 310                 315                 320

Arg Ile Ala Asn Val Ile Thr Asn Leu Arg Ile Lys Asp Ala Ser Ala
                325                 330                 335

Glu Leu Arg Lys Leu Thr Val Asp Glu Lys Gln Ser Ile Tyr Asp Gln
            340                 345                 350

Leu Val Ser Pro Ser Ser Glu Asp Ile Thr Trp Ser Asp Leu Cys Asp
        355                 360                 365

Phe Leu Gly Phe Lys Arg Ser Gln Leu Lys Gly Val Gly Ser Leu Thr
    370                 375                 380

Glu Asp Gly Glu Glu Arg Ile Ser Ser Arg Pro Pro Arg Leu Thr Ser
```

```
385                 390                 395                 400

Val Gln Arg Ile Tyr Glu Ser Asp Asn Lys Ile Arg Lys Pro Leu Val
                405                 410                 415

Ala Trp Trp Lys Ser Ala Ser Asp Asn Glu His Glu Ala Met Ile Arg
            420                 425                 430

Leu Leu Ser Asn Thr Val Asp Ile Asp Lys Val Arg Glu Asp Val Ala
        435                 440                 445

Tyr Ala Ser Ala Ile Glu Phe Ile Asp Gly Leu Asp Asp Asp Ala Leu
    450                 455                 460

Thr Lys Leu Asp Ser Val Asp Leu Pro Ser Gly Arg Ala Ala Tyr Ser
465                 470                 475                 480

Val Glu Thr Leu Gln Lys Leu Thr Arg Gln Met Leu Thr Thr Asp Asp
                485                 490                 495

Asp Leu His Glu Ala Arg Lys Thr Leu Phe Asn Val Thr Asp Ser Trp
            500                 505                 510

Arg Pro Pro Ala Asp Pro Ile Gly Glu Pro Leu Gly Asn Pro Ser Val
        515                 520                 525

Asp Arg Val Leu Lys Asn Val Asn Arg Tyr Leu Met Asn Cys Gln Gln
    530                 535                 540

Arg Trp Gly Asn Pro Val Ser Val Asn Ile Glu His Val Arg Ser Ser
545                 550                 555                 560

Phe Ser Ser Val Ala Phe Ala Arg Lys Asp Lys Arg Glu Tyr Glu Lys
                565                 570                 575

Asn Asn Glu Lys Arg Ser Ile Phe Arg Ser Ser Leu Ser Glu Gln Leu
            580                 585                 590
```

```
Arg Ala Asp Glu Gln Met Glu Lys Val Arg Glu Ser Asp Leu Arg Arg
        595                 600                 605

Leu Glu Ala Ile Gln Arg Gln Asn Gly Gln Cys Leu Tyr Cys Gly Arg
    610                 615                 620

Thr Ile Thr Phe Arg Thr Cys Glu Met Asp His Ile Val Pro Arg Lys
625                 630                 635                 640

Gly Val Gly Ser Thr Asn Thr Arg Thr Asn Phe Ala Ala Val Cys Ala
                645                 650                 655

Glu Cys Asn Arg Met Lys Ser Asn Thr Pro Phe Ala Ile Trp Ala Arg
            660                 665                 670

Ser Glu Asp Ala Gln Thr Arg Gly Val Ser Leu Ala Glu Ala Lys Lys
        675                 680                 685

Arg Val Thr Met Phe Thr Phe Asn Pro Lys Ser Tyr Ala Pro Arg Glu
    690                 695                 700

Val Lys Ala Phe Lys Gln Ala Val Ile Ala Arg Leu Gln Gln Thr Glu
705                 710                 715                 720

Asp Asp Ala Ala Ile Asp Asn Arg Ser Ile Glu Ser Val Ala Trp Met
                725                 730                 735

Ala Asp Glu Leu His Arg Arg Ile Asp Trp Tyr Phe Asn Ala Lys Gln
            740                 745                 750

Tyr Val Asn Ser Ala Ser Ile Asp Asp Ala Glu Ala Glu Thr Met Lys
        755                 760                 765

Thr Thr Val Ser Val Phe Gln Gly Arg Val Thr Ala Ser Ala Arg Arg
    770                 775                 780

Ala Ala Gly Ile Glu Gly Lys Ile His Phe Ile Gly Gln Gln Ser Lys
```

```
785                 790                 795                 800

Thr Arg Leu Asp Arg Arg His His Ala Val Asp Ala Ser Val Ile Ala
                805                 810                 815

Met Met Asn Thr Ala Ala Ala Gln Thr Leu Met Glu Arg Glu Ser Leu
            820                 825                 830

Arg Glu Ser Gln Arg Leu Ile Gly Leu Met Pro Gly Glu Arg Ser Trp
        835                 840                 845

Lys Glu Tyr Pro Tyr Glu Gly Thr Ser Arg Tyr Glu Ser Phe His Leu
    850                 855                 860

Trp Leu Asp Asn Met Asp Val Leu Leu Glu Leu Leu Asn Asp Ala Leu
865                 870                 875                 880

Asp Asn Asp Arg Ile Ala Val Met Gln Ser Gln Arg Tyr Val Leu Gly
                885                 890                 895

Asn Ser Ile Ala His Asp Ala Thr Ile His Pro Leu Glu Lys Val Pro
            900                 905                 910

Leu Gly Ser Ala Met Ser Ala Asp Leu Ile Arg Arg Ala Ser Thr Pro
        915                 920                 925

Ala Leu Trp Cys Ala Leu Thr Arg Leu Pro Asp Tyr Asp Glu Lys Glu
    930                 935                 940

Gly Leu Pro Glu Asp Ser His Arg Glu Ile Arg Val His Asp Thr Arg
945                 950                 955                 960

Tyr Ser Ala Asp Asp Glu Met Gly Phe Phe Ala Ser Gln Ala Ala Gln
                965                 970                 975

Ile Ala Val Gln Glu Gly Ser Ala Asp Ile Gly Ser Ala Ile His His
            980                 985                 990
```

```
Ala Arg Val Tyr Arg Cys Trp Lys  Thr Asn Ala Lys Gly  Val Arg Lys
        995                 1000                1005


Tyr Phe  Tyr Gly Met Ile Arg  Val Phe Gln Thr Asp  Leu Leu Arg
    1010                1015                1020


Ala Cys  His Asp Asp Leu Phe  Thr Val Pro Leu Pro  Pro Gln Ser
    1025                1030                1035


Ile Ser  Met Arg Tyr Gly Glu  Pro Arg Val Val Gln  Ala Leu Gln
    1040                1045                1050


Ser Gly  Asn Ala Gln Tyr Leu  Gly Ser Leu Val Val  Gly Asp Glu
    1055                1060                1065


Ile Glu  Met Asp Phe Ser Ser  Leu Asp Val Asp Gly  Gln Ile Gly
    1070                1075                1080


Glu Tyr  Leu Gln Phe Phe Ser  Gln Phe Ser Gly Gly  Asn Leu Ala
    1085                1090                1095


Trp Lys  His Trp Val Val Asp  Gly Phe Phe Asn Gln  Thr Gln Leu
    1100                1105                1110


Arg Ile  Arg Pro Arg Tyr Leu  Ala Ala Glu Gly Leu  Ala Lys Ala
    1115                1120                1125


Phe Ser  Asp Asp Val Val Pro  Asp Gly Val Gln Lys  Ile Val Thr
    1130                1135                1140


Lys Gln  Gly Trp Leu Pro Pro  Val Asn Thr Ala Ser  Lys Thr Ala
    1145                1150                1155


Val Arg  Ile Val Arg Arg Asn  Ala Phe Gly Glu Pro  Arg Leu Ser
    1160                1165                1170


Ser Ala  His His Met Pro Cys  Ser Trp Gln Trp Arg  His Glu
```

1175 1180 1185

<210> 72
<211> 166
<212> PRT
<213> uncultured Termite

<400> 72

Met Asn Lys Val Gln Glu Ile Glu Tyr Lys Lys Ile Arg Glu Lys Leu
1 5 10 15

Ala Asp Arg Glu Tyr Arg Ile Gly Leu Asp Leu Gly Val Gly Ser Ile
20 25 30

Gly Tyr Val Val Val Ser Leu Lys Glu Cys Asn Asp Leu Ser Tyr Leu
35 40 45

Pro Glu Asp Ile Ile Leu Ser Gly Ser Arg Ile Phe Lys Ser Ser Ile
50 55 60

Gly Ala Val Glu Arg Arg Glu Phe Arg Leu Gln Arg Asn Ser His Arg
65 70 75 80

His His Arg Glu Arg Met Arg Phe Leu Trp Gln Leu Leu Ala Glu Lys
85 90 95

Gln Leu Ala Leu Gln Ser Ser Lys Asp Leu Glu Lys Lys Glu Asn Ser
100 105 110

Ala Asp Cys Glu Thr Ser Gln Lys Arg Phe Pro Ile Asn Ile Leu Lys
115 120 125

Glu Asp Pro Tyr Ile Leu Arg Tyr Lys Ala Leu Glu Glu Lys Leu Ser
130 135 140

Leu Phe Gln Leu Gly Tyr Val Leu Tyr His Ile Ala Asn His Ser Asn
145 150 155 160

Thr Ala Tyr Glu Asn Thr
165

<210> 73
<211> 1032
<212> PRT
<213> uncultured Termite

<400> 73

Met Leu Tyr His Ile Ala Asn His Arg Gly Thr Asp Ser Val Arg Ser
1 5 10 15

Phe Leu Glu Tyr Asp Asp Asp Lys Ile Lys Glu Asn Thr Leu Thr Ala
20 25 30

Lys Ile Ala Lys Glu Thr Lys Lys Val Ile Asp Ala Lys Lys Tyr Arg
35 40 45

Thr Phe Gly Glu Tyr Leu Tyr Lys Gly Lys Ile Glu Lys Phe Gln Gln
50 55 60

Asn Ile Arg Lys Lys Val Ser Asn Arg Lys Thr Pro Ala Asn Lys Asn
65 70 75 80

Lys Glu Phe Ala Val Thr Arg Asp Val Ile Ile Lys Glu Thr Glu Lys
85 90 95

Ile Leu Ala Ser Gln Lys Gln Tyr Tyr Thr Tyr Ile Leu Thr Asp Glu
100 105 110

Tyr Ile Lys Lys Ile Lys Asp Ala Ile Ser Tyr Gln Thr Glu Lys Leu
115 120 125

Ile Pro Glu Ser Gly Tyr Cys Pro Tyr Phe Lys Asp Glu Lys Arg Leu
130 135 140

Pro Arg Ser His Lys Leu Asn Glu Tyr Arg Arg Met Tyr Glu Ala Leu
145 150 155 160

```
Asn Asn Ala Lys Tyr Phe Asp Pro Val Leu Asp Glu Asn Thr Gly Glu
                165                 170                 175

Ile Leu Ser Tyr Gln Glu Lys Glu Phe Ser Arg Glu Glu Lys Lys Ile
            180                 185                 190

Leu Phe Asp Glu Val Leu Leu Lys Gly Met Glu Leu Thr Glu Ser Gly
        195                 200                 205

Ala Lys Lys Leu Leu Tyr His Leu Pro Asp Gly Cys Glu Val Gln Leu
    210                 215                 220

Gln Gly Arg Asp Lys Thr Thr Gln Lys Ile Lys Gly Tyr Ala Leu Val
225                 230                 235                 240

Asp Leu Glu Ala Ser Pro Phe Trp Leu Arg Leu Ser Gln Gln Gln Gln
                245                 250                 255

Asp Glu Phe Leu Tyr Asp Trp Asn Ser Leu Pro Leu Glu Lys Leu Lys
            260                 265                 270

Pro Lys Leu Thr Asn Tyr Tyr Ser Leu Thr Glu Ser Glu Val Asp Glu
        275                 280                 285

Thr Phe Gln Glu Ile Lys Leu Pro Ser Asn Tyr Ala Ser Val Gly Lys
    290                 295                 300

Lys Ala Met Glu Ile Leu Leu Thr Tyr Ile Lys Asp Gly Cys Ser Tyr
305                 310                 315                 320

Thr Glu Ala Leu Glu Lys Ala Val Ser Glu Gly Lys Leu Lys Val Asp
                325                 330                 335

Lys Gln Thr Met Ile Tyr Asp Ser Leu Pro Tyr Tyr Gly Lys Ile Leu
            340                 345                 350

Lys Glu Ser Thr Gln Lys Leu Ile Gly Lys Ala Phe Ser Lys Gln Phe
```

```
        355                 360                 365

Ala Asp Arg Asn Tyr Lys Glu Pro Asp Thr Asn Lys Asn Glu Arg Glu
    370                 375                 380

Phe Gly Lys Ile Ala Asn Pro Val Val His Gln Thr Leu Asn Glu Leu
385                 390                 395                 400

Arg Lys Leu Ile Asn Glu Ile Ile Thr Val Phe Gly Lys Lys Pro Leu
                405                 410                 415

Glu Ile Gly Leu Glu Thr Thr Arg Glu Leu Lys Lys Ser Lys Lys Asn
            420                 425                 430

Arg Glu Tyr Leu Ser Lys Gln Gln Asn Lys Asn Glu Tyr Ala Arg Asn
        435                 440                 445

Arg Ile Tyr Lys Glu Tyr Ile Glu Pro His Leu Ser Gln Ile Lys Ser
    450                 455                 460

Arg Gln Glu Asn Pro Ser Lys Tyr Ile Ser Lys Phe Glu Leu Leu Glu
465                 470                 475                 480

Glu Gln Asn Phe Ile Cys Pro Phe Cys Ser Glu Lys Ile Thr Pro Asp
                485                 490                 495

Asp Ile Ile Asn Ser Lys Val Asp Val Glu His Ile Phe Pro Ile Glu
            500                 505                 510

Glu Ser Glu Asp Ile Thr Lys Asn Asn Leu Val Ile Ala His Asn Glu
        515                 520                 525

Cys Asn Ala Asp Lys Gly Lys Lys Ser Pro Phe Asp Ala Phe Gly Asp
    530                 535                 540

Lys Thr Ser Gly Lys Tyr Arg Trp Asn Cys Ile Leu His Asn Ala Gln
545                 550                 555                 560
```

```
Lys Asn Leu Pro His Lys Val Trp Arg Phe Tyr Gln Gly Ser Leu Glu
               565                 570                 575

Lys Phe Leu Glu Asn Lys Pro Met Ser Arg Arg Phe Gly Thr Asp Asn
            580                 585                 590

Ser Tyr Ile Ser Lys Ile Ala Ala Arg Tyr Leu Ala Cys Leu Phe Asn
        595                 600                 605

Asp Pro Tyr His Ser Glu Ile Phe Cys Ile Lys Ser Ser Leu Ile Ala
    610                 615                 620

Gln Leu Arg Ile Ala Trp Asp Leu Asn Ser Ile Met Val Pro Leu Val
625                 630                 635                 640

Lys Asn Ile Leu Ser Glu Lys Glu Leu Glu Glu Phe Lys Ile Ser Lys
               645                 650                 655

Asn Lys Lys Ile Arg Ile Asp Asn Arg His His Ala Leu Asp Ala Ile
            660                 665                 670

Val Ile Ala Tyr Ala Asn Arg Gly Tyr His Asn Phe Leu Asn Arg Ile
        675                 680                 685

His Ala Lys Glu Tyr Lys Ile Asn Tyr Arg Glu Lys Ser Trp Leu Ser
    690                 695                 700

Lys Ile Leu Leu Pro Pro Leu Asn Arg Asp Leu Glu Asp Phe Lys Ile
705                 710                 715                 720

Ser Val Lys Asp Ser Ile Glu Lys Ala Asn Val Ser Ile Lys His Asp
               725                 730                 735

His Asn Thr Asn Gly Ser Leu Val Lys Ala Thr Ala Tyr Lys Val Tyr
            740                 745                 750

Tyr Ser Gly Ala Gly Glu Tyr Ile Ile Thr Thr Ser Lys Asn Val Glu
```

```
        755                 760                 765

Glu Ile Ser Phe Lys Glu Lys Glu Asp Pro Lys Asp Thr Leu Tyr Arg
    770                 775                 780

Ala Leu Cys Lys Phe Glu Cys Arg Asp Ile Asp Ile Lys Asp Glu Lys
785                 790                 795                 800

Leu Ile Lys Lys Leu Lys Tyr Asn Ser Thr Leu Tyr Lys Lys Val Gln
                805                 810                 815

Asn Asn Leu Ser Lys Ala Lys Gln Glu Leu Glu Gln Asp Asn Lys Lys
            820                 825                 830

Thr Glu Glu Glu Gly Lys Lys Ser Gln Lys Ile Thr Glu Val Arg Ile
        835                 840                 845

Tyr Lys Lys Ala Cys Ser Leu Val Lys Gly Gln Tyr Ile Gln Cys Gly
    850                 855                 860

Ser Arg Leu Lys Asp Lys Phe Phe Ala Val Lys Glu Pro Thr Glu Ile
865                 870                 875                 880

Lys Thr Gly Leu Gly Tyr Asp Thr Gly Asp Asn Leu Phe Leu Asp Leu
                885                 890                 895

Tyr Tyr Asp Lys Thr Gly Lys Leu Cys Gly Glu Ile Ile Arg Lys Val
            900                 905                 910

Asn Phe Asn Arg Asn Lys Pro Asn Tyr Gln Lys Glu Gly Tyr Thr Leu
        915                 920                 925

Phe Glu Arg Ile Tyr Gln Ser Asp Ile Leu Glu Val Asp Thr Ser Glu
    930                 935                 940

Asp Arg Ile Ser Leu Lys Asn Lys Thr Gly Ser Ala Pro Ser Asp Arg
945                 950                 955                 960
```

```
Thr Phe Ile Lys Val Asn Thr Phe Thr Glu Val Asn Ala Tyr Phe Asp
                965                 970                 975


Gly Lys Arg Asp Lys Ile Gln Ile Phe Phe Gly Asn Leu Leu Lys Ser
            980                 985                 990


Ser Phe Lys Asn Asp Ser Phe Phe  Ile Ser Ser Met Gln  Lys Tyr Asn
        995                 1000                1005


Val Arg  Lys Val Ile Leu Thr  Ser Leu Gly Ile Ile  Lys Tyr Arg
    1010                1015                1020


Ser Gln  Ile Leu Lys Asn Lys  Glu Val
    1025                1030


<210>  74
<211>  1032
<212>  PRT
<213>  uncultured Termite

<400>  74

Met Lys Lys Arg Ile Leu Gly Leu Asp Ile Gly Ile Ala Ser Val Gly
1               5                   10                  15


Trp Ala Leu Val Glu Phe Asp Asp Glu Phe Gln Asp Asn Lys Lys Lys
            20                  25                  30


Gly Thr Ile Ile Lys Ser Gly Val Arg Ile Phe Thr Arg Ala Glu Thr
        35                  40                  45


Pro Lys Glu Arg Glu Ser Leu Ala Lys Pro Arg Arg Glu Ala Arg Ser
    50                  55                  60


Gln Arg Arg Arg Ile Arg Arg Arg Val Glu Arg Leu Asn Ser Ile Arg
65                  70                  75                  80


Glu Leu Phe Val Lys Asn Gly Val Val Glu Glu Trp Ser Val Ser Lys
                85                  90                  95
```

```
Lys Asn Pro Asn Asn Ile Tyr Ile Thr Leu Asn Gln Ile Lys Thr Pro
            100                 105                 110

Trp Gln Leu Arg Met Glu Ser Leu Asp Arg Lys Leu Thr Asn Glu Gln
        115                 120                 125

Phe Ala Val Val Leu Thr His Leu Ala Lys His Arg Gly Tyr Lys Ser
    130                 135                 140

Leu Arg Lys Asp Asp Lys Ala Gly Lys Val Leu Glu Ala Ile Ser Gln
145                 150                 155                 160

Asn Lys Lys Arg Leu Asn Asp Ser Asp Tyr Arg Thr Leu Gly Glu Met
                165                 170                 175

Phe Cys Lys Asn Glu Ser Tyr Lys Glu His Lys Arg Asn Lys Gly Gly
            180                 185                 190

Glu Tyr Ile Asn Ser Val Ala Arg Glu Leu Ile Glu Glu Glu Val Glu
        195                 200                 205

Lys Ile Phe Val Lys Gln Arg Glu Lys Gly Asn Asn Phe Ala Asp Val
    210                 215                 220

Asn Thr Glu Arg Glu Tyr Leu Lys Ile Ala Phe Ser Gln Lys Pro Ala
225                 230                 235                 240

Gly Ser Ile Ser Lys Met Val Gly Phe Cys Thr Phe Glu Asn Gly Glu
                245                 250                 255

Lys Arg Ala Pro Arg Asp Ser Tyr Ser Ala Glu Leu Phe Lys Val Leu
            260                 265                 270

Cys Thr Ile Asn Asn Thr Thr Phe Thr Asp Met Lys Thr Gly Glu Ile
        275                 280                 285
```

```
Arg Ser Phe Ser Lys Glu Glu Ile Gly Lys Thr Leu Glu Thr Val Lys
    290                 295                 300

Asn Val Lys Asp Val Lys Tyr Ala Lys Ile Arg Lys Asp Leu Gly Leu
305                 310                 315                 320

Glu Asp Ser Val Lys Phe Ser Gly Val Asp Tyr Arg Glu Asn Ala Lys
                325                 330                 335

Ser Lys Gly Glu Gly Glu Ile Phe Val Ser Met Lys Thr Tyr His Glu
            340                 345                 350

Ile Lys Ser Lys Ile Glu Lys Leu Ser Lys Glu Lys Trp Asp Asn Leu
        355                 360                 365

Lys Gly Asn Thr Glu Leu Leu Asp Ser Ile Val Asn Ile Ile Ala Asn
    370                 375                 380

Leu Lys Asp Asp Glu Ser Ile Lys Lys Glu Phe Gln Lys Leu Lys Ile
385                 390                 395                 400

Asp Glu Asp Ile Ile Asp Val Leu Leu Asn Phe Glu Phe Lys Lys Phe
                405                 410                 415

Ile Asn Leu Ser Phe Lys Ala Leu Arg Lys Ile Ile Pro Phe Gln Phe
            420                 425                 430

Gln Gly Gln Lys Tyr Ile Thr Ala Ser Thr Ser Ala Gly Tyr Ser Leu
        435                 440                 445

Lys Gln Glu Gly Ile Lys Asn Lys Leu Val Pro Pro Ala Lys Glu Asn
    450                 455                 460

Ile Asn Val Ala Val Val Ala Arg Ala Phe Ala Gln Thr Arg Lys Val
465                 470                 475                 480

Ile Asn Ala Val Ile Arg Lys Tyr Gly Gln Phe Asp Gln Ile Asn Ile
                485                 490                 495
```

```
Glu Leu Ala Thr Glu Leu Lys Asn Ser Lys Phe Asp Arg Ser Lys Ile
            500                 505                 510

Glu Glu Gly Gln Lys Lys Phe Gln Ser Gln Lys Asp Lys Ile Phe Lys
        515                 520                 525

Glu Val Gln Glu Leu Arg Gly Gly Met Thr Pro Ser Ser Ser Leu Leu
    530                 535                 540

Leu Lys Tyr Arg Leu Trp Arg Glu Gln Asp Glu Arg Cys Val Tyr Ser
545                 550                 555                 560

Gly Arg Lys Ile Ser Phe Glu Asp Leu Leu Asp Thr Gly Phe Leu Asp
                565                 570                 575

Ile Asp His Ile Ile Pro Tyr Ser Lys Ser Met Asp Asp Ser Phe Asn
            580                 585                 590

Asn Lys Val Leu Cys Leu Ala Glu Glu Asn Arg Asn Lys Lys Asn Asp
        595                 600                 605

Ile Pro Phe Asn Tyr Tyr Gln Arg Ile Asp Arg Asp Trp Asn Leu Leu
    610                 615                 620

Ile Ser Ile Ile Thr Ser Met Lys Asn Met Lys Ile Ala Lys Lys Ser
625                 630                 635                 640

Arg Leu Leu Lys Gln Glu Leu Ser Asp Ile Glu Gly Phe Ile Glu Arg
                645                 650                 655

Asn Ile Asn Asp Thr Arg Tyr Ala Thr Arg Tyr Ile Lys Asp Phe Leu
            660                 665                 670

Glu Asn Asn Leu Glu Phe Lys Glu Asn Glu Phe Ile Lys Val Lys Val
        675                 680                 685
```

```
Gln Ala Arg Ser Gly Gly Leu Thr Ser Val Leu Ser Tyr Asn Trp Gly
    690                 695                 700

Met Ser Lys Asp Arg Glu Glu Ser Tyr Phe His His Ala Lys Asp Ala
705                 710                 715                 720

Ile Ile Val Ala Cys Ser Thr Gln Gly Met Val Gln Tyr Ile Ser Lys
                725                 730                 735

Ile Ser Gln Gln Tyr Glu Asn Asp Lys Asp Lys Met Lys Lys Ile Lys
            740                 745                 750

Asp Lys Thr Glu Asn Cys Ile Pro Lys Pro Trp Asp Ser Phe Arg Ala
        755                 760                 765

Asp Val Glu Glu Ser Ile Glu Gly Ile Phe Val Ser Phe Ala Pro Arg
    770                 775                 780

His Lys Val Thr Gly Ser Ala His Lys Glu Thr Ile Tyr Ser Lys Lys
785                 790                 795                 800

His Leu Glu Lys Glu Arg Tyr Val Thr Val Lys Lys Ser Leu Asp Lys
                805                 810                 815

Ile Lys Leu Ser Asp Leu Glu Asn Ile Pro Cys Asn Glu Asn Cys Gly
            820                 825                 830

Ile Ile Arg Val Leu Lys Glu Arg Leu Glu Lys Phe Lys Asn Asp Ser
        835                 840                 845

Leu Lys Ala Phe Ala Asp Pro Val His Met Pro Thr Lys Cys Pro Asn
    850                 855                 860

Lys Lys Gly Pro Val Ile Arg Ser Val Lys Ile Lys Glu Ser Asn Lys
865                 870                 875                 880

Thr Gly Ile Glu Val Arg Lys Gly Leu Ala Glu Arg Gly Glu Met Val
                885                 890                 895
```

```
Arg Val Asp Val Phe Ile Lys Asp Lys Lys Tyr Tyr Leu Val Pro Ile
            900                 905                 910

Tyr Val Ser Asp Phe Lys Asn Lys Asp Leu Pro Asn Lys Ala Ile Ala
        915                 920                 925

Ala Leu Lys Leu Glu Asn Glu Trp Ile Met Ile Asp Lys Thr Tyr Ser
    930                 935                 940

Phe Lys Phe Ser Leu Phe Lys Asp Asp Leu Ile Lys Ile Lys Lys Lys
945                 950                 955                 960

Lys Glu Glu Ile Phe Gly Tyr Phe Gly Gly Val His Arg Ser Thr Gly
                965                 970                 975

Thr Ile Lys Ile Lys Ser Arg His Lys Pro Lys Glu Ile Asp Glu Gly
            980                 985                 990

Ile Gly Ser Arg Cys Leu Leu Asp  Phe Arg Lys Phe Gln  Val Asp Val
        995                 1000                1005

Leu Gly  Asn Tyr Thr Glu Val  Lys His Glu Lys Arg  Met Pro Ala
    1010                1015                1020

Tyr Ile  Thr Arg Lys Asp Lys  Lys His
    1025                1030
```

<210> 75
<211> 1361
<212> PRT
<213> Lactobacillus casei

<400> 75

```
Met Thr Lys Leu Gly Lys Pro Tyr Gly Ile Gly Val Asp Ile Gly Ser
1               5                   10                  15

Asn Ser Ile Gly Phe Ala Ala Val Asp Glu Asn Ser His Leu Ile Arg
```

```
            20                  25                  30

Leu Lys Gly Lys Thr Val Ile Gly Ala Arg Leu Phe Glu Glu Gly Lys
        35                  40                  45

Ala Ala Ala Asp Arg Arg Ala Ser Arg Thr Thr Arg Arg Arg Leu Ser
    50                  55                  60

Arg Asn Arg Trp Arg Leu Ser Phe Leu Arg Asp Phe Phe Glu Ser His
65                  70                  75                  80

Ile Thr Pro Thr Gly Pro Asn Phe Phe Met Arg Gln Lys Tyr Ser Glu
                85                  90                  95

Ile Ser Pro Lys Asp Lys Ala Arg Tyr Lys Tyr Glu Lys Arg Leu Phe
            100                 105                 110

Asn Asp Arg Thr Asp Ala Glu Phe Tyr Gln Gln Tyr Pro Thr Met Tyr
        115                 120                 125

His Leu Arg Asn Arg Leu Leu Thr Asp Pro Ser Lys Ala Asp Val Arg
    130                 135                 140

Glu Ile Tyr Phe Ala Ile His His Ile Leu Lys Ser Arg Gly His Phe
145                 150                 155                 160

Leu Thr Ser Gly Tyr Ala Lys Asp Phe Asn Thr Asn Lys Val Ala Leu
                165                 170                 175

Asn Glu Ile Phe Pro Ala Leu Gln Asp Ala Tyr Ala Gln Val Tyr Pro
            180                 185                 190

Asp Leu Asp Ile Thr Phe Asp Glu Asn Lys Val Asn Glu Phe Lys Thr
        195                 200                 205

Val Leu Leu Asn Glu Lys Ala Thr Pro Ser Asp Thr Gln Arg Ala Leu
    210                 215                 220
```

```
Val Asn Leu Leu Leu Ala Glu Asp Gly Asp Lys Asp Ile Leu Lys Gln
225                 230                 235                 240


Gln Lys Gln Val Leu Thr Glu Phe Ala Lys Ala Val Val Gly Leu Lys
                245                 250                 255


Thr Lys Leu Asn Val Ala Leu Gly Thr Glu Val Asp Ser Ser Glu Ala
            260                 265                 270


Thr Val Trp Asn Phe Ser Leu Gly Gln Leu Asp Asp Lys Trp Ala Gly
        275                 280                 285


Ile Glu Ser Ala Met Thr Asp Glu Gly Thr Glu Ile Leu Asp Gln Ile
    290                 295                 300


Arg Asp Leu Tyr Arg Ala Arg Leu Leu Asn Gly Ile Val Pro Ala Gly
305                 310                 315                 320


Lys Thr Leu Ser Gln Ala Lys Val Asp Asp Tyr Ala Gln His His Glu
                325                 330                 335


Asp Leu Glu Leu Phe Lys Asp Tyr Leu Lys Gln Leu Glu Asp Asp Gly
            340                 345                 350


Thr Ala Lys Ala Ile Arg Gln Leu Tyr Asp Arg Tyr Ile Asp Gly Asp
        355                 360                 365


Asp Ala Lys Pro Phe Val Arg Glu Asp Phe Val Lys Ala Leu Thr Lys
    370                 375                 380


Glu Val Thr Ala His Pro Asn Ala Lys Ser Pro Glu Leu Leu Glu Arg
385                 390                 395                 400


Leu Ala Gln Pro Asp Phe Met Leu Lys Gln Arg Asn Lys Ala Asn Gly
                405                 410                 415


Ala Ile Pro Val Gln Met Gln Gln Arg Glu Leu Asp Gln Ile Ile Lys
```

```
            420                 425                 430

Asn Gln Ser Val Tyr Tyr Asp Trp Leu Ala Ala Pro Asn Pro Val Glu
        435                 440                 445

Lys His Arg Lys Ser Met Pro Tyr Gln Leu Asp Glu Leu Leu Asn Phe
    450                 455                 460

Arg Ile Pro Tyr Tyr Val Gly Pro Leu Val Thr Ala Lys Glu Gln Lys
465                 470                 475                 480

Ala Ala Gln Gly Gly Val Phe Ala Trp Met Val Arg Lys Asp Pro Asp
                485                 490                 495

Gly Asn Ile Thr Pro Tyr Asn Phe Asp Glu Lys Val Asp Arg Glu Ala
            500                 505                 510

Ser Ala Asn Thr Phe Ile Gln Arg Met Lys Thr Thr Asp Thr Tyr Leu
        515                 520                 525

Ile Gly Glu Asp Val Leu Pro Lys Gln Ser Leu Leu Tyr Gln Arg Tyr
    530                 535                 540

Glu Val Leu Asn Glu Leu Asn Asn Val Arg Val Asn Asn Glu Lys Leu
545                 550                 555                 560

Ser Ile Glu Gln Lys Gln Gln Val Ile Arg Glu Leu Phe Glu Arg His
                565                 570                 575

Asn Ser Val Thr Ile Lys Gln Phe Ala Glu Asn Leu Arg Ala His Gly
            580                 585                 590

Asp Tyr Ala His Ile Pro Glu Ile Arg Gly Leu Ala Asp Glu Lys Arg
        595                 600                 605

Phe Leu Ser Ser Leu Ser Thr Tyr Arg Gln Leu Lys Ser Leu Leu Pro
    610                 615                 620
```

```
Asp Ala Ile Asp Asp Pro Ala Lys Gln Ala Asp Ile Glu Asn Ile Ile
625                 630                 635                 640

Ala Trp Ser Thr Val Phe Glu Asp Ala Ala Ile Phe Lys Thr Lys Leu
                645                 650                 655

Lys Glu Ile Asn Trp Leu Asp Ser Gln Thr Ile Thr Lys Leu Ser Asn
            660                 665                 670

Ile Arg Tyr Arg Gly Trp Gly Gln Phe Ser His Lys Phe Leu Asn Gly
        675                 680                 685

Leu Thr Leu Gly Asn Gly His Thr Ile Ile Gln Glu Leu Phe Leu Ser
    690                 695                 700

Asn Asn Asn Leu Met Gln Ile Leu Thr Asp Glu Thr Leu Gln Lys Lys
705                 710                 715                 720

Met Thr Glu Leu Asn Ala Asp Lys Leu Lys Ala Ala Asn Ile Asn Asp
                725                 730                 735

Ala Ile Asp Asp Ala Tyr Thr Ser Pro Ser Asn Lys Lys Ala Leu Arg
            740                 745                 750

Gln Val Leu Arg Val Ile Glu Asp Ile Lys Arg Ala Ala Asp Gly Gln
        755                 760                 765

Asp Pro Ser Trp Leu Tyr Val Glu Thr Ala Asp Gly Gly Gly Thr Pro
    770                 775                 780

Gly Lys Arg Thr Arg Ala Arg Gln His Gln Leu Gln Glu Ile Tyr Ala
785                 790                 795                 800

Asn Ala Ala His Glu Leu Ile Asp Ser Ala Val Arg Gly Glu Leu Glu
                805                 810                 815

Asp Lys Ile Ala Asp Lys Ala Asp Phe Asn Asp Arg Leu Val Leu Tyr
```

```
            820                 825                 830

Phe Met Gln Gly Gly Arg Asp Ile Tyr Thr Gly Thr Pro Leu Asn Ile
        835                 840                 845

Asp Gln Leu Ser Ser Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Leu
    850                 855                 860

Ile Lys Asp Asn Ser Leu Asp Asn Arg Val Leu Val His Ala Ile Ile
865                 870                 875                 880

Asn Arg Glu Lys Asn Ala Thr Phe Ala Ser Thr Ile Tyr Ala Gln Lys
                885                 890                 895

Met Asn Ala Thr Trp Arg Gln Trp His Glu Ala Gly Leu Ile Ser Gly
            900                 905                 910

Arg Lys Leu Arg Asn Leu Gln Met Arg Pro Asp Gln Ile Asp Lys Tyr
        915                 920                 925

Ala Ser Gly Phe Val Ala Arg Gln Leu Val Glu Thr Arg Gln Ile Ile
    930                 935                 940

Lys Leu Thr Glu Gln Ile Val Ala Ala Gln Tyr Pro Glu Thr Lys Ile
945                 950                 955                 960

Ile Ala Val Lys Ala Gly Leu Ser His Gln Leu Arg Glu Glu Leu Glu
                965                 970                 975

Phe Pro Lys Asn Arg Asp Val Asn His Tyr His His Ala Phe Asp Ala
            980                 985                 990

Phe Leu Ala Ala Arg Ile Gly Thr  Tyr Leu Leu Lys Arg  Phe Pro Asn
        995                 1000                1005

Leu Gln  Ala Phe Phe Thr Tyr  Gly Lys Phe Lys Lys  Ala Asp Val
    1010                1015                1020
```

```
Lys Lys  Leu Arg Gly Phe Asn  Phe Ile Arg Asp Ile  Thr His Ala
    1025                1030                1035

Glu Asp  Lys Ile Val Val Lys  Asp Thr Gly Glu Val  Ile Trp Asp
    1040                1045                1050

Lys Lys  Arg Asp Val Asp Glu  Leu Asp Arg Ile Tyr  Asn Phe Lys
    1055                1060                1065

Arg Met  Leu Ile Thr His Glu  Val His Phe Glu Lys  Ala Asp Leu
    1070                1075                1080

Phe Lys  Gln Thr Val Tyr Gly  Ala Lys Asp Ser Lys  Glu Ala Gly
    1085                1090                1095

Gly Lys  Lys Gln Leu Ile Ser  Lys Lys Lys Gly Tyr  Pro Val Asp
    1100                1105                1110

Ile Tyr  Gly Gly Tyr Thr Gln  Glu Thr Gly Ser Tyr  Leu Ser Val
    1115                1120                1125

Val Arg  Leu Thr Lys Lys Ala  Met Tyr Ala Val Val  Lys Val Ser
    1130                1135                1140

Thr Arg  Asp Ala Ala Lys Leu  Ala Val Ala Lys Ser  Ile Ser Glu
    1145                1150                1155

Gln Lys  Glu Asn Glu Thr Leu  Asn Asp Ile Ile Asp  Glu Lys Leu
    1160                1165                1170

Ser Lys  Ile Ser Lys Asn Gly  Lys Ile Thr His Glu  Leu Phe Glu
    1175                1180                1185

Val Val  Leu Pro Arg Val Gly  Gln Lys Thr Leu Phe  Lys Asn Ser
    1190                1195                1200

Lys Tyr  Asn Leu Phe Leu Val  Asn Ser Asp Thr Tyr  Met His Asn
```

```
    1205                1210                1215

Tyr Gln  Glu Leu Trp Met Pro  Arg Glu Tyr Gln Lys  Met Trp Lys
    1220                1225                1230

Asp Ile  Ser Leu Ser Lys Tyr  Gly Asp Ala Gln Thr  Glu Asp Gln
    1235                1240                1245

Leu Asp  Gln Ile Phe Gly Phe  Ile Val Ser Gln Val  Asn Ser Tyr
    1250                1255                1260

Phe Asn  Leu Tyr Asp Ile Asn  Gln Phe Arg Lys Lys  Leu Asn Asp
    1265                1270                1275

Ala Ala  Asp Lys Phe Ala Thr  Leu Pro Met Arg Asp  Thr Asp Asp
    1280                1285                1290

Met Gln  Gly Lys Ile Ala Thr  Ile Gly Gln Leu Leu  Ile Gly Leu
    1295                1300                1305

Gln Ala  Asn Ala Ala Arg Ser  Asp Leu Arg Asn Leu  Asp Ile Lys
    1310                1315                1320

Thr Pro  Leu Gly Leu Leu Gln  Ile Pro Asn Gly Ile  Ser Leu Asp
    1325                1330                1335

Ser Asp  Thr Ser Val Val Tyr  Gln Ser Pro Thr Gly  Leu Leu Glu
    1340                1345                1350

Arg Glu  Val His Leu Ser Asp  Leu
    1355                1360
```

<210> 76
<211> 1348
<212> PRT
<213> Streptococcus equi

<400> 76

```
Met Lys Lys Pro Tyr Thr Ile Ala Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Val Val Val Thr Asp Asp Tyr Arg Val Pro Thr Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Glu Arg Lys Thr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asp Thr Ala Glu Gly Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Lys Glu Ile Phe Thr Glu Glu Met Ala Lys Val Asp Asp Gly
                85                  90                  95

Phe Phe Gln Arg Leu Glu Asp Ser Phe Tyr Val Leu Glu Asp Lys Glu
            100                 105                 110

Gly Asn Lys His Pro Ile Phe Ala Asn Leu Ala Asp Glu Val Ala Tyr
        115                 120                 125

His Lys Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Val Asp
    130                 135                 140

Asn Pro Gln Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Val Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Thr Leu Ser Ser
                165                 170                 175

Lys Asn Asn Asn Leu Gln Lys Ser Phe Asp His Leu Val Asp Thr Tyr
            180                 185                 190

Asn Leu Leu Phe Glu Glu Gln Arg Leu Leu Thr Glu Gly Ile Asn Ala
        195                 200                 205
```

```
Lys Glu Leu Leu Ser Ala Ala Leu Ser Lys Ser Lys Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ser Leu Ile Pro Gly Gln Lys Lys Thr Gly Ile Phe Gly Asn
225                 230                 235                 240

Ile Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ala Asn Phe
                245                 250                 255

Gly Leu Ser Lys Asp Val Lys Leu Gln Leu Ala Lys Asp Thr Tyr Ala
            260                 265                 270

Asp Asp Leu Asp Ser Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Thr Glu Ser Asp Glu Ile Thr Arg Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Val Lys Arg Tyr Arg Glu His His Lys Asp Leu Val Thr Leu Lys
                325                 330                 335

Thr Leu Ile Lys Asp Gln Leu Pro Glu Lys Tyr Gln Glu Ile Phe Leu
            340                 345                 350

Asp Lys Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Gly Gln Val Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Tyr Leu Lys Pro Ile Leu Ala Arg Leu Asp
    370                 375                 380

Gly Ser Glu Pro Leu Leu Leu Lys Ile Asp Arg Glu Asp Phe Leu Arg
385                 390                 395                 400
```

```
Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Glu Glu Leu His Ala Ile Leu Arg Arg Gln Glu Val Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Lys Lys Ile Glu Ser Leu Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly His Ser Arg Phe Ala Trp
    450                 455                 460

Val Lys Arg Lys Phe Asp Gly Ala Ile Arg Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Ile Val Asp Glu Glu Ala Ser Ala Gln Ile Phe Ile Glu Lys Met Thr
                485                 490                 495

Lys Asn Asp Leu Tyr Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Thr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Ala Thr Glu Gly Met Thr Arg Pro Gln Phe Leu Ser Ala Asp Gln
    530                 535                 540

Lys Gln Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asn Tyr Phe Lys Lys Ile Glu Cys Trp Asp
                565                 570                 575

Ser Val Glu Ile Thr Gly Val Glu Asp Ser Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Gln Asp Lys Asp Phe Leu Asp
        595                 600                 605
```

```
Asn Pro Asp Asn Gln Lys Ile Ile Glu Asp Ile Ile Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Lys Lys Met Ile Ser Lys Arg Leu Asp Gln Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Lys Val Val Leu Asn Lys Leu Glu Arg His His Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Gly Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ala Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Ser Glu Leu Ser Phe
    690                 695                 700

Ile Asp Glu Ile Ala Lys Ala Gln Val Ile Gly Lys Thr Glu Tyr Ser
705                 710                 715                 720

Lys Asp Leu Val Gly Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Ser Gln Thr Ile Lys Ile Val Asp Glu Leu Val Lys Ile Met Gly
            740                 745                 750

Tyr Leu Pro Gln Gln Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
        755                 760                 765

Thr Ala Gln Gly Ile Lys Asn Ala Arg Gln Arg Met Arg Lys Leu Glu
    770                 775                 780

Glu Thr Ala Lys Lys Leu Gly Ser Asn Ile Leu Lys Glu His Pro Val
785                 790                 795                 800
```

```
Asp Asn Ser Gln Leu Gln Asn Asp Lys Arg Tyr Leu Tyr Tyr Leu Gln
                805                 810                 815

Asn Gly Lys Asp Met Tyr Thr Gly Asp Asp Leu Asp Ile Asp Tyr Leu
            820                 825                 830

Ser Ser Tyr Asp Ile Asp His Ile Ile Pro Gln Ser Phe Ile Lys Asn
        835                 840                 845

Asn Ser Ile Asp Asn Lys Val Leu Thr Ser Gln Gly Ala Asn Arg Gly
    850                 855                 860

Lys Leu Asp Asn Val Pro Ser Glu Ala Ile Val Arg Lys Met Lys Gly
865                 870                 875                 880

Tyr Trp Gln Ser Leu Leu Arg Ala Gly Ala Ile Ser Lys Gln Lys Phe
                885                 890                 895

Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Gln Val Asp Lys
            900                 905                 910

Ala Gly Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925

His Val Ala Gln Ile Leu Asp Ser Arg Phe Asn Thr Glu Phe Asp Asp
    930                 935                 940

His Asn Lys Arg Ile Arg Lys Val His Ile Ile Thr Leu Lys Ser Lys
945                 950                 955                 960

Leu Val Ser Asp Phe Arg Lys Glu Phe Gly Leu Tyr Lys Ile Arg Asp
                965                 970                 975

Ile Asn His Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val
            980                 985                 990

Ala Lys Ala Ile Leu Gly Lys Tyr  Pro Gln Leu Ala Pro  Glu Phe Val
        995                 1000                1005
```

```
Tyr Gly  Asp Tyr Pro Lys Tyr  Asn Ser Phe Lys Glu  Arg Gln Lys
    1010                1015                1020

Ala Thr  Gln Lys Met Leu Phe  Tyr Ser Asn Ile Leu  Lys Phe Phe
    1025                1030                1035

Lys Asp  Gln Glu Ser Leu His  Val Asn Ser Asp Gly  Glu Glu Ile
    1040                1045                1050

Trp Asn  Ala Asn Lys His Leu  Pro Ile Ile Lys Asn  Val Leu Ser
    1055                1060                1065

Ile Pro  Gln Val Asn Ile Val  Lys Lys Thr Glu Val  Gln Thr Gly
    1070                1075                1080

Gly Phe  Tyr Lys Glu Ser Ile  Leu Ser Lys Gly Asn  Ser Asp Lys
    1085                1090                1095

Leu Ile  Pro Arg Lys Asn Asn  Trp Asp Thr Arg Lys  Tyr Gly Gly
    1100                1105                1110

Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val Leu Val  Ile Ala Lys
    1115                1120                1125

Met Glu  Lys Gly Lys Ala Lys  Val Leu Lys Pro Val  Lys Glu Met
    1130                1135                1140

Val Gly  Ile Thr Ile Met Glu  Arg Thr Ala Phe Glu  Glu Asn Pro
    1145                1150                1155

Val Val  Phe Leu Glu Ala Arg  Gly Tyr Arg Glu Ile  Gln Glu His
    1160                1165                1170

Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu Phe Glu  Leu Glu Asn
    1175                1180                1185
```

```
Gly Arg  Arg Arg Leu Leu Ala  Ser Ala Ser Glu Leu  Gln Lys Gly
    1190                1195                1200

Asn Glu  Leu Phe Leu Pro Val  Asp Tyr Met Thr Phe  Leu Tyr Leu
    1205                1210                1215

Ala Ala  His Tyr His Glu Leu  Thr Gly Ser Ser Glu  Asp Val Leu
    1220                1225                1230

Arg Lys  Lys Tyr Phe Val Asp  Arg His Leu His Tyr  Phe Asp Asp
    1235                1240                1245

Ile Ile  Gln Met Ile Asn Asp  Phe Ala Glu Arg His  Ile Leu Ala
    1250                1255                1260

Ser Ser  Asn Leu Glu Lys Ile  Asn His Thr Tyr His  Asn Asn Ser
    1265                1270                1275

Asp Leu  Pro Val Asn Glu Arg  Ala Glu Asn Ile Ile  Asn Val Phe
    1280                1285                1290

Thr Phe  Val Ala Leu Gly Ala  Pro Ala Ala Phe Lys  Phe Phe Asp
    1295                1300                1305

Ala Thr  Ile Asp Arg Lys Arg  Tyr Thr Ser Thr Lys  Glu Val Leu
    1310                1315                1320

Asn Ala  Thr Leu Ile His Gln  Ser Val Thr Gly Leu  Tyr Glu Thr
    1325                1330                1335

Arg Ile  Asp Leu Ser Gln Leu  Gly Glu Asn
    1340                1345
```

<210> 77
<211> 1341
<212> PRT
<213> Ruminococcus lactaris

<400> 77

```
Met Gly Lys Gly Tyr Tyr Val Gly Leu Asp Met Gly Thr Gly Ser Val
1               5                  10                  15

Gly Trp Ala Val Thr Asp Glu Ser Tyr Gln Ile Leu Arg Arg His Gly
            20                  25                  30

Lys Ala Met Trp Gly Val Arg Leu Phe Glu Ser Ala Lys Thr Ala Glu
        35                  40                  45

Glu Arg Arg Met Phe Arg Thr Gly Arg Arg Arg Leu Asp Arg Arg Gly
    50                  55                  60

Trp Arg Ile Glu Ile Leu Gln Glu Ile Phe Ala Glu Glu Ile Ser Arg
65                  70                  75                  80

Val Asp Pro Gly Phe Phe Leu Arg Met Lys Glu Ser Lys Tyr Tyr Pro
                85                  90                  95

Glu Asp Lys Arg Asp Ile Gln Gly Asn Cys Pro Glu Leu Pro Tyr Thr
            100                 105                 110

Leu Phe Val Asp Lys Thr Phe Thr Asp Lys Asp Phe His Lys Lys Tyr
        115                 120                 125

Pro Thr Ile Tyr His Leu Arg Lys Met Leu Met Glu Thr Glu Asp Thr
    130                 135                 140

Pro Asp Met Arg Leu Val Tyr Leu Ala Leu His His Met Met Lys His
145                 150                 155                 160

Arg Gly His Phe Leu Leu Ser Gly Asp Ile Ser Gln Val Thr Glu Phe
                165                 170                 175

Lys Asn Thr Phe Asn Gln Phe Ile Glu Asn Ile Arg Asn Glu Glu Met
            180                 185                 190

Asp Phe Glu Ile Glu Leu Asp Glu Ser Ala Val Gln Met Ile Glu Glu
```

```
        195                 200                 205

Thr Leu Lys Asp Lys Asn Leu Thr Arg Ser Ala Lys Lys Ser Lys Leu
    210                 215                 220

Val Lys Gly Leu Asn Ala Lys Asn Val Arg Asp Lys Ala Phe Leu Thr
225                 230                 235                 240

Leu Leu Ser Gly Gly Thr Val Lys Leu Ser Asp Leu Phe Gly Met Glu
                245                 250                 255

Glu Leu Asn Glu Gly Glu Arg Pro Lys Ile Ser Phe Ala Asp Asn Gly
            260                 265                 270

Tyr Glu Glu Tyr Ala Ala Val Val Glu Met Glu Leu Gly Glu Leu Tyr
        275                 280                 285

Tyr Ile Val Glu Ser Ala Lys Ala Val Tyr Asp Trp Ala Ile Leu Ser
    290                 295                 300

Asp Ile Leu Gly Gly Ser Thr Ser Val Ser Asp Ala Lys Val Arg Ala
305                 310                 315                 320

Tyr Glu Lys His Lys Ala Asp Leu Lys Tyr Leu Lys Ala Val Val Lys
                325                 330                 335

Glu Tyr Phe Pro Lys Glu Val Tyr Asn Ala Val Phe Val Glu Ser Ser
            340                 345                 350

Asp Lys Leu Asn Asn Tyr Pro Ala Tyr Ile Gly Met Thr Lys Lys Asn
        355                 360                 365

Gly Lys Lys Val Ser Leu Glu Gly Lys Arg Cys Ser Arg Glu Glu Phe
    370                 375                 380

Met Asp Phe Leu Lys Lys Asn Ile Val Val Lys Leu Pro Asp Glu Glu
385                 390                 395                 400
```

```
Ala Lys Met Tyr Leu Gln Ser Glu Leu Glu Lys Asp Ser Phe Leu Pro
                405                 410                 415

Lys Gln Val Asn Lys Asp Asn Gly Val Ile Pro Tyr Gln Val His Lys
            420                 425                 430

Tyr Glu Leu Lys Lys Ile Leu Asp Asn Leu Gly Asp Lys Ile Pro Phe
        435                 440                 445

Leu Lys Glu Asn Ala Glu Lys Ile Glu Lys Leu Phe Ser Phe Arg Ile
    450                 455                 460

Pro Tyr Tyr Val Gly Pro Leu Arg Thr Gly Asn Gly Glu Asn Ser Lys
465                 470                 475                 480

Phe Ala Trp Ala Glu Arg Lys Ser Thr Glu Lys Ile Tyr Pro Trp Asn
                485                 490                 495

Phe Glu Asn Val Ile Asp Val Glu Gln Ser Ala Glu Asn Phe Ile Arg
            500                 505                 510

Arg Met Thr Asn Lys Cys Thr Tyr Leu Ile Gly Glu Asp Val Leu Pro
        515                 520                 525

Lys Asp Ser Leu Leu Tyr Ser Lys Phe Met Val Leu Asn Glu Leu Asn
    530                 535                 540

Asn Leu Arg Leu Asp Gly Gln Lys Ile Ser Val Glu Leu Lys Gln Lys
545                 550                 555                 560

Ile Tyr Arg Asp Val Phe Cys Arg Ser Arg Lys Val Thr Gln Lys Lys
                565                 570                 575

Leu Lys Ser Tyr Leu Ile Arg Glu Gly Ile Ala Gly Lys Asn Val Glu
            580                 585                 590

Leu Thr Gly Ile Asp Gly Asp Phe Lys Gly Ser Leu Thr Ala Tyr His
```

```
        595                 600                 605

Asp Phe Lys Glu Lys Leu Ile Asp Val Glu Leu Thr Gln Lys Glu Lys
    610                 615                 620

Glu Glu Ile Ile Leu Asn Ile Val Leu Phe Gly Asp Asp Lys Lys Leu
625                 630                 635                 640

Leu Lys Gln Arg Leu Lys Lys Lys Phe Pro Gln Leu Thr Glu Lys Gln
                645                 650                 655

Ile Asn Thr Val Thr Ala Leu Ser Tyr Lys Gly Trp Gly Arg Leu Ser
            660                 665                 670

Lys Lys Leu Leu Glu Glu Val Thr Val Pro Ala Pro Glu Thr Gly Glu
        675                 680                 685

Val Trp Asn Ile Ile Thr Ala Leu Trp Glu Thr Asn Asp Asn Phe Met
    690                 695                 700

Gln Leu Leu Ser Lys Glu Tyr Gln Phe Ser Asp Arg Ile Glu Glu Phe
705                 710                 715                 720

Asn Glu Glu Lys Ala Asp Pro Glu Val Ser Tyr Gln Thr Ile Glu Asp
                725                 730                 735

Leu Tyr Val Ser Pro Ala Val Lys Arg Gln Ile Trp Gln Thr Leu Gln
            740                 745                 750

Ile Ile Gln Glu Ile Glu Lys Val Met Gly Glu Lys Pro Lys Arg Val
        755                 760                 765

Phe Val Glu Met Ala Arg Glu Lys Gln Glu Asn Lys Arg Thr Glu Ser
    770                 775                 780

Arg Lys Lys Thr Leu Ser Asp Leu Tyr Thr Lys Cys Lys Lys Glu Glu
785                 790                 795                 800
```

```
Pro Glu Trp Ile Glu Ala Leu Cys Thr Ser Leu Glu Lys His Glu Glu
               805                 810                 815

His Gln Leu Arg Ser Asp Lys Leu Tyr Leu Tyr Tyr Thr Gln Lys Gly
            820                 825                 830

Arg Cys Met Tyr Ser Gly Glu Pro Ile Asp Leu Glu Asp Leu Trp Asp
        835                 840                 845

Asn Thr Lys Tyr Asp Ile Asp His Ile Tyr Pro Gln Ser Lys Thr Met
    850                 855                 860

Asp Asp Ser Leu Lys Asn Arg Val Leu Val Lys Lys Glu Tyr Asn Ala
865                 870                 875                 880

Lys Lys Ser Asp Thr Tyr Pro Ile Ala Ala Asp Ile Gln Lys Lys Met
               885                 890                 895

Met Pro Phe Trp Lys Ser Leu Leu Thr Gly Gly Phe Ile Pro Lys Glu
            900                 905                 910

Lys Tyr Asp Arg Leu Val Arg Asn Asn Pro Leu Asp Ala Asn Glu Leu
        915                 920                 925

Ala Gly Phe Ile Glu Arg Gln Ile Val Glu Thr Arg Gln Ser Thr Lys
    930                 935                 940

Ala Val Ala Glu Ile Leu Lys Lys Ile Leu Pro Asp Thr Glu Ile Val
945                 950                 955                 960

Tyr Val Lys Ala Lys Thr Val Ser Lys Phe Arg Gln Asp Phe Asp Phe
               965                 970                 975

Ile Lys Val Arg Asp Met Asn Asp Leu His His Ala Lys Asp Ala Tyr
            980                 985                 990

Leu Asn Ile Val Val Gly Asn Val  Tyr Phe Val Lys Phe  Thr Lys Asn
```

995 1000 1005

Ala Ala Trp Phe Val Lys Glu Asn Pro Gly Arg Thr Tyr Asn Leu
1010 1015 1020

Glu Lys Met Phe Ile Trp Asp Val Ala Arg Asp Gly Glu Ile Ala
1025 1030 1035

Trp Lys Ala Gly Lys Ser Gly Ser Ile Val Gln Val Arg Ala Met
1040 1045 1050

Met Glu Lys Asn His Ile Leu Val Thr Arg Arg Ser Tyr Glu Val
1055 1060 1065

Lys Gly Gly Leu Phe Asp Gln Gln Ile Leu Lys Lys Gly Lys Gly
1070 1075 1080

Gln Val Pro Val Lys Glu Ser Asp Glu Arg Leu Arg Asp Ile Gly
1085 1090 1095

Lys Tyr Gly Gly Tyr Asn Lys Ala Ala Gly Val Tyr Phe Met Leu
1100 1105 1110

Val Ser Ser Lys Asp Lys Lys Gly Lys Glu Gln Arg Thr Ile Glu
1115 1120 1125

Phe Val Pro Ile Tyr Leu Lys Asp Arg Val Glu Lys Asp Met Glu
1130 1135 1140

Ser Ala Arg Asn Tyr Leu Met Glu Glu Arg Gly Leu Arg Glu Pro
1145 1150 1155

Lys Ile Leu Ile Lys Lys Ile Lys Ile Asp Thr Leu Phe Lys Val
1160 1165 1170

Asp Gly Phe Tyr Met Trp Leu Ser Gly Arg Thr Ser Asn Gln Leu
1175 1180 1185

```
Ile Phe  Lys Gly Ala Asn Gln  Leu Ile Leu Ser Lys  Glu Asp Met
    1190                1195                1200


Lys Thr  Leu Lys Lys Val Val  Lys Tyr Ile Gln Arg  Gln Lys Glu
    1205                1210                1215


Asp Lys  Asn Val Lys Ile Ser  Met Arg Asp Gly Ile  Thr Glu Glu
    1220                1225                1230


Glu Leu  Leu Lys Leu Tyr Glu  Thr Phe Leu Asp Lys  Ile Arg His
    1235                1240                1245


Ser Ile  Tyr Gly Ala Arg Leu  Ser Ser Gln Glu Lys  Thr Leu Val
    1250                1255                1260


Asn Gly  Lys Glu Lys Phe Ile  Asp Leu Ser Val Glu  Ala Lys Cys
    1265                1270                1275


Gln Val  Leu Tyr Glu Ile Leu  His Leu Phe Gln Cys  Gln Ser Gly
    1280                1285                1290


Ala Ala  Asn Leu Lys Met Ile  Gly Gly Pro Ala Ser  Ala Gly Ile
    1295                1300                1305


Leu Val  Met Asn Asn Asn Ile  Ser Lys Cys Lys Asn  Ile Ser Ile
    1310                1315                1320


Val Asn  Gln Ser Pro Thr Gly  Ile Tyr Glu Lys Glu  Ile Asp Leu
    1325                1330                1335


Leu Arg  Val
    1340


<210>  78
<211>  1003
<212>  PRT
<213>  Gluconacetobacter diazotrophicus
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<400> 78

```
Met Ile Asp Glu Ser Leu Thr Phe Gly Ile Asp Leu Gly Ile Gly Ser
1               5                  10                  15

Cys Gly Trp Ala Val Leu Arg Arg Pro Ser Ala Phe Gly Arg Lys Gly
            20                  25                  30

Val Ile Glu Gly Met Gly Ser Trp Cys Phe Asp Val Pro Glu Thr Ser
        35                  40                  45

Lys Glu Arg Thr Pro Thr Asn Gln Ile Arg Arg Ser Asn Arg Leu Leu
    50                  55                  60

Arg Arg Val Ile Arg Arg Arg Arg Asn Arg Met Ala Ala Ile Arg Arg
65                  70                  75                  80

Leu Leu His Ala Ala Gly Leu Leu Pro Ser Thr Asp Ser Asp Ala Leu
                85                  90                  95

Lys Arg Pro Gly His Asp Pro Trp Glu Leu Arg Ala Arg Gly Leu Asp
            100                 105                 110

Lys Pro Leu Lys Pro Val Glu Phe Ala Val Val Leu Gly His Ile Ala
        115                 120                 125

Lys Arg Arg Gly Phe Lys Ser Ala Ala Lys Arg Lys Ala Thr Asn Ile
    130                 135                 140

Ser Ser Asp Asp Lys Lys Met Leu Thr Ala Leu Glu Ala Thr Arg Glu
145                 150                 155                 160

Arg Leu Gly Arg Tyr Arg Thr Val Gly Glu Met Phe Ala Arg Asp Pro
                165                 170                 175

Asp Phe Ala Ser Arg Arg Arg Asn Arg Glu Gly Lys Tyr Asp Arg Thr
            180                 185                 190
```

```
Thr Ala Arg Asp Asp Leu Glu His Glu Val His Ala Leu Phe Ala Ala
        195                 200                 205

Gln Arg Arg Leu Gly Gln Gly Phe Ala Ser Pro Glu Leu Glu Glu Ala
    210                 215                 220

Phe Thr Ala Ser Ala Phe His Gln Arg Pro Met Gln Asp Ser Glu Arg
225                 230                 235                 240

Leu Val Gly Phe Cys Pro Phe Glu Arg Thr Glu Lys Arg Ala Ala Lys
                245                 250                 255

Leu Thr Pro Ser Phe Glu Arg Phe Arg Leu Leu Ala Arg Leu Leu Asn
            260                 265                 270

Leu Arg Ile Thr Thr Pro Asp Gly Glu Arg Pro Leu Thr Val Asp Glu
        275                 280                 285

Ile Ala Leu Val Thr Arg Asp Leu Gly Lys Thr Ala Lys Leu Ser Ile
    290                 295                 300

Lys Arg Val Arg Thr Leu Ile Gly Leu Glu Asp Asn Gln Arg Phe Thr
305                 310                 315                 320

Thr Ile Arg Pro Glu Asp Glu Asp Arg Asp Ile Val Ala Arg Thr Gly
                325                 330                 335

Gly Ala Met Thr Gly Thr Ala Thr Leu Arg Lys Ala Leu Gly Glu Ala
            340                 345                 350

Leu Trp Thr Asp Met Gln Glu Arg Pro Glu Gln Leu Asp Ala Ile Val
        355                 360                 365

Gln Val Leu Ser Phe Phe Glu Ala Asn Glu Thr Ile Thr Glu Lys Leu
    370                 375                 380

Arg Glu Ile Gly Leu Thr Leu Ala Val Leu Asp Val Leu Leu Thr Ala
385                 390                 395                 400
```

```
Leu Asp Ala Gly Val Phe Ala Lys Phe Lys Gly Ala Ala His Ile Ser
               405                 410                 415

Thr Lys Ala Ala Arg Asn Leu Leu Pro His Leu Glu Gln Gly Arg Arg
            420                 425                 430

Tyr Asp Glu Ala Cys Thr Met Ala Gly Tyr Asp His Ala Ala Ser Arg
        435                 440                 445

Leu Ser His His Gly Gln Ile Val Ala Lys Thr Gln Phe Asn Ala Leu
    450                 455                 460

Val Thr Glu Ile Gly Glu Ser Ile Ala Asn Pro Ile Ala Arg Lys Ala
465                 470                 475                 480

Leu Ile Glu Gly Leu Lys Gln Ile Trp Ala Met Arg Asn His Trp Gly
               485                 490                 495

Leu Pro Gly Ser Ile His Val Glu Leu Ala Arg Asp Val Gly Asn Ser
            500                 505                 510

Ile Glu Lys Arg Arg Glu Ile Glu Lys His Ile Glu Lys Asn Thr Ala
        515                 520                 525

Leu Arg Ala Arg Glu Arg Arg Glu Val His Asp Leu Leu Asp Leu Glu
    530                 535                 540

Asp Val Asn Gly Asp Thr Leu Leu Arg Tyr Arg Leu Trp Lys Glu Gln
545                 550                 555                 560

Gly Gly Lys Cys Leu Tyr Thr Gly Lys Ala Ile His Ile Arg Gln Ile
               565                 570                 575

Ala Ala Thr Asp Asn Ser Val Gln Val Asp His Ile Leu Pro Trp Ser
            580                 585                 590
```

```
Arg Phe Gly Asp Asp Ser Phe Asn Asn Lys Thr Leu Cys Leu Ala Ser
        595                 600                 605

Ala Asn Gln Gln Lys Lys Arg Ser Thr Pro Tyr Glu Trp Leu Ser Gly
    610                 615                 620

Gln Thr Gly Asp Ala Trp Asn Ala Phe Val Gln Arg Ile Glu Thr Asn
625                 630                 635                 640

Lys Glu Leu Arg Gly Phe Lys Lys Arg Asn Tyr Leu Leu Lys Asn Ala
                645                 650                 655

Lys Glu Ala Glu Glu Lys Phe Arg Ser Arg Asn Leu Asn Asp Thr Arg
            660                 665                 670

Tyr Ala Ala Arg Leu Phe Ala Glu Ala Val Lys Leu Leu Tyr Ala Phe
        675                 680                 685

Gly Glu Arg Gln Glu Lys Gly Gly Asn Arg Arg Val Phe Thr Arg Pro
    690                 695                 700

Gly Ala Leu Thr Ala Ala Leu Arg Gln Ala Trp Gly Val Glu Ser Leu
705                 710                 715                 720

Lys Lys Gln Asp Gly Lys Arg Ile Asn Asp Asp Arg His His Ala Leu
                725                 730                 735

Asp Ala Leu Thr Val Ala Ala Val Asp Glu Ala Glu Ile Gln Arg Leu
            740                 745                 750

Thr Lys Ser Phe His Glu Trp Glu Gln Gln Gly Leu Gly Arg Pro Leu
        755                 760                 765

Arg Arg Val Glu Pro Pro Trp Glu Ser Phe Arg Ala Asp Val Glu Ala
    770                 775                 780

Thr Tyr Pro Glu Val Phe Val Ala Arg Pro Glu Arg Arg Arg Ala Arg
785                 790                 795                 800
```

```
Gly Glu Gly His Ala Ala Thr Ile Arg Gln Val Lys Glu Arg Glu Cys
               805                 810                 815

Thr Pro Ile Val Phe Glu Arg Lys Ala Val Ser Ser Leu Lys Glu Ala
            820                 825                 830

Asp Leu Glu Arg Ile Lys Asp Gly Glu Arg Asn Glu Ala Ile Val Glu
        835                 840                 845

Ala Ile Arg Ser Trp Ile Ala Thr Gly Arg Pro Ala Asp Ala Pro Pro
    850                 855                 860

Arg Ser Pro Arg Gly Asp Ile Ile Thr Lys Ile Arg Leu Ala Thr Thr
865                 870                 875                 880

Ile Lys Ala Ala Val Pro Val Arg Gly Gly Thr Ala Gly Arg Gly Glu
               885                 890                 895

Met Val Arg Ala Asp Val Phe Ser Lys Pro Asn Arg Arg Gly Lys Asp
            900                 905                 910

Glu Trp Tyr Leu Val Pro Val Tyr Pro His Gln Ile Met Asn Arg Lys
        915                 920                 925

Ala Trp Pro Lys Pro Pro Met Arg Ser Ile Val Ala Asn Lys Asp Glu
    930                 935                 940

Asp Glu Trp Thr Glu Val Gly Pro Glu His Gln Phe Arg Phe Ser Leu
945                 950                 955                 960

Tyr Pro Arg Ser Asn Ile Glu Ile Ile Arg Pro Ser Gly Glu Val Ile
               965                 970                 975

Glu Gly Tyr Phe Val Gly Leu His Arg Asn Thr Gly Ala Leu Ile Pro
            980                 985                 990
```

Thr Pro Val Gly Pro Asp Ser Tyr Val Ile Ala
        995   1000

<210> 79
<211> 1368
<212> PRT
<213> Streptococcus pyogenes

<400> 79

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20   25   30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35   40   45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50   55   60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65   70   75   80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Ile Ala Lys Val Asp Asp Ser
                85   90   95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100   105   110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115   120   125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130   135   140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145   150   155   160

```
Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Arg Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Arg Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
```

```
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560
```

```
Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
               565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
               645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Leu Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
               725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
```

```
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

Glu Glu Gly Ile Lys Glu Leu Gly Ser Asp Ile Leu Lys Glu Tyr Pro
785                 790                 795                 800

Val Glu Thr Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Lys Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Arg Val Ile Thr Leu Lys Ser
945                 950                 955                 960
```

```
Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
               965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Ile Arg Lys  Met Ile Ala
    1010                1015                1020

Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050

Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080

Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
```

```
    1145                1150                1155

Ser Val  Lys Glu Leu Val Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170

Phe Glu  Lys Asp Pro Val Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Arg Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215

Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230

Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245

Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260

His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275

Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290

Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                1300                1305

Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
    1310                1315                1320

Phe Lys  Cys Phe Asp Thr Thr  Ile Gly Arg Asn Arg  Tyr Lys Ser
    1325                1330                1335
```

```
Ile Lys  Glu Val Leu Asp Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1340                1345                1350


Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                1360                1365


<210>  80
<211>  1504
<212>  PRT
<213>  Bacteroides dorei

<400>  80

Met Lys Asn Ile Val Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Val Val Asn Gly Ser Val Asn Asp Asp Gly Ser Glu Gln Leu Val
            20                  25                  30


Lys Ile Gln Ala Ser Gly Ser Arg Ile Ile Pro Met Asp Ala Ala Met
        35                  40                  45


Ile Gly Asp Phe Asn Lys Gly Asn Ser Ile Ser Gln Thr Ala Glu Arg
    50                  55                  60


Thr Arg Leu Arg Gly Val Arg Arg Leu Ser Glu Arg Tyr Leu Leu Arg
65                  70                  75                  80


Arg Glu Arg Leu His Arg Ile Leu Asp Ile Leu Gly Phe Leu Pro Phe
                85                  90                  95


His Phe Ala Gln Asp Leu Asp Arg His Gly Lys Ile Val Lys Gly Lys
            100                 105                 110


Glu Pro Lys Leu Ala Trp Arg Lys Asn Glu Ala Gly Gln Phe Glu Phe
        115                 120                 125


Ile Phe Gln Asp Ser Phe Lys Glu Met Leu Glu Asp Phe Lys Leu Asn
    130                 135                 140
```

```
Tyr Pro Asn Leu Ile Thr Asp Asp Lys Lys Val Pro Tyr Asp Trp Thr
145                 150                 155                 160

Ile Tyr Tyr Leu Arg Lys Lys Gly Leu Thr Ser Lys Ile Ser Lys Glu
                165                 170                 175

Glu Leu Ala Trp Ile Leu Leu Asn Phe Asn Gln Lys Arg Gly Tyr Tyr
            180                 185                 190

Gln Leu Arg Gly Glu Glu Glu Glu Glu Asn Lys Asp Lys Leu Val Glu
        195                 200                 205

Phe Tyr Ala Leu Lys Val Val Ala Val Glu Asp Ser Gly Glu Lys Lys
    210                 215                 220

Gly Lys Asp Ile Trp Tyr Asn Val His Leu Glu Asn Gly Trp Val Tyr
225                 230                 235                 240

Arg Arg Thr Ser Asn Met Ser Leu Asp Trp Val Gly Lys Thr Lys Glu
                245                 250                 255

Phe Ile Val Thr Thr Asp Leu Glu Lys Asp Gly Thr Pro Lys Lys Asp
            260                 265                 270

Lys Glu Gly Asn Val Lys Arg Ser Phe Arg Ala Pro Lys Glu Asp Asp
        275                 280                 285

Trp Ser Leu Val Lys Lys Lys Thr Glu Ala Asp Ile Asp Gln Thr His
    290                 295                 300

Lys Thr Val Gly Ala Tyr Ile Tyr Asp Thr Leu Leu Gly Asn Pro Ser
305                 310                 315                 320

Gln Lys Ile Arg Gly Arg Leu Val Arg Thr Ile Glu Arg Lys Tyr Tyr
                325                 330                 335
```

```
Lys Glu Glu Leu Lys Leu Ile Leu Glu Lys Gln Lys Glu Phe His Leu
            340                 345                 350

Glu Leu Gln Asp Arg Ala Leu Tyr Ala Ala Cys Ile Glu Glu Leu Tyr
        355                 360                 365

Pro Ile Asn Glu Ala His Arg Asn Asn Val Gly Asn Arg Asp Phe Thr
    370                 375                 380

Tyr Leu Phe Leu Glu Asp Ile Leu Phe Tyr Gln Arg Pro Leu Lys Ser
385                 390                 395                 400

Lys Lys Ser Leu Ile Asp Asn Cys Pro Tyr Glu Glu Asn Gln Gly Leu
                405                 410                 415

Asp Lys Glu Thr Gly Glu Ile Lys Ser Phe Pro Val Lys Cys Ile Ala
            420                 425                 430

Lys Ser His Pro Leu Phe Gln Glu Phe Arg Leu Trp Gln Phe Ile Ile
        435                 440                 445

Asn Leu Arg Ile Tyr Arg Lys Asp Leu Ala Gln Asp Val Asp Val Thr
    450                 455                 460

Asn Glu Leu Leu Lys Thr Glu Glu Asp Tyr Val Ala Leu Phe Asp Trp
465                 470                 475                 480

Leu Asn Gly Lys Lys Glu Ile Asp Gln Lys Ala Phe Leu Lys Tyr Pro
                485                 490                 495

Val Phe Gly Leu Lys Lys Glu Ile Glu Asn Tyr Arg Trp Asn Tyr Val
            500                 505                 510

Gln Asp Lys Pro Tyr Pro Cys Asn Glu Thr Arg Ser Leu Met Leu Ala
        515                 520                 525

Arg Leu Glu Lys Cys Asp Ile Ser Ile Glu Phe Leu Thr Lys Glu Asn
    530                 535                 540
```

```
Glu Glu Ala Leu Trp His Ile Leu Tyr Ser Val Glu Asp Lys Asn Glu
545                 550                 555                 560

Ile Val Lys Ala Leu Gln Lys Phe Ala Asp Lys His Asp Leu Asn Ala
                565                 570                 575

Ser Phe Val Asp Val Phe Gln Lys Phe Pro Pro Phe Lys Lys Glu Tyr
            580                 585                 590

Gly Ser Tyr Ser Ala Lys Ala Ile Lys Lys Leu Leu Pro Leu Met Arg
        595                 600                 605

Met Gly Lys Tyr Trp Ser Glu Asn Ser Ile Asp Lys Gly Thr Arg Glu
    610                 615                 620

Arg Ile Asp Lys Ile Ile Thr Gly Glu Tyr Asp Glu Lys Ile Glu Asn
625                 630                 635                 640

Arg Val Arg Glu Lys Ala Ile His Leu Ala Asp Val Ser Asp Phe Lys
                645                 650                 655

Gly Leu Pro Leu Trp Leu Val Cys Tyr Ile Val Tyr Gly Arg His Ser
            660                 665                 670

Glu Ala Lys Glu Ile Ile Gln Trp Lys Ser Pro Ala Asp Ile Asp Ser
        675                 680                 685

Tyr Leu Arg Ser Phe Lys Gln His Ser Leu Arg Asn Pro Ile Val Glu
    690                 695                 700

Gln Ile Ile Ile Glu Thr Leu Arg Val Val Arg Asp Ile Trp Lys Gln
705                 710                 715                 720

Val Gly Asn Ile Asp Glu Ile His Val Glu Leu Gly Arg Glu Met Lys
                725                 730                 735
```

```
Asn Pro Ala Asp Lys Arg Lys Lys Met Thr Gln Gln Met Ser Glu Asn
            740                 745                 750

Glu Asn Thr Asn Leu Arg Ile Lys Tyr Leu Leu Thr Glu Phe Leu Asn
        755                 760                 765

Pro Glu Tyr Glu Val Glu Asn Val Arg Pro Tyr Ser Pro Ser Gln Gln
    770                 775                 780

Asp Ile Leu Arg Ile Tyr Glu Glu Gly Val Leu Asn Ser Val Ser Asp
785                 790                 795                 800

Leu Pro Glu Glu Ile Ser Asp Ile Leu Lys Lys Phe Thr Glu Thr Asp
                805                 810                 815

Leu Lys Lys Arg Pro Ser Arg Ser Glu Val Leu Arg Tyr Lys Leu Trp
            820                 825                 830

Leu Glu Gln Lys Tyr Arg Ser Pro Tyr Thr Gly Glu Val Ile Pro Leu
        835                 840                 845

Gly Lys Leu Phe Thr Pro Ala Tyr Glu Ile Glu His Val Ile Pro Gln
    850                 855                 860

Ser Tyr Tyr Phe Asp Asp Ser Phe Ser Asn Lys Val Ile Cys Glu Ala
865                 870                 875                 880

Glu Val Asn Lys Leu Lys Ser Asn Leu Leu Gly His Glu Phe Ile Val
                885                 890                 895

Lys His His Gly Glu Ile Val Glu Leu Pro Phe Gly Lys Lys Val Arg
            900                 905                 910

Ile Phe Thr Val Asp Glu Tyr Glu Gln Phe Val Lys Asp Asn Tyr Ser
        915                 920                 925

Arg Thr Arg Ser Lys Met Lys Lys Leu Leu Met Asp Asp Ile Pro Glu
    930                 935                 940
```

```
Glu Phe Val Thr Arg Gln Leu Asn Asp Ser Arg Tyr Ile Ser Lys Val
945                 950                 955                 960


Val Lys Ser Leu Leu Ser Asn Ile Val Arg Glu Lys Gly Glu Glu Glu
                965                 970                 975


Ala Ile Ser Lys Asn Val Ile Pro Cys Thr Gly Gly Val Thr Asp Arg
            980                 985                 990


Leu Lys Lys Asp Trp Gly Ile Asn  Glu Val Trp Asn Lys  Ile Ile Leu
        995                 1000                1005


Pro Arg  Phe Gln Arg Leu Asn  Glu Leu Thr Gly Thr  Asn Lys Phe
    1010                1015                1020


Thr Thr  Lys Asn Val Gly Ile  Gln Glu Ile Pro Thr  Met Pro Leu
    1025                1030                1035


Glu Leu  Gln Lys Gly Phe Asn  Lys Lys Arg Ile Asp  His Arg His
    1040                1045                1050


His Ala  Met Asp Ala Ile Ile  Ile Ala Cys Ala Asn  Arg Asn Ile
    1055                1060                1065


Ile Asn  Tyr Leu Asn Asn Lys  Ser Ala Thr Ala Lys  Ala Glu Leu
    1070                1075                1080


Ser Arg  Tyr Asp Leu Gln Lys  Met Leu Cys Asp Lys  Ala Lys Thr
    1085                1090                1095


Asp Asn  Asn Gly Asn Tyr Lys  Trp Val Ile Arg Lys  Pro Trp Ala
    1100                1105                1110


Ser Phe  Thr Gln Asp Thr Tyr  Leu Ala Leu Glu Asn  Ile Ile Val
    1115                1120                1125
```

```
Ser Phe  Lys Gln Asn Leu Arg  Val Ile Asn Lys Ala  Thr Asn Arg
    1130                1135                1140

Phe Leu  His Tyr Asn Glu Glu  Gly Lys Lys Ile Phe  Val Lys Gln
    1145                1150                1155

Gly Lys  Gly Asp Asn Trp Ala  Ile Arg Lys Ser Met  His Lys Asp
    1160                1165                1170

Thr Val  Phe Gly Glu Val Asn  Leu Arg Arg Ile Lys  Thr Val Ala
    1175                1180                1185

Leu Asn  Glu Ala Met Lys Asn  Pro Gln Ser Ile Val  Val Lys Asp
    1190                1195                1200

Phe Lys  Arg Lys Leu Leu Glu  Leu Trp Asn Leu Gly  Phe Asp Ala
    1205                1210                1215

Lys Arg  Ile Lys Lys Tyr Phe  Glu Asp Asn Arg Glu  Thr Trp Ser
    1220                1225                1230

Asp Ile  Asn Leu Ser Lys Ile  Glu Val Tyr Tyr Phe  Ser Lys Asp
    1235                1240                1245

Thr Lys  Asp Arg Phe Phe Ala  Thr Arg Lys Pro Leu  Asp Thr Ser
    1250                1255                1260

Phe Asp  Arg Lys Lys Ile Glu  Asn Asn Ile Thr Asp  Thr Gly Ile
    1265                1270                1275

Gln Lys  Ile Leu Leu Arg His  Leu Glu Leu Lys Asp  Asn Asn Pro
    1280                1285                1290

Asp Ile  Ala Phe Ser Pro Asp  Gly Ile Asp Glu Met  Asn Arg Asn
    1295                1300                1305

Ile Ile  Gln Leu Asn Asn Gly  Lys Tyr His Gln Pro  Ile Ile Lys
    1310                1315                1320
```

```
Ile Arg  Trp Tyr Glu Gln Ala  Asp Lys Phe Ala Val  Gly Gln Thr
    1325                1330                1335

Gly Asn  Lys Ser Ser Lys Phe  Val Glu Ala Ala Lys  Gly Thr Asn
    1340                1345                1350

Leu Phe  Phe Ala Val Tyr Glu  Ser Asn Ile Leu Asp  Lys Lys Thr
    1355                1360                1365

Asn Thr  Ile Ile Lys Lys Arg  Asn Tyr Ala Thr Ile  Pro Leu Asn
    1370                1375                1380

Val Ala  Ile Glu Arg Gln Lys  Gln Gly Leu Pro Val  Ala Pro Glu
    1385                1390                1395

Asp Glu  Asn Gly Asn Asp Pro  Ile Phe Val Leu Ser  Pro Asn Asp
    1400                1405                1410

Leu Val  Tyr Leu Pro Thr Asp  Asp Glu Leu Ala Asn  Gly Ile Ile
    1415                1420                1425

Ala Gln  Pro Leu Asp Arg Gly  Arg Ile Tyr Lys Met  Val Ser Ser
    1430                1435                1440

Ser Gly  Glu Gln Cys Phe Phe  Ile Lys His Ile Val  Ala Asn Val
    1445                1450                1455

Leu Val  Asp Lys Phe Glu Phe  Ser Pro Leu Asn Lys  Met Glu Arg
    1460                1465                1470

Ala Leu  Thr Gly Glu Met Ile  Lys Met Ile Cys Ile  Pro Ile Lys
    1475                1480                1485

Val Asp  Arg Leu Gly Asn Val  Leu Glu Ser Ser Ser  Ser Tyr Lys
    1490                1495                1500
```

Lys

<210> 81
<211> 1426
<212> PRT
<213> Capnocytophaga sputigena

<400> 81

Met Lys Asn Ile Leu Gly Leu Asp Leu Gly Ile Thr Ser Ile Ser Phe
1 5 10 15

Ala His Ile Val Glu Asp Glu Asn Lys Glu Lys Ser Glu Ile Lys Glu
20 25 30

Leu Gly Val Arg Ile Val Ser Leu Thr Thr Asp Glu Gln Ser Asp Phe
35 40 45

Glu Lys Gly Lys Ser Ile Thr Thr Asn Ala Asn Arg Thr Leu Lys His
50 55 60

Gly Ala Arg Leu Asn Leu Asp Arg Tyr Gln Gln Arg Arg Lys Tyr Leu
65 70 75 80

Ile Asp Leu Leu Gln Lys Ala Asn Leu Ile Thr Ser Ser Ser Ile Leu
85 90 95

Ala Glu Asn Gly Lys Asn Thr Thr His Ser Thr Trp Gln Leu Arg Ala
100 105 110

Lys Ala Val Thr Glu Arg Ile Glu Lys Glu Glu Phe Ala Arg Val Leu
115 120 125

Leu Ala Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Ala Lys
130 135 140

Thr Glu Asp Glu Gly Gln Ala Ile Asp Gly Met Ala Ile Ala Lys Arg
145 150 155 160

```
Leu Tyr Asp Glu Asn Leu Thr Pro Gly Gln Leu Ser Leu Gln Leu Leu
                165                 170                 175

Gln Gln Asn Lys Lys Leu Leu Pro Asp Phe Tyr Arg Ser Asp Leu Gln
            180                 185                 190

Arg Glu Phe Asp Leu Val Trp Asn Phe Gln Lys Gln Phe Tyr Pro Asp
        195                 200                 205

Ile Leu Thr Asp Ser Phe Tyr Lys Glu Leu Gln Gly Lys Gly Lys Asp
    210                 215                 220

Ala Thr Ser Lys Ala Phe Ser Lys Arg Tyr His Phe Asp Thr Ala Glu
225                 230                 235                 240

Asn Lys Gly Ser Lys Glu Ser Val Arg Leu Gln Ala Tyr Gln Trp Arg
                245                 250                 255

Ala Glu Ala Ile Ser Lys Gln Leu Ser Lys Glu Glu Val Ala Tyr Val
            260                 265                 270

Leu Thr Glu Ile Asn Asn Asn Leu Asn Asn Ala Ser Gly Tyr Leu Gly
        275                 280                 285

Ala Ile Ser Asp Arg Ser Lys Glu Leu Tyr Phe Asn Arg Gln Thr Val
    290                 295                 300

Gly Gln Tyr Leu Tyr Ala Gln Leu Gln Glu Asn Arg His Asn Ser Leu
305                 310                 315                 320

Lys Asn Lys Val Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe Glu Arg
                325                 330                 335

Ile Trp Glu Thr Gln Ala Ser Phe His Lys Glu Leu Thr Asp Glu Leu
            340                 345                 350

Lys Lys Gln Ile Arg Asp Val Val Ile Phe Tyr Gln Arg Lys Leu Lys
```

```
        355                 360                 365

Ser Gln Lys Gly Leu Ile Ser Phe Cys Glu Phe Glu Ser Lys Glu Ile
    370                 375                 380

Glu Ile Glu Lys Asp Gly Lys Thr Ile Thr Lys Thr Ile Gly Ala Arg
385                 390                 395                 400

Val Val Pro Lys Ser Ser Pro Leu Phe Gln Glu Phe Lys Ile Trp Gln
                405                 410                 415

Ile Leu Asn Asn Val Thr Cys Lys Arg Lys Gly Ile Arg Lys Lys Lys
            420                 425                 430

Ser Ser Ala Lys Ser Thr Glu Leu Asp Leu Phe Asn Glu Pro Ser Gln
        435                 440                 445

Thr Ile Phe Ser Leu Asp Met Glu Cys Lys Gln Leu Leu Phe Asp Glu
    450                 455                 460

Leu Asn Leu Lys Gly Asp Leu Lys Ser Asp Lys Val Leu Lys Leu Leu
465                 470                 475                 480

Gly Tyr Ser Pro Gln Glu Trp Glu Ile Asn Tyr Asn Gln Leu Glu Gly
                485                 490                 495

Asn Arg Thr Gln Lys Ala Leu Tyr Glu Ala Tyr Leu Lys Ile Val Glu
            500                 505                 510

Met Glu Ala His Asp Val Lys Asp Ile Leu Gln Ile Lys Ser Ala Lys
        515                 520                 525

Asp Asp Trp Ser Leu Asp Glu Ser Pro Leu Ser Ala Ser Glu Ile Lys
    530                 535                 540

Glu Lys Val Lys Asp Ile Phe Gln Ala Leu Gly Ile Cys Thr Lys Ile
545                 550                 555                 560
```

```
Leu Tyr Phe Asp Pro Leu Leu Pro Val Lys Glu Phe Glu Lys Gln Asp
                565                 570                 575

Ser Tyr Gln Leu Trp His Leu Leu Tyr Ser Tyr Glu Ser Asp Asp Ser
            580                 585                 590

Thr Ser Gly Asn Glu Thr Leu Tyr Arg Ile Leu Glu Lys Lys Tyr Ala
        595                 600                 605

Phe Lys Arg Glu His Ala Arg Ile Leu Ala Asn Val Ala Leu Gln Asp
    610                 615                 620

Asp Tyr Gly Ser Leu Ser Thr Lys Ala Ile Arg Lys Ile Tyr Pro Asn
625                 630                 635                 640

Ile Lys Glu Asn Gln Tyr Ser Lys Ala Cys Glu Leu Ala Gly Tyr Lys
                645                 650                 655

His Ser Lys Leu Ser Leu Thr Thr Glu Glu Leu Glu Ala Arg Glu Leu
            660                 665                 670

Lys Asn Ile Ile Pro Leu Leu Lys Lys Asn Ala Leu Arg Asn Pro Val
        675                 680                 685

Val Glu Lys Ile Leu Asn Gln Met Ile Asn Val Val Asn Ala Leu Ile
    690                 695                 700

Glu Lys Asn Ser Glu Arg Asp Ala Glu Gly Lys Ile Thr Lys Tyr Phe
705                 710                 715                 720

His Phe Asp Glu Ile Arg Ile Glu Leu Ala Arg Glu Leu Lys Lys Asn
                725                 730                 735

Ala Gln Lys Arg Tyr Glu Met Thr Gln Asn Ile Asn Lys Ala Lys Leu
            740                 745                 750

Glu His Gln Lys Ile Ser Glu Ile Leu Gln Lys Lys Phe Gly Ile Lys
```

```
        755                 760                 765

Asn Pro Thr Lys Ser Asp Ile Ile Arg Tyr Arg Leu Tyr Gln Glu Leu
    770                 775                 780

Glu His Asn Gly Tyr Lys Glu Leu Tyr Thr Asn Ala Pro Ile Ala Arg
785                 790                 795                 800

Asp Met Leu Phe Ser Lys Asn Ile Glu Ile Glu His Ile Val Pro Lys
                805                 810                 815

Ala Arg Val Phe Asp Asp Ser Phe Ser Asn Lys Thr Leu Thr Phe His
            820                 825                 830

Arg Ile Asn Ser Asn Lys Gly Glu Tyr Thr Ala Phe Asp Tyr Ile Thr
        835                 840                 845

Ser Leu Asn Ser Glu Glu Glu Leu Asn Gln Tyr Leu Thr Arg Val Glu
    850                 855                 860

Asn Ala Tyr Lys Thr Lys Ser Ile Ser Leu Thr Lys Tyr Lys Asn Leu
865                 870                 875                 880

Leu Lys Lys Ala Ser Glu Ile Gly Asp Gly Phe Ile Asn Arg Asp Leu
                885                 890                 895

Arg Asp Thr Gln Tyr Ile Ala Lys Lys Ala Lys Glu Ile Leu Phe Gln
            900                 905                 910

Val Thr Lys Asn Val Leu Ser Thr Ser Gly Ser Ile Thr Asp Arg Leu
        915                 920                 925

Arg Glu Asp Trp Gly Leu Val Asp Val Met Lys Glu Leu Asn Met Pro
    930                 935                 940

Lys Tyr Gln Ser Leu Gly Leu Thr Glu Val Glu Glu Arg Lys Glu Gly
945                 950                 955                 960
```

```
Asn Lys Val Thr Val Ile Lys Asn Trp Thr Lys Arg Asn Asp His Arg
               965                 970                 975

His His Ala Met Asp Ala Leu Thr Val Ala Phe Thr Lys Pro Ser Tyr
            980                 985                 990

Ile Gln Tyr Leu Asn His Leu Asn  Ala Arg Lys Asp Glu  Asn Asn Lys
        995                 1000                1005

Asn Tyr  Ser Val Ile Leu Ala  Ile Glu Glu Lys Glu  Thr Ile Lys
    1010                1015                1020

Val Pro  Thr Asn Asn Gly Lys  Asn Lys Arg Val Phe  Ile Glu Pro
    1025                1030                1035

Ile Pro  Asn Phe Arg Gln Val  Ala Lys Lys His Leu  Glu Glu Ile
    1040                1045                1050

Phe Ile  Ser His Lys Ala Lys  Asn Lys Val Val Thr  Lys Asn Val
    1055                1060                1065

Asn Lys  Pro Ala Gly Thr Asp  Lys Gln Gln Ile Thr  Leu Thr Pro
    1070                1075                1080

Arg Gly  Gln Leu His Lys Glu  Thr Ile Tyr Gly Lys  Tyr Gln Tyr
    1085                1090                1095

Tyr Val  Asn Lys Glu Glu Lys  Val Gly Val Lys Phe  Asp Glu Arg
    1100                1105                1110

Thr Ile  Thr Lys Val Ser Asn  Pro Leu Tyr Arg Glu  Ala Leu Leu
    1115                1120                1125

Lys Arg  Leu Gln Ala Asn Asp  Asn Asp Pro Lys Lys  Ala Phe Thr
    1130                1135                1140

Gly Lys  Asn Ala Leu Ser Lys  Asn Pro Ile Tyr Leu  Asp Glu Thr
```

```
    1145                1150                1155

Lys Thr  Lys Thr Leu Pro Glu  Lys Val Asn Leu Thr  Tyr Leu Glu
    1160                1165                1170

Glu Asp  Phe Ser Ile Arg Lys  Asp Ile Ser Pro Asp  Asn Phe Lys
    1175                1180                1185

Asp Leu  Lys Ser Ile Glu Lys  Val Ile Asp Gln Gly  Val Lys Arg
    1190                1195                1200

Ile Leu  Ile Lys Arg Leu Gln  Asp Tyr Asp Asn Asp  Pro Lys Lys
    1205                1210                1215

Ala Phe  Val Asp Leu Glu Lys  Asn Pro Ile Trp Leu  Asn Lys Glu
    1220                1225                1230

Lys Gly  Ile Ala Ile Lys Arg  Val Thr Ile Ser Gly  Val Ser Asn
    1235                1240                1245

Ala Gln  Pro Leu His Ile Gly  Lys Asp His Leu Gly  Lys Thr Thr
    1250                1255                1260

Leu Asn  Lys Glu Gly Asn Glu  Ile Pro Val Asp Tyr  Val Ser Thr
    1265                1270                1275

Gly Asn  Asn His His Val Ala  Ile Tyr Arg Asp Lys  Glu Gly Asn
    1280                1285                1290

Leu Gln  Glu Gln Ile Val Ser  Phe Phe Glu Ala Val  Val Arg Thr
    1295                1300                1305

Gln Gln  Gly Leu Pro Ile Ile  Asp Lys Thr Tyr Lys  Gln Glu Glu
    1310                1315                1320

Gly Trp  Gln Phe Leu Phe Thr  Met Lys Gln Asn Glu  Met Phe Val
    1325                1330                1335
```

```
Phe Pro  Asn Ala Thr Thr Gly  Phe Asn Pro Ala Glu  Ile Asp Leu
    1340                1345                1350


Leu Asp  Pro Lys Asn Lys Lys  Leu Ile Ser Pro Asn  Leu Phe Arg
    1355                1360                1365


Val Gln  Lys Ile Ala Thr Lys  Asp Tyr Phe Phe Arg  His His Leu
    1370                1375                1380


Glu Thr  Asn Val Glu Thr Asp  Asn Val Leu Lys Asn  Thr Thr Trp
    1385                1390                1395


Lys Arg  Glu Gly Leu Ser Gly  Leu Lys Asp Ile Val  Lys Val Arg
    1400                1405                1410


Ile Asn  His Leu Gly Asp Ile  Val Ser Ile Gly Glu  Tyr
    1415                1420                1425


<210>  82
<211>  1443
<212>  PRT
<213>  Parabacteroides johnsonii

<400>  82

Met Ile Lys Leu Leu Tyr Leu Glu Lys Leu Lys Gln Tyr Thr Met Lys
1               5                  10                  15


Lys Ile Leu Gly Leu Asp Leu Gly Thr Ser Ser Ile Gly Trp Ala Leu
            20                  25                  30


Val Asn Glu Ala Glu Asn Ser Asp Glu Val Ser Ser Ile Ile Lys Leu
        35                  40                  45


Gly Val Arg Val Asn Pro Leu Thr Val Asp Glu Met Gln Asn Phe Glu
    50                  55                  60


Lys Gly Lys Ser Ile Thr Thr Asn Ala Asp Arg Thr Leu Lys Arg Ser
65                  70                  75                  80
```

```
Met Arg Arg Asn Leu Gln Arg Tyr Lys Leu Arg Arg Asp Ala Leu Ile
                85                  90                  95

Glu Leu Leu Lys Lys Val Gly Phe Ile Thr Asp Lys Thr Ile Leu Ser
            100                 105                 110

Glu Gln Gly Asn Arg Thr Thr Phe Glu Thr Tyr Arg Leu Arg Ala Lys
        115                 120                 125

Ala Ala Glu Glu Glu Ile Ser Leu Lys Glu Leu Ala Arg Val Leu Leu
    130                 135                 140

Met Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Ala Lys Gly
145                 150                 155                 160

Glu Glu Glu Gly Ala Leu Ile Asp Gly Met Glu Ile Ala Lys Lys Leu
                165                 170                 175

Tyr Asp Glu Asp Leu Thr Pro Gly Gln Leu Cys Leu Gln Leu Leu Glu
            180                 185                 190

Ser Gly Lys Lys Phe Phe Pro Asp Phe Tyr Arg Ser Asp Leu Gln Glu
        195                 200                 205

Glu Phe Asn Lys Ile Trp Asp Phe Gln Lys Gln Phe Asn Leu Phe Ser
    210                 215                 220

Phe Cys Asp Val Ala Lys Glu Glu Val Lys Gly Lys Asn Lys Ser Gln
225                 230                 235                 240

Thr Trp Ala Ile Leu Ala Lys Tyr Phe Val Glu Thr Lys Lys Val Asn
                245                 250                 255

Val Trp Asn Glu His Glu Ala Gln Thr Glu Asn Arg Glu Glu Val Tyr
            260                 265                 270
```

```
Lys Leu Val Gly Leu Lys Arg Thr Val Lys Gly Glu Glu Leu Lys Lys
        275                 280                 285

Glu Asn Tyr Arg Trp Arg Val Gln Ala Leu Thr Glu Gln Leu Asp Leu
    290                 295                 300

Glu Lys Ile Ala Val Val Leu Gln Glu Ile Asn Gly Gln Ile Ser Ala
305                 310                 315                 320

Ser Ser Gly Tyr Leu Gly Ala Ile Ser Asp Arg Ser Lys Val Leu Tyr
                325                 330                 335

Phe Asn Arg Gln Thr Val Gly Gln Tyr Gln Met Ala Glu Leu Asn Lys
            340                 345                 350

Asn Pro Asn Met Ser Leu Arg Asn Met Val Phe Tyr Arg Gln Asp Tyr
        355                 360                 365

Leu Asp Glu Phe Asn Val Ile Trp Glu Lys Gln Ala Glu Phe His Lys
    370                 375                 380

Glu Leu Thr Pro Glu Leu Lys Lys Glu Ile Arg Asp Ile Ile Ile Phe
385                 390                 395                 400

Tyr Gln Arg Arg Leu Lys Ser Gln Lys Gly Leu Ile Ser Phe Cys Glu
                405                 410                 415

Phe Glu Asn Arg Glu Val Val Val Glu Lys Glu Gly Lys Lys Gln Thr
            420                 425                 430

Lys Ile Ile Gly Cys Lys Val Ile Pro Arg Ser His Pro Leu Phe Gln
        435                 440                 445

Glu Phe Lys Ile Trp Gln Thr Leu Asn Asn Ile Glu Val Phe Val Gly
    450                 455                 460

Glu Lys Lys Gly Lys Arg Lys Lys Ser Asn Val Ser Ser Asp Leu Phe
465                 470                 475                 480
```

```
Gly Asp Thr Glu Asp Ala Leu Ile Thr Glu Gly Arg Arg Phe Leu Tyr
                485                 490                 495

Gln Glu Glu Lys Lys Ile Leu Ala Lys Glu Leu Ser Ile Lys Lys Gly
            500                 505                 510

Leu Thr Lys Ala Glu Ile Leu Arg Leu Leu Phe Glu Asn Pro Gln Glu
        515                 520                 525

Leu Asp Ile Asn Phe Lys Gln Ile Asp Gly Asn Gln Thr Gly Phe Ala
    530                 535                 540

Leu Phe Ser Ala Tyr Ser Asn Met Ile Glu Lys Tyr Gly Tyr Glu Pro
545                 550                 555                 560

Leu Asp Phe Lys Lys Pro Ala Glu Asp Leu Ile Ser Gln Leu Lys Thr
                565                 570                 575

Val Phe Thr Asp Leu Gly Trp Asn Thr Asp Leu Leu Phe Ile Asp Leu
            580                 585                 590

Asp Lys Glu Asn Lys Glu Trp Glu Lys Gln Pro Tyr Phe Arg Leu Trp
        595                 600                 605

His Leu Leu Tyr Ser Phe Glu Gly Asp Asn Thr Pro Thr Gly Asn Gly
    610                 615                 620

Lys Leu Ile Glu Lys Ile Met Gln Leu Cys Gly Ile Glu Lys Glu Tyr
625                 630                 635                 640

Ala Ile Glu Leu Ala Asn Val Ser Leu Gln Asp Asp Tyr Gly Ser Leu
                645                 650                 655

Ser Ala Lys Ala Ile Lys Lys Ile Leu Leu Tyr Leu Lys Glu Gly Asn
            660                 665                 670
```

```
Gln Tyr Asp Met Ala Cys Glu Tyr Ala Gly Tyr Arg His Ser Lys Ser
        675                 680                 685

Ser Leu Thr Lys Glu Glu Ile Glu Asn Lys Val Leu Lys Asp Lys Leu
    690                 695                 700

Glu Ile Leu Pro Lys Asn Ser Leu Arg Asn Pro Val Val Glu Lys Ile
705                 710                 715                 720

Leu Asn Gln Met Val Asn Val Ile Asn Thr Val Met Glu Val Tyr Gly
                725                 730                 735

Arg Pro Asp Glu Ile Arg Val Glu Leu Ala Arg Glu Leu Lys Lys Ser
            740                 745                 750

Ala Lys Glu Arg Glu Glu Leu Thr Lys Ala Val Ala Lys Asn Thr Arg
        755                 760                 765

Glu His Glu Glu Ile Arg Lys Val Leu Gln Ser Glu Phe Gly Met Ile
    770                 775                 780

Asn Val Ser Arg Asn Asp Ile Ile Arg Tyr Lys Leu Tyr Glu Glu Leu
785                 790                 795                 800

Lys Asp Asn Gly Tyr Lys Thr Leu Tyr Ser Asn Gln Tyr Ile Pro Arg
                805                 810                 815

Glu Lys Leu Phe Ser Lys Glu Ile Asp Ile Glu His Ile Ile Pro Gln
            820                 825                 830

Ser Arg Leu Phe Asp Asp Ser Leu Ser Asn Lys Thr Leu Glu Tyr Lys
        835                 840                 845

Ser Ile Asn Ile Glu Lys Gly Asn Lys Thr Ala Tyr Asp Phe Val Lys
    850                 855                 860

Glu Lys Tyr Gly Glu Glu Gly Leu Gln Gln Tyr Leu Asn Arg Cys Glu
865                 870                 875                 880
```

```
Asn Leu Cys Lys Asp Lys Lys Ala Lys Leu Arg Lys Leu Lys Met Glu
                885                 890                 895

Leu Asn Glu Ile Pro Asp Gly Phe Ile Asp Arg Asp Leu Arg Asn Thr
            900                 905                 910

Gln Tyr Ile Ala Lys Lys Ala Leu Ser Met Leu Thr Glu Ile Cys Arg
        915                 920                 925

Arg Val Val Ala Thr Thr Gly Ser Ile Thr Asp Lys Leu Arg Glu Asp
    930                 935                 940

Trp Gln Leu Val Asp Val Met Lys Glu Leu Asn Leu Pro Lys Tyr Glu
945                 950                 955                 960

Ala Leu Gly Leu Val Glu Val Tyr Glu Asp Lys Asp Gly Arg Lys Ile
                965                 970                 975

Lys Arg Ile Lys Asp Trp Thr Lys Arg Asn Asp His Arg His His Ala
            980                 985                 990

Met Asp Ala Leu Thr Val Ala Phe  Thr Lys Asp Val Phe  Ile Gln Tyr
        995                 1000                1005

Phe Asn  Asn Lys Asn Ala Ala  Trp Glu Ser Asp Ser  Lys Glu His
    1010                1015                1020

Thr Asn  Ile Val Gly Ile Lys  Thr Arg Tyr Phe Glu  Ser Gly Lys
    1025                1030                1035

Ala Val  Pro Pro Ile Pro Leu  Gly Gln Phe Arg Val  Glu Ala Lys
    1040                1045                1050

Cys His  Leu Glu Asn Leu Leu  Val Ser Ile Lys Ala  Lys Asn Lys
    1055                1060                1065
```

```
Val Val  Thr Thr Asn Val Asn  Cys Ile Lys Lys Lys  Gly Gly Thr
    1070                1075                1080

Tyr Lys  Asn Thr Gln Gln Thr  Pro Arg Gly Gln Leu  His Leu Glu
    1085                1090                1095

Thr Ile  Tyr Gly Ser His Asn  Gln Tyr Val Thr Lys  Ile Glu Lys
    1100                1105                1110

Val Asn  Ala Ser Phe Asp Ala  Val Lys Ile Ala Thr  Val Ser Lys
    1115                1120                1125

Gln Asp  Tyr Arg Asn Ala Leu  Leu Lys Arg Leu Glu  Val Phe Gly
    1130                1135                1140

Asn Asp  Pro Lys Lys Ala Phe  Thr Gly Lys Asn Ser  Leu Glu Lys
    1145                1150                1155

Asn Pro  Ile Tyr Leu Asp Arg  Ala Gln Thr Ile Gln  Val Pro Asp
    1160                1165                1170

Lys Val  Gln Thr Val Glu Leu  Glu Thr Ala Tyr Thr  Ile Arg Lys
    1175                1180                1185

Pro Val  Asp Pro Thr Leu Asn  Val Asp Lys Val Val  Asp Lys Lys
    1190                1195                1200

Ile Arg  Leu Ile Leu Glu Gln  Arg Leu Lys Glu Tyr  Gly Gly Asp
    1205                1210                1215

Ala Lys  Lys Ala Phe Val Asn  Leu Asp Glu Asn Pro  Ile Trp Leu
    1220                1225                1230

Asn Glu  Glu Lys Gly Ile Ser  Ile Lys Arg Val Thr  Ile Arg Gly
    1235                1240                1245

Ile Ser  Lys Ala Gln Ala Leu  His Asp Lys Lys Asp  Lys Asp Gly
    1250                1255                1260
```

```
Asn Phe  Ile Leu Asp Glu Thr  Gly Lys Arg Ile Pro  Val Asp Phe
    1265                1270                1275

Val Asn  Thr Gly Asn Asn His  His Val Ala Ile Tyr  Arg Lys Pro
    1280                1285                1290

Val Leu  Asp Lys Lys Gly Gln  Val Ile Phe Asp Asp  Glu Gly Asn
    1295                1300                1305

Pro Met  Tyr Glu Leu Asp Glu  Asp Val Val Pro Phe  Phe Glu Ala
    1310                1315                1320

Val Thr  Arg Ala Asn Leu Gly  Ile Pro Ile Ile Asp  Lys Asp Tyr
    1325                1330                1335

Lys Lys  Ser Glu Gly Trp Gln  Phe Leu Phe Ser Met  Lys Gln Asn
    1340                1345                1350

Glu Tyr  Phe Val Phe Pro Asn  Glu Lys Thr Gly Phe  Asn Pro Lys
    1355                1360                1365

Glu Val  Asp Leu Leu Asp Pro  Asp Asn Tyr Ala Met  Ile Ser Pro
    1370                1375                1380

Asn Leu  Phe Arg Val Gln Lys  Ile Gly Leu Asn Asp  Tyr Thr Phe
    1385                1390                1395

Arg His  His Leu Glu Thr Thr  Ile Gln Asn Asp Leu  Lys Phe Ile
    1400                1405                1410

Thr Trp  Ile Arg Cys Gly Lys  Ser Gly Ile Lys Asp  Ile Val Lys
    1415                1420                1425

Val Arg  Ile Asn His Ile Gly  Gln Ile Val Ser Val  Gly Glu Tyr
    1430                1435                1440
```

<210> 83
<211> 984
<212> PRT
<213> Campylobacter jejuni

<400> 83

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15


Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30


Thr Lys Val Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45


Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60


Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80


Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95


Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110


Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125


Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
    130                 135                 140


Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145                 150                 155                 160


Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175
```

```
Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
```

```
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Val Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575
```

```
Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asn Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
```

```
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975
```

Arg Gln Arg Glu Asp Phe Lys Lys
980

<210> 84
<211> 1082
<212> PRT
<213> Neisseria meningitidis

<400> 84

Met Ala Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
1 5 10 15

Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Asp
20 25 30

Glu Asn Pro Ile Cys Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
35 40 45

Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Met Ala Arg Arg Leu
50 55 60

Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65 70 75 80

Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
85 90 95

Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
100 105 110

Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
115 120 125

Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
130 135 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145 150 155 160

```
Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Ile Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Val Ser Gly Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350
```

```
Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Ile Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
                485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560
```

```
Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Gly
               565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
               645                 650                 655

Phe Asp Glu Asp Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp Arg Met Arg Leu Thr
        675                 680                 685

Gly Lys Gly Lys Lys Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700

Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala Glu Asn Asp
705                 710                 715                 720

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
               725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750
```

```
Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765

Lys Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
                805                 810                 815

Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
        835                 840                 845

Ser Ala Lys Arg Leu Asp Glu Gly Val Ser Val Leu Arg Val Pro Leu
    850                 855                 860

Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Glu Arg
865                 870                 875                 880

Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
                885                 890                 895

Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910

Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Val Glu Gln Val
        915                 920                 925

Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940

Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Gly Asp Lys Tyr Tyr
945                 950                 955                 960
```

```
Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
               965                 970                 975


Arg Ala Val Val Gln Gly Lys Asp Glu Glu Asp Trp Gln Leu Ile Asp
            980                 985                 990


Asp Ser Phe Asn Phe Lys Phe Ser  Leu His Pro Asn Asp  Leu Val Glu
        995                 1000                1005


Val Ile  Thr Lys Lys Ala Arg  Met Phe Gly Tyr Phe  Ala Ser Cys
    1010                1015                1020


His Arg  Gly Thr Gly Asn Ile  Asn Ile Arg Ile His  Asp Leu Asp
    1025                1030                1035


His Lys  Ile Gly Lys Asn Gly  Ile Leu Glu Gly Ile  Gly Val Lys
    1040                1045                1050


Thr Ala  Leu Ser Phe Gln Lys  Tyr Gln Ile Asp Glu  Leu Gly Lys
    1055                1060                1065


Glu Ile  Arg Pro Cys Arg Leu  Lys Lys Arg Pro Pro  Val Arg
    1070                1075                1080


<210>  85
<211>  1021
<212>  PRT
<213>  Clostridium cellulolyticum

<400>  85

Met Lys Tyr Thr Leu Gly Leu Asp Val Gly Ile Ala Ser Val Gly Trp
1               5                   10                  15


Ala Val Ile Asp Lys Asp Asn Asn Lys Ile Ile Asp Leu Gly Val Arg
            20                  25                  30


Cys Phe Asp Lys Ala Glu Glu Ser Lys Thr Gly Glu Ser Leu Ala Thr
```

```
        35                  40                  45

Ala Arg Arg Ile Ala Arg Gly Met Arg Arg Ile Ser Arg Arg Ser
    50                  55                  60

Gln Arg Leu Arg Leu Val Lys Lys Leu Phe Val Gln Tyr Glu Ile Ile
65                  70                  75                  80

Lys Asp Ser Ser Glu Phe Asn Arg Ile Phe Asp Thr Ser Arg Asp Gly
                85                  90                  95

Trp Lys Asp Pro Trp Glu Leu Arg Tyr Asn Ala Leu Ser Arg Ile Leu
            100                 105                 110

Lys Pro Tyr Glu Leu Val Gln Val Leu Thr His Ile Thr Lys Arg Arg
        115                 120                 125

Gly Phe Lys Ser Asn Arg Lys Glu Asp Leu Ser Thr Thr Lys Glu Gly
    130                 135                 140

Val Val Ile Thr Ser Ile Lys Asn Asn Ser Glu Met Leu Arg Thr Lys
145                 150                 155                 160

Asn Tyr Arg Thr Ile Gly Glu Met Ile Phe Met Glu Thr Pro Glu Asn
                165                 170                 175

Ser Asn Lys Arg Asn Lys Val Asp Glu Tyr Ile His Thr Ile Ala Arg
            180                 185                 190

Glu Asp Leu Leu Asn Glu Ile Lys Tyr Ile Phe Ser Ile Gln Arg Lys
        195                 200                 205

Leu Gly Ser Pro Phe Val Thr Glu Lys Leu Glu His Asp Phe Leu Asn
    210                 215                 220

Ile Trp Glu Phe Gln Arg Pro Phe Ala Ser Gly Asp Ser Ile Leu Ser
225                 230                 235                 240
```

```
Lys Val Gly Lys Cys Thr Leu Leu Lys Glu Glu Leu Arg Ala Pro Thr
                245                 250                 255

Ser Cys Tyr Thr Ser Glu Tyr Phe Gly Leu Leu Gln Ser Ile Asn Asn
            260                 265                 270

Leu Val Leu Val Glu Asp Asn Asn Thr Leu Thr Leu Asn Asn Asp Gln
        275                 280                 285

Arg Ala Lys Ile Ile Glu Tyr Ala His Phe Lys Asn Glu Ile Lys Tyr
    290                 295                 300

Ser Glu Ile Arg Lys Leu Leu Asp Ile Glu Pro Glu Ile Leu Phe Lys
305                 310                 315                 320

Ala His Asn Leu Thr His Lys Asn Pro Ser Gly Asn Asn Glu Ser Lys
                325                 330                 335

Lys Phe Tyr Glu Met Lys Ser Tyr His Lys Leu Lys Ser Thr Leu Pro
            340                 345                 350

Thr Asp Ile Trp Gly Lys Leu His Ser Asn Lys Glu Ser Leu Asp Asn
        355                 360                 365

Leu Phe Tyr Cys Leu Thr Val Tyr Lys Asn Asp Asn Glu Ile Lys Asp
    370                 375                 380

Tyr Leu Gln Ala Asn Asn Leu Asp Tyr Leu Ile Glu Tyr Ile Ala Lys
385                 390                 395                 400

Leu Pro Thr Phe Asn Lys Phe Lys His Leu Ser Leu Val Ala Met Lys
                405                 410                 415

Arg Ile Ile Pro Phe Met Glu Lys Gly Tyr Lys Tyr Ser Asp Ala Cys
            420                 425                 430

Asn Met Ala Glu Leu Asp Phe Thr Gly Ser Ser Lys Leu Glu Lys Cys
```

```
        435                 440                 445

Asn Lys Leu Thr Val Glu Pro Ile Ile Glu Asn Val Thr Asn Pro Val
    450                 455                 460

Val Ile Arg Ala Leu Thr Gln Ala Arg Lys Val Ile Asn Ala Ile Ile
465                 470                 475                 480

Gln Lys Tyr Gly Leu Pro Tyr Met Val Asn Ile Glu Leu Ala Arg Glu
                485                 490                 495

Ala Gly Met Thr Arg Gln Asp Arg Asp Asn Leu Lys Lys Glu His Glu
            500                 505                 510

Asn Asn Arg Lys Ala Arg Glu Lys Ile Ser Asp Leu Ile Arg Gln Asn
        515                 520                 525

Gly Arg Val Ala Ser Gly Leu Asp Ile Leu Lys Trp Arg Leu Trp Glu
    530                 535                 540

Asp Gln Gly Gly Arg Cys Ala Tyr Ser Gly Lys Pro Ile Pro Val Cys
545                 550                 555                 560

Asp Leu Leu Asn Asp Ser Leu Thr Gln Ile Asp His Ile Tyr Pro Tyr
                565                 570                 575

Ser Arg Ser Met Asp Asp Ser Tyr Met Asn Lys Val Leu Val Leu Thr
            580                 585                 590

Asp Glu Asn Gln Asn Lys Arg Ser Tyr Thr Pro Tyr Glu Val Trp Gly
        595                 600                 605

Ser Thr Glu Lys Trp Glu Asp Phe Glu Ala Arg Ile Tyr Ser Met His
    610                 615                 620

Leu Pro Gln Ser Lys Glu Lys Arg Leu Leu Asn Arg Asn Phe Ile Thr
625                 630                 635                 640
```

```
Lys Asp Leu Asp Ser Phe Ile Ser Arg Asn Leu Asn Asp Thr Arg Tyr
               645                 650                 655

Ile Ser Arg Phe Leu Lys Asn Tyr Ile Glu Ser Tyr Leu Gln Phe Ser
            660                 665                 670

Asn Asp Ser Pro Lys Ser Cys Val Val Cys Val Asn Gly Gln Cys Thr
        675                 680                 685

Ala Gln Leu Arg Ser Arg Trp Gly Leu Asn Lys Asn Arg Glu Glu Ser
    690                 695                 700

Asp Leu His His Ala Leu Asp Ala Ala Val Ile Ala Cys Ala Asp Arg
705                 710                 715                 720

Lys Ile Ile Lys Glu Ile Thr Asn Tyr Tyr Asn Glu Arg Glu Asn His
               725                 730                 735

Asn Tyr Lys Val Lys Tyr Pro Leu Pro Trp His Ser Phe Arg Gln Asp
            740                 745                 750

Leu Met Glu Thr Leu Ala Gly Val Phe Ile Ser Arg Ala Pro Arg Arg
        755                 760                 765

Lys Ile Thr Gly Pro Ala His Asp Glu Thr Ile Arg Ser Pro Lys His
    770                 775                 780

Phe Asn Lys Gly Leu Thr Ser Val Lys Ile Pro Leu Thr Thr Val Thr
785                 790                 795                 800

Leu Glu Lys Leu Glu Thr Met Val Lys Asn Thr Lys Gly Gly Ile Ser
               805                 810                 815

Asp Lys Ala Val Tyr Asn Val Leu Lys Asn Arg Leu Ile Glu His Asn
            820                 825                 830

Asn Lys Pro Leu Lys Ala Phe Ala Glu Lys Ile Tyr Lys Pro Leu Lys
```

```
        835                 840                 845

Asn Gly Thr Asn Gly Ala Ile Ile Arg Ser Ile Arg Val Glu Thr Pro
    850                 855                 860

Ser Tyr Thr Gly Val Phe Arg Asn Glu Gly Lys Gly Ile Ser Asp Asn
865                 870                 875                 880

Ser Leu Met Val Arg Val Asp Val Phe Lys Lys Lys Asp Lys Tyr Tyr
                885                 890                 895

Leu Val Pro Ile Tyr Val Ala His Met Ile Lys Lys Glu Leu Pro Ser
            900                 905                 910

Lys Ala Ile Val Pro Leu Lys Pro Glu Ser Gln Trp Glu Leu Ile Asp
        915                 920                 925

Ser Thr His Glu Phe Leu Phe Ser Leu Tyr Gln Asn Asp Tyr Leu Val
    930                 935                 940

Ile Lys Thr Lys Lys Gly Ile Thr Glu Gly Tyr Tyr Arg Ser Cys His
945                 950                 955                 960

Arg Gly Thr Gly Ser Leu Ser Leu Met Pro His Phe Ala Asn Asn Lys
                965                 970                 975

Asn Val Lys Ile Asp Ile Gly Val Arg Thr Ala Ile Ser Ile Glu Lys
            980                 985                 990

Tyr Asn Val Asp Ile Leu Gly Asn  Lys Ser Ile Val Lys  Gly Glu Pro
        995                 1000                1005

Arg Arg  Gly Met Glu Lys Tyr  Asn Ser Phe Lys Ser  Asn
    1010                1015                1020

<210>  86
<211>  1131
<212>  PRT
```

<213> Acidovorax ebreus

<400> 86

```
Met Ala Gln His Val Phe Gly Leu Asp Ile Gly Ile Ala Ser Val Gly
1               5                  10                  15


Trp Ala Ile Leu Gly Glu Gln Arg Ile Ile Asp Leu Gly Val Arg Cys
            20                  25                  30


Phe Asp Lys Ala Glu Thr Ala Lys Glu Gly Asp Pro Leu Asn Leu Thr
        35                  40                  45


Arg Arg Gln Ala Arg Leu Leu Arg Arg Arg Leu Tyr Arg Arg Ala Trp
    50                  55                  60


Arg Leu Thr Gln Leu Ser Arg Leu Leu Lys Arg Lys Gly Leu Ile Ala
65                  70                  75                  80


Asp Ala Lys Leu Phe Ala Lys Ala Pro Ser Tyr Gly Asp Ser Ala Trp
                85                  90                  95


Glu Leu Arg Arg Gln Gly Leu Asp Arg Leu Leu Thr Pro Leu Glu Trp
            100                 105                 110


Ala Arg Val Ile Tyr His Gln Cys Lys His Arg Gly Phe His Trp Thr
        115                 120                 125


Ser Lys Ala Glu Glu Ala Lys Ala Asp Ser Asp Ala Glu Gly Gly Arg
    130                 135                 140


Val Lys Gln Gly Leu Ala His Thr Lys Ala Leu Met Gln Ala Lys Asn
145                 150                 155                 160


Tyr Arg Ser Ala Ala Glu Met Val Leu Ala Glu Phe Pro Asp Ala Gln
                165                 170                 175


Arg Asn Lys Arg Gly Gln Tyr Asp Lys Ala Leu Ser Arg Val Leu Leu
            180                 185                 190
```

```
Gly Glu Glu Leu Ala Leu Leu Phe Ala Thr Gln Arg Arg Leu Gly Asn
        195                 200                 205

Pro His Ala Ser Asp Phe Phe Glu Lys Leu Ile Leu Gly Asp Gly Asp
    210                 215                 220

Arg Lys Ser Gly Leu Phe Trp Gln Gln Lys Pro Ala Leu Ser Gly Ala
225                 230                 235                 240

Asp Leu Leu Lys Met Leu Gly Lys Cys Thr Phe Glu Lys Gly Glu Tyr
                245                 250                 255

Arg Ala Pro Lys Ala Ser Phe Ser Val Glu Arg His Val Trp Leu Thr
            260                 265                 270

Arg Leu Asn Asn Leu Arg Ile Val Val Asp Gly Arg Ser Arg Pro Leu
        275                 280                 285

Asn Glu Ala Glu Arg Gln Ala Ala Leu Leu Leu Pro Tyr Gln Thr Glu
    290                 295                 300

Thr Ser Lys Tyr Lys Thr Leu Lys Asn Ala Phe Ile Lys Ala Gly Leu
305                 310                 315                 320

Trp Gly Asp Gly Val Arg Phe Gly Gly Leu Ala Tyr Pro Ser Gln Ala
                325                 330                 335

Gln Ile Asp Ala Glu Lys Thr Lys Asp Pro Glu Asp Gln Phe Leu Val
            340                 345                 350

Lys Leu Pro Ala Trp His Glu Leu Arg Lys Ala Phe Lys Ala Ala Gly
        355                 360                 365

His Glu Ala Leu Trp Gln Gln Ile Ser Thr Pro Ala Leu Asp Gly Asp
    370                 375                 380
```

```
Pro Thr Leu Leu Asp Gln Ile Ala Thr Val Leu Ser Val Tyr Lys Asp
385                 390                 395                 400

Gly Ala Glu Val Val Gln Gln Leu Arg Gln Leu Ala Leu Pro Glu Pro
                405                 410                 415

Ala Ala Ser Ile Ala Val Leu Glu Lys Ile Ser Phe Asp Lys Phe Ser
            420                 425                 430

Ser Leu Ser Leu Lys Ala Leu Arg Arg Ile Val Pro Leu Met Gln Ser
        435                 440                 445

Gly Leu Arg Tyr Asp Glu Ala Val Ala Gln Ile Pro Glu Tyr Gly His
    450                 455                 460

His Ser Gln Arg Ile Glu Pro Gly Ala Ala Lys His Leu Tyr Leu Pro
465                 470                 475                 480

Pro Phe Tyr Glu Ala Gln Arg Lys Tyr Ala Gly Lys Gly Asp His Ile
                485                 490                 495

Gly Ser Met Gln Phe Arg Asp Asp Ala Asp Ile Pro Arg Asn Pro Val
            500                 505                 510

Val Leu Arg Ala Leu Asn Gln Ala Arg Lys Val Val Asn Ala Leu Ile
        515                 520                 525

Arg Glu Tyr Gly Ser Pro Ile Ala Val Asn Ile Glu Met Ala Arg Asp
    530                 535                 540

Leu Ser Arg Pro Leu Asp Glu Arg Asn Lys Val Lys Arg Ala Gln Glu
545                 550                 555                 560

Glu Phe Arg Asp Arg Asn Asp Arg Ala Arg Ser Glu Phe Glu Arg Asp
                565                 570                 575

Phe Gly Tyr Lys Pro Lys Ala Ala Ala Phe Glu Lys Trp Met Leu Tyr
            580                 585                 590
```

```
Arg Glu Gln Leu Gly Gln Cys Ala Tyr Ser Gln Gln Pro Leu Asp Ile
        595                 600                 605

Gln Arg Val Leu Asp Asp His Asn Tyr Ala Gln Val Asp His Ala Leu
    610                 615                 620

Pro Tyr Ser Arg Ser Tyr Asp Asp Ser Lys Asn Asn Lys Val Leu Val
625                 630                 635                 640

Leu Thr His Glu Asn Gln Asn Lys Gly Asn Arg Thr Ala Phe Glu Tyr
                645                 650                 655

Leu Thr Ser Phe Pro Asp Gly Glu Asp Gly Glu Arg Trp Arg Thr Phe
            660                 665                 670

Val Ala Trp Val Gln Gly Asn Lys Ala Tyr Arg Met Ala Lys Arg Asn
        675                 680                 685

Arg Leu Leu Arg Lys Asn Tyr Gly Val Asp Glu Ser Lys Gly Phe Ile
    690                 695                 700

Asp Arg Asn Leu Asn Asp Thr Arg Tyr Ile Cys Lys Phe Phe Lys Asn
705                 710                 715                 720

Tyr Val Glu Glu His Leu Gln Leu Ala Ala Arg Ala Asp Gly Asp Thr
                725                 730                 735

Ala Arg Arg Cys Val Val Val Asn Gly Gln Leu Thr Ala Phe Leu Arg
            740                 745                 750

Ala Arg Trp Gly Leu Thr Lys Val Arg Gly Asp Ser Asp Arg His His
        755                 760                 765

Ala Leu Asp Ala Ala Val Val Ala Ala Cys Thr His Gly Met Val Lys
    770                 775                 780
```

```
Ala Leu Ala Asp Tyr Ser Arg Arg Lys Glu Ile Ser Phe Leu Gln Glu
785                 790                 795                 800

Gly Phe Pro Asp Pro Glu Thr Gly Glu Ile Leu Asn Pro Ala Ala Phe
                805                 810                 815

Asp Arg Ala Arg Gln His Phe Pro Glu Pro Trp Thr His Phe Ala His
            820                 825                 830

Glu Leu Lys Ala Arg Leu Phe Thr Asp Asp Leu Ala Ala Leu Arg Glu
        835                 840                 845

Asp Met Gln Arg Leu Gly Ser Tyr Thr Thr Glu Asp Leu Gly Arg Leu
    850                 855                 860

Arg Thr Leu Phe Val Ser Arg Ala Pro Gln Arg Arg Ser Gly Gly Ala
865                 870                 875                 880

Val His Lys Glu Thr Ile Tyr Ala Gln Pro Glu Ser Leu Lys Gln Gln
                885                 890                 895

Gly Gly Val Ile Glu Lys Ile Leu Leu Thr Ser Leu Lys Leu Gln Asp
            900                 905                 910

Phe Asp Lys Leu Leu Asn Pro Glu Ser Asn Asp His Phe Val Glu Pro
        915                 920                 925

His Arg Asn Glu Arg Leu Tyr Ala Ala Ile Arg Gln Arg Leu Glu Gln
    930                 935                 940

Phe Gly Gly Arg Ala Asp Lys Ala Phe Gly Pro Asp Asn Leu Phe His
945                 950                 955                 960

Lys Pro Asp Lys Asn Asn Gln Pro Thr Gly Pro Val Val Arg Ser Ile
                965                 970                 975

Lys Leu Val Arg Gly Lys Gln Thr Gly Ile Pro Ile Arg Gly Gly Leu
            980                 985                 990
```

```
Ala Lys Asn Asp Ser Met Leu Arg  Val Asp Ile Phe Thr  Lys Ala Gly
        995                 1000                1005


Lys Phe  His Leu Val Pro Val  Tyr Val His His Arg  Val Thr Gly
    1010                1015                1020


Leu Pro  Asn Arg Ala Ile Val  Ala Phe Lys Asp Glu  Asp Glu Trp
    1025                1030                1035


Thr Leu  Ile Asp Glu Ser Phe  Ala Phe Leu Phe Ser  Val Tyr Pro
    1040                1045                1050


Asn Asp  Tyr Val Lys Val Thr  Leu Lys Lys Glu Gln  Gln Ser Gly
    1055                1060                1065


Tyr Tyr  Ser Gly Ala Asp Arg  Ser Thr Gly Ala Met  Asn Leu Trp
    1070                1075                1080


Ala His  Asp Arg Ala Ala Ser  Val Gly Lys Asp Gly  Leu Ile Arg
    1085                1090                1095


Gly Ile  Gly Val Lys Thr Ala  Leu Ser Val Glu Lys  Phe Asn Val
    1100                1105                1110


Asp Val  Leu Gly Arg Ile Tyr  Leu Ala Pro Pro Glu  Thr Arg Ser
    1115                1120                1125


Gly Leu  Ala
    1130
```

<210> 87
<211> 1122
<212> PRT
<213> Streptococcus suis

<400> 87

```
Met Ser Asn Gly Lys Ile Leu Gly Leu Asp Ile Gly Ile Ala Ser Val
```

```
1               5                   10                  15

Gly Val Gly Val Ile Asp Ala Gln Thr Gly Glu Ile Ile His Ala Ser
            20                  25                  30

Ser Arg Ile Phe Pro Ser Ala Asn Ala Ala Asn Asn Ala Glu Arg Arg
        35                  40                  45

Thr Phe Arg Gly Ser Arg Arg Leu Ile Arg Arg Lys Lys His Arg Ile
    50                  55                  60

Lys Arg Leu Asp Asp Leu Phe Asn Asp Phe His Ile Asn Leu Asp Gly
65                  70                  75                  80

Glu Met Ser Thr Asp Asn Pro Tyr Val Leu Arg Val Lys Gly Leu Ser
                85                  90                  95

Gln Lys Leu Thr Val Glu Glu Leu Tyr Ile Ser Ile Lys Asn Ile Met
            100                 105                 110

Lys Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Glu Ser Asp Asn Glu
        115                 120                 125

Ala Gly Arg Ser Asp Tyr Ala Lys Ala Ile Glu Arg Asn Arg Gln Leu
    130                 135                 140

Leu Thr Ser Lys Thr Pro Gly Glu Ile Gln Leu Glu Arg Leu Glu Lys
145                 150                 155                 160

Tyr Gly Gln Leu Arg Gly Asn Phe Thr Ile Ile Asp Glu Glu Gly Gln
                165                 170                 175

Ser Gln Gln Ile Ile Asn Val Phe Ser Thr Ser Asp Tyr Val Lys Glu
            180                 185                 190

Val Glu Lys Ile Leu Asp Cys Gln Lys Met Tyr His Lys Phe Ile Ser
        195                 200                 205
```

```
Asp Glu Phe Cys Asp Lys Leu Ile Glu Leu Leu Arg Glu Lys Arg Lys
    210                 215                 220

Tyr Tyr Val Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Ile
225                 230                 235                 240

Tyr Arg Thr Asp Gly Thr Thr Leu Glu Asn Leu Phe Gly Ile Leu Ile
                245                 250                 255

Gly Lys Cys Thr Phe Tyr Pro Asp Gln Tyr Arg Ser Ser Arg Ala Ser
            260                 265                 270

Tyr Thr Ala Gln Glu Phe Asn Phe Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285

Val Pro Thr Glu Thr Lys Lys Leu Ser Gln Glu Gln Lys Glu Phe Leu
    290                 295                 300

Val Asn Tyr Ala Lys Glu Thr Ser Val Leu Gly Ala Gly Lys Ile Leu
305                 310                 315                 320

Gln Gln Ile Ala Lys Leu Ala Asp Cys Lys Val Glu Asp Ile Arg Gly
                325                 330                 335

Tyr Arg Leu Asp Asn Lys Asp Lys Pro Glu Leu His Thr Phe Glu Thr
            340                 345                 350

Tyr Arg Ala Met Lys Gly Leu Val Pro Leu Val Asp Ile Gly Val Leu
        355                 360                 365

Ser Arg Glu Gln Leu Asp Ile Leu Ala Asp Ile Leu Thr Leu Asn Thr
    370                 375                 380

Asp Phe Glu Gly Ile Arg Glu Ala Leu Lys Lys Gln Leu Pro Asn Val
385                 390                 395                 400

Phe Asp Glu Lys Gln Val Lys Gly Leu Ala Ser Phe Arg Lys Ser Lys
```

```
                405                 410                 415

Ser Gln Leu Phe Ala Lys Gly Trp His Asn Leu Ser Gln Lys Ile Met
            420                 425                 430

Leu Glu Val Ile Pro Glu Leu Tyr Ala Thr Ser Asp Glu Gln Met Thr
        435                 440                 445

Ile Leu Thr Arg Leu Gly Lys Phe Glu Lys Ser Ser Val Ala Glu Tyr
    450                 455                 460

Pro Ser Ser Ile Asn Val Asp Glu Ile Thr Asp Glu Ile Tyr Asn Pro
465                 470                 475                 480

Val Val Ala Lys Ser Ile Arg Gln Thr Ile Lys Ile Ile Asn Ala Ser
                485                 490                 495

Ile Lys Lys Trp Gly Glu Phe Asp Gln Ile Val Ile Glu Met Pro Arg
            500                 505                 510

Asp Arg Asn Glu Asp Glu Glu Lys Lys Arg Ile Ala Asp Gly Gln Lys
        515                 520                 525

Ala Asn Ala Lys Glu Lys Ala Asp Ser Ile Leu Arg Ala Ala Glu Leu
    530                 535                 540

Tyr Cys Ala Gly Lys Val Leu Pro Asp Tyr Val Tyr Asn Gly His Asn
545                 550                 555                 560

Gln Leu Ala Thr Lys Ile Arg Leu Trp Tyr Gln Gln Gly Glu Arg Cys
                565                 570                 575

Ile Tyr Thr Gly Gln Pro Ile Ser Ile His Asp Leu Ile His Asn Gln
            580                 585                 590

Asn Gln Tyr Glu Ile Asp His Ile Leu Pro Leu Ser Leu Thr Phe Asp
        595                 600                 605
```

```
Asp Ser Leu Ser Asn Lys Val Leu Val Leu Ala Thr Ala Asn Gln Glu
    610                 615                 620

Lys Ala Gln Arg Thr Pro Tyr Asn Tyr Leu Lys Ser Ala Thr Ser Ala
625                 630                 635                 640

Trp Ser Tyr Arg Glu Phe Lys Asp Tyr Val Thr Lys Arg Lys Gly Ile
                645                 650                 655

Gly Lys Lys Lys Cys Glu Tyr Leu Thr Phe Glu Glu Asp Ile Asn Gly
            660                 665                 670

Phe Glu Val Arg Ser Lys Phe Ile Gln Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Ala Ser Lys Val Ile Leu Asn Ala Leu Gln Asp Tyr Phe Lys Ile
    690                 695                 700

Ser Gly Ile Gln Thr Lys Val Ser Val Val Arg Gly Gln Phe Thr Ser
705                 710                 715                 720

Gln Leu Arg His Lys Trp Gly Ile Glu Lys Thr Arg Glu Thr Tyr His
                725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Arg
            740                 745                 750

Leu Trp Lys Lys Gln Glu Ser Pro Leu Val Val Asp Tyr Gln Glu Gly
        755                 760                 765

Arg Gln Val Asp Leu Glu Thr Gly Glu Ile Leu Glu Leu Thr Asp Glu
    770                 775                 780

Gln Tyr Lys Glu Leu Val Tyr Gln Pro Pro Tyr Gln Gly Phe Val Asn
785                 790                 795                 800

Thr Ile Ser Ser Ser Ala Phe Asp Asn Glu Ile Leu Phe Ser Tyr Gln
```

```
                805                 810                 815

Val Asp Ser Lys Val Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala
            820                 825                 830

Thr Arg Asn Ala Gln Leu Gly Lys Asp Lys Thr Glu Gly Ile Tyr Val
        835                 840                 845

Leu Gly Lys Ile Lys Asp Ile Tyr Thr Gln Ala Gly Tyr Glu Ala Phe
    850                 855                 860

Leu Lys Arg Tyr Thr Lys Asp Lys Thr Ser Phe Leu Met Tyr His Lys
865                 870                 875                 880

Asp Leu Asp Thr Trp Glu Lys Val Ile Glu Ile Ile Leu Arg Asp Tyr
                885                 890                 895

Arg Glu Tyr Asp Glu Lys Gly Lys Glu Ile Gly Asn Pro Phe Glu Arg
            900                 905                 910

Tyr Arg Arg Glu Asn Gly Tyr Val Lys Lys Tyr Ser Arg Lys Gly Asn
        915                 920                 925

Gly Thr Ala Ile Lys Ser Leu Lys Tyr Tyr Asp Asn Lys Leu Gly Asn
    930                 935                 940

His Ile Asp Ile Thr Pro Glu Asn Ser Arg Asn Ala Val Val Leu Gln
945                 950                 955                 960

Ser Leu Lys Pro Trp Arg Thr Asp Val Tyr Phe Asn Lys Glu Thr Gly
                965                 970                 975

Lys Tyr Glu Phe Leu Gly Ile Lys Tyr Ser Asp Leu Ser Phe Glu Lys
            980                 985                 990

Gly Thr Gly Glu Tyr Gly Ile Ser  Gln Glu Lys Tyr Asp  Ser Ile Lys
        995                 1000                1005
```

```
Ile Ala  Glu Gly Val Ala Lys  Lys Ser Ile Phe Lys  Phe Thr Leu
    1010                1015                1020


Tyr Lys  Gln Asp Leu Leu Phe  Ile Lys Asp Ile Glu  Asn Asn Phe
    1025                1030                1035


Gly Lys  Leu Leu Arg Phe Thr  Ser Lys Asn Asp Thr  Ser Lys His
    1040                1045                1050


Tyr Val  Glu Leu Lys Pro Tyr  Asp Lys Asn Lys Phe  Gly Thr Glu
    1055                1060                1065


Glu Pro  Leu Leu Pro Val Leu  Gly Asn Val Ala Lys  Ser Gly Gln
    1070                1075                1080


Cys Ile  Lys Gly Leu Asn Lys  Ser Asn Ile Ser Ile  Tyr Lys Val
    1085                1090                1095


Arg Thr  Asp Ile Leu Gly Tyr  Arg His Phe Ile Lys  Gln Glu Gly
    1100                1105                1110


Glu His  Pro Gln Leu Lys Phe  Lys Lys
    1115                1120


<210>  88
<211>  1509
<212>  PRT
<213>  Bacteroides coprophilus

<400>  88

Met Lys Lys Thr Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Val Ile Asn Ser Asn Ile Asp Ser Glu Gly Lys Glu Lys Leu Val
            20                  25                  30


Gly Ile Ser Ser Cys Gly Ser Arg Ile Ile Pro Met Asp Ala Thr Thr
        35                  40                  45
```

```
Leu Gly Asp Phe Gly Lys Gly Asn Thr Lys Ser Pro Val Ala Glu Arg
    50                  55                  60

Thr Arg Leu Arg Gly Ile Arg Arg Leu Leu Glu Arg Ser Leu Leu Arg
65                  70                  75                  80

Arg Glu Arg Leu His Arg Val Leu Ser Val Met Gly Phe Leu Pro Glu
                85                  90                  95

His Tyr Ala Ser Gln Leu Asp Arg Tyr Gly Lys Phe Leu Pro Glu Thr
            100                 105                 110

Glu Pro Lys Leu Ala Trp Tyr Lys Asp Asp Ser Gly Arg Tyr Gln Phe
        115                 120                 125

Leu Phe Gln Lys Ser Phe His Glu Met Leu Glu Asp Phe Arg Gln His
    130                 135                 140

Gln Pro Glu Leu Val Ala Gly Glu Lys Lys Ile Pro Tyr Asp Trp Thr
145                 150                 155                 160

Ile Tyr Tyr Leu Arg Lys Lys Ala Leu Ser Gln Glu Ile Thr Lys Glu
                165                 170                 175

Glu Leu Ala Trp Ile Leu Leu Asn Phe Asn Gln Lys Arg Gly Tyr Tyr
            180                 185                 190

Gln Leu Arg Gly Glu Glu Glu Gln Glu Glu Asn Asn Lys Ser Val Glu
        195                 200                 205

Tyr His Ala Leu Lys Val Val Ser Val Glu Asp Ser Gly Glu Arg Lys
    210                 215                 220

Gly Lys Asp Ile Trp Tyr Asn Val Thr Leu Glu Asn Gly Trp Val Tyr
225                 230                 235                 240
```

```
Arg Arg Ala Ser Asn Ile Pro Leu Asp Trp Thr Gly Lys Val Lys Glu
                245                 250                 255

Phe Val Val Thr Thr Glu Leu Asp Asp Ala Gly Asn Pro Lys Lys Asp
            260                 265                 270

Lys Glu Gly Asn Val Lys Arg Ser Phe Arg Ala Pro Lys Glu Asp Asp
        275                 280                 285

Trp Gly Leu Leu Lys Thr Arg Thr Gln Ala Gln Ile Asp Glu Ser Gly
    290                 295                 300

Lys Thr Val Gly Thr Tyr Ile Tyr Glu Ser Leu Leu Cys Met Pro Asn
305                 310                 315                 320

Gln Lys Ile Arg Gly Lys Leu Val Arg Thr Ile Glu Arg Lys Tyr Tyr
                325                 330                 335

Lys Asp Glu Leu Arg Gln Ile Leu Val Lys Gln Ser Glu Phe His Ala
            340                 345                 350

Ala Leu Gln Asp His Asn Leu Leu Leu Ser Cys Ile Glu Glu Leu Tyr
        355                 360                 365

Pro Asn Asn Glu Ala His Arg Arg Leu Leu Ser Ala Ser Ser Phe Ile
    370                 375                 380

Tyr Phe Leu Ile Glu Asp Ile Leu Phe Tyr Gln Arg Pro Leu Lys Ser
385                 390                 395                 400

Gln Lys Gly Leu Ile Asp Asn Cys Pro Tyr Glu Ser His Ile Tyr Lys
                405                 410                 415

Asp Lys Lys Asp Gly Ser Leu His His Val Pro Leu Lys Cys Val Ser
            420                 425                 430

Lys Ser His Pro Leu Phe Gln Glu Phe Arg Leu Trp Gln Phe Leu Ser
        435                 440                 445
```

```
Asn Leu Arg Ile Tyr Gln Arg Glu Arg Met Met Asp Gly Ser Leu Lys
    450                 455                 460

Leu Asp Val Asp Val Thr Arg Glu Phe Leu Pro Ser Glu Glu Asp Tyr
465                 470                 475                 480

Val Lys Leu Phe Asp Trp Leu Asn Glu Arg Lys Glu Ile Ser Gln Lys
                485                 490                 495

Phe Leu Leu Ala Tyr Lys Pro Phe Gly Leu Lys Lys Asn Glu Gln Ala
            500                 505                 510

Asn Tyr Arg Trp Asn Tyr Val Glu Asp Lys Ser Tyr Pro Cys Asn Glu
        515                 520                 525

Thr Arg Ala Glu Ile Lys Ser Arg Leu Ser Lys Ala Gly Val Pro Glu
    530                 535                 540

Glu Phe Leu Thr Glu Glu Lys Glu Glu Ala Leu Trp His Ile Leu Tyr
545                 550                 555                 560

Ser Ile Ser Asp Lys Lys Glu Leu Thr Lys Ala Leu Gly Thr Phe Ala
                565                 570                 575

Ala Lys Asn Cys Leu Asn Glu Ser Phe Val Glu Val Phe Ala Lys Ile
            580                 585                 590

Pro Pro Phe Glu Ser Asn Tyr Ala Ala Tyr Ser Leu Lys Ala Ile Arg
        595                 600                 605

Lys Leu Leu Ala Leu Met Arg Met Gly Lys Tyr Trp Asn Glu Gln Ala
    610                 615                 620

Ile Asp Arg Gln Thr Arg Asp Arg Ile Glu Lys Ile Leu Thr Gly Glu
625                 630                 635                 640
```

```
Tyr Asp Glu Thr Ile Arg Ser Arg Val Arg Glu Lys Ala Met Leu Leu
                645                 650                 655

Thr Asp Ile Ser Ser Phe Arg Gly Leu Pro Leu Trp Leu Ala Cys Tyr
            660                 665                 670

Ile Val Tyr Asp Arg His Ser Glu Ser Lys Glu Leu Val Lys Trp Glu
        675                 680                 685

Thr Pro Ala Asp Ile Asp His Phe Leu Ser Lys Phe Lys Gln Asn Ser
    690                 695                 700

Leu Arg Asn Pro Ile Val Glu Gln Val Ile Thr Glu Ser Leu Arg Thr
705                 710                 715                 720

Val Arg Asp Ile Trp Lys Gln Glu Gly Lys Ile Asp Glu Ile His Val
                725                 730                 735

Glu Leu Gly Arg Glu Met Lys Asn Pro Ala Lys Glu Arg Ala Arg Ile
            740                 745                 750

Thr Ala Gln Val Gln Glu Asn Glu Asn Thr Asn Leu Arg Ile Lys Ala
        755                 760                 765

Leu Leu Ala Glu Phe Met Asn Pro Glu Phe Glu Ile Glu Asn Val His
    770                 775                 780

Pro Tyr Ser Pro Gly Gln Gln Glu Ile Leu Arg Ile Tyr Glu Asp Gly
785                 790                 795                 800

Val Leu Ser Gly Ile Ala Glu Lys Asp Leu Pro Asp Asp Ile Thr Ala
                805                 810                 815

Ile Leu Lys Lys Phe Arg Glu Asn Asp Val Lys Lys Arg Pro Thr Thr
            820                 825                 830

Ser Glu Val Leu Arg Tyr Lys Leu Trp Leu Glu Gln Arg Tyr Arg Ser
        835                 840                 845
```

```
Pro Tyr Thr Gly Arg Val Ile Pro Leu Gly Lys Leu Phe Thr Pro Ala
    850                 855                 860

Tyr Glu Ile Glu His Val Ile Pro Gln Ser Arg Tyr Phe Asp Asp Ser
865                 870                 875                 880

Ile Ser Asn Lys Val Ile Cys Glu Ser Ala Val Asn Lys Leu Lys Asp
                885                 890                 895

Asn Cys Leu Gly Tyr Glu Phe Ile Lys Lys His Ser Gly Glu Met Val
            900                 905                 910

Glu Leu Gly Asn Gly Glu Thr Val Pro Val Phe Ser Val Glu Glu Tyr
        915                 920                 925

Glu Arg Phe Val Lys Glu Ser Tyr Phe Gly Asn Ser Lys Lys Met Lys
    930                 935                 940

Lys Leu Leu Leu Glu Asp Ile Pro Asp Ser Phe Ile Glu Arg Gln Leu
945                 950                 955                 960

Asn Asp Ser Arg Tyr Ile Ser Arg Val Val Thr Ser Leu Leu Ser Asn
                965                 970                 975

Leu Val Cys Glu Glu Gly Glu Gln Asp Gly Leu Ser Lys Asn Val Ile
            980                 985                 990

Val Cys Thr Gly Gly Ile Thr Asp  Arg Leu Lys Lys Asp  Trp Gly Val
        995                 1000                1005

Gln Glu  Val Trp Asn Arg Ile  Ile Leu Pro Arg Phe  Leu Arg Leu
    1010                1015                1020

Asn Glu  Ile Thr Gly Arg Thr  Asp Phe Thr Ser Thr  Ser Val Asn
    1025                1030                1035
```

```
Gly His  Leu Leu Pro Ala Leu  Pro Leu Tyr Leu Gln  Lys Gly Phe
    1040                1045                1050

Asn Lys  Lys Arg Ile Asp His  Arg His His Ala Met  Asp Ala Ile
    1055                1060                1065

Val Ile  Ala Cys Ala Asn Arg  Asn Ile Val Asn Tyr  Leu Asn Asn
    1070                1075                1080

Ser Ser  Ala Arg Lys Asn Ser  Glu Ile Ser Arg Tyr  Asp Leu Gln
    1085                1090                1095

Arg Leu  Leu Cys Glu Lys Val  Lys Thr Asp Ala Asn  Gly Asn Tyr
    1100                1105                1110

Lys Trp  Ile Leu Arg Lys Pro  Trp Glu Thr Phe Thr  Gln Asp Val
    1115                1120                1125

Tyr Ala  Ala Leu Thr Asn Ile  Val Val Ser Phe Lys  Gln Asn Leu
    1130                1135                1140

Arg Val  Ile Asn Arg Thr Thr  Asn Tyr Tyr Gln His  Tyr Asn Glu
    1145                1150                1155

Ala Gly  Glu Lys Arg Met Ile  Pro Gln Thr Lys Gly  Asp Arg Trp
    1160                1165                1170

Ala Ile  Arg Lys Pro Met His  Lys Asp Thr Val Tyr  Gly Glu Val
    1175                1180                1185

Asn Leu  Arg Lys Glu Lys Thr  Leu Pro Leu Arg Asp  Val Val Lys
    1190                1195                1200

Asn Pro  Ser Ile Val Val Asp  Lys Ser Leu Lys Asn  Lys Leu Tyr
    1205                1210                1215

Glu Leu  Leu Lys Ser Gln Tyr  Asp Leu Lys Ala Ile  Ala Lys Tyr
    1220                1225                1230
```

```
Phe Glu  Thr His Gln Asp Val  Trp Ala Asp Val Asn  Leu Lys Lys
    1235                1240                1245

Ile Lys  Val Tyr Tyr Phe Thr  Lys Glu Thr Asn Glu  Arg Phe Phe
    1250                1255                1260

Ala Thr  Arg Lys Ser Leu Asp  Pro Ser Phe Asp Gln  Lys Lys Ile
    1265                1270                1275

Glu Glu  Glu Val Thr Asp Thr  Gly Val Gln Lys Ile  Leu Leu His
    1280                1285                1290

His Leu  Gln Gln Asn Asn Asn  Asp Pro Asp Met Ala  Phe Ser Pro
    1295                1300                1305

Asp Gly  Ile Asp Arg Met Asn  Gln Asn Met Thr Ile  Leu Asn Asp
    1310                1315                1320

Gly Lys  Trp His Gln Pro Ile  Tyr Lys Val Arg Thr  Tyr Glu Lys
    1325                1330                1335

Ala Asp  Lys Phe Ala Val Gly  Glu Ser Gly Asn Lys  Ala Lys Lys
    1340                1345                1350

Phe Val  Glu Ala Ala Lys Gly  Thr Asn Leu Phe Phe  Ala Val Tyr
    1355                1360                1365

Glu Ser  Val Gln Glu Asp Glu  Ala Ile Gly Lys Gln  Val Cys Lys
    1370                1375                1380

Arg Thr  Phe Ala Thr Ile Pro  Leu Asn Glu Val Ile  Lys Arg Lys
    1385                1390                1395

Lys Gln  Gly Leu Pro Ala Ala  Pro Glu Asp Leu Asn  Gly Asn Leu
    1400                1405                1410
```

```
Pro Lys  Phe Val Leu Ser Pro  Asn Asp Leu Val Tyr  Leu Pro Thr
    1415                 1420                 1425


Glu Glu  Glu Arg Asn Ser Ser  Arg Ile Ile Gln Pro  Leu Asp Arg
    1430                 1435                 1440


Glu Arg  Ile Tyr Lys Met Val  Ser Ser Ser Gly Ser  Gln Cys Phe
    1445                 1450                 1455


Phe Ile  Lys Val Phe Val Ala  Asn Ser Ile Trp Asp  Lys Asn Glu
    1460                 1465                 1470


Tyr Ser  Ser Leu Asn Lys Met  Glu Arg Ala Ile Thr  Asn Glu Met
    1475                 1480                 1485


Ile Lys  Glu Ile Cys Val Pro  Ile Lys Ile Asp Arg  Leu Gly Asn
    1490                 1495                 1500


Val Ser  Leu Ile Gln Ile
    1505
```

<210> 89
<211> 1219
<212> PRT
<213> Bacteroides cellulosilyticus

<400> 89

```
Met Lys Glu Glu Val Arg Gly Lys Asn Arg Ser Gln Thr Trp Ala Ile
1               5                   10                  15


Leu Ala Lys Phe Phe Val Trp Ser Glu Lys Glu Ser Val Trp Asn Glu
            20                  25                  30


Lys Glu Ala Arg Thr Glu Glu Arg Val Lys Glu Tyr Lys Leu Val Gly
        35                  40                  45


Leu Lys Arg Asp Thr Lys Gly Asn Glu Leu Lys Leu Glu Asn Tyr Arg
    50                  55                  60
```

```
Trp Arg Val Gln Ala Leu Ser Glu Gln Leu Asn Pro Glu Ile Val Ala
65                  70                  75                  80

Ile Val Leu Gln Glu Ile Asn Gly Gln Ile Ser Ala Ser Ser Gly Tyr
                85                  90                  95

Leu Gly Ala Ile Ser Asp Arg Ser Lys Gln Leu Tyr Phe Asn Arg Gln
            100                 105                 110

Thr Val Gly Gln Tyr Leu Met Ser Glu Leu Glu Lys Asp Pro Asn Val
        115                 120                 125

Ser Leu Arg Asn Arg Val Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe
    130                 135                 140

Asp Arg Ile Trp Glu Lys Gln Ala Glu Phe His Glu Glu Leu Thr Val
145                 150                 155                 160

Glu Leu Lys Lys Glu Ile Arg Asp Ile Ile Ile Phe Tyr Gln Arg Arg
                165                 170                 175

Leu Lys Ser Gln Lys Gly Leu Ile Ser Phe Cys Glu Phe Glu Lys Arg
            180                 185                 190

Glu Val Val Val Glu Glu Asp Gly Arg Lys Lys Asn Lys Thr Val Gly
        195                 200                 205

Cys Arg Val Ile Pro Arg Ser His Pro Leu Phe Gln Glu Phe Lys Ile
    210                 215                 220

Trp Gln Thr Leu Asn Asp Ile Glu Val Phe Ala Trp Asp Lys Gln Ser
225                 230                 235                 240

Lys Arg Lys Lys Ala Asp Lys Ser Ser Ile Leu Phe Asp Asn Ser Glu
                245                 250                 255

Asp Ala Leu Leu Val Glu Gly Lys Arg Phe Leu Tyr Gln Glu Glu Lys
```

```
            260                 265                 270

Glu Leu Leu Ala Lys Glu Leu Phe Val Lys Glu Ser Met Lys Lys Ala
        275                 280                 285

Glu Val Leu Lys Leu Leu Phe Glu Asn Tyr Gln Glu Leu Asp Leu Asn
    290                 295                 300

Phe Lys Gln Ile Asp Gly Asn His Thr Gly Phe Ala Leu Phe Ser Ala
305                 310                 315                 320

Tyr Ser Lys Met Ile Glu Lys Tyr Gly Tyr Glu Pro Val Asp Phe Lys
                325                 330                 335

Arg Ser Ala Asp Glu Ile Ile Glu Lys Leu Glu Thr Ile Phe Thr Asn
            340                 345                 350

Leu Gly Trp Asn Thr Glu Leu Leu Ser Ile Asp Leu Ser Lys Glu Asp
        355                 360                 365

Lys Glu Leu Glu Arg Gln Ser Tyr Phe Arg Leu Trp His Leu Leu Tyr
    370                 375                 380

Ser Phe Glu Gly Asp Asn Thr Pro Thr Gly Asn Gly Lys Leu Leu Glu
385                 390                 395                 400

Lys Ile Met Gln Leu Cys Asp Val Glu Lys Glu Tyr Ala Val Glu Leu
                405                 410                 415

Ala Asn Val Ser Phe Gln Glu Asp Tyr Gly Ser Leu Ser Ala Lys Ala
            420                 425                 430

Ile Lys Lys Ile Leu Pro Tyr Leu Lys Glu Gly Asn Gln Tyr Asp Val
        435                 440                 445

Ala Cys Asp Tyr Ala Gly Tyr Arg His Ser Arg Ser Ser Leu Thr Lys
    450                 455                 460
```

```
Asp Glu Ile Glu Asn Lys Ile Leu Lys Asp Lys Leu Glu Ile Leu Pro
465                 470                 475                 480

Lys Asn Ser Leu Arg Asn Pro Val Val Glu Lys Ile Leu Asn Gln Met
                485                 490                 495

Val Asn Leu Ile Asn Thr Leu Ile Asp Thr Tyr Gly Lys Pro Asp Glu
            500                 505                 510

Ile Arg Val Glu Leu Ala Arg Glu Leu Lys Lys Asn Ala Lys Glu Arg
        515                 520                 525

Glu Glu Leu Thr Lys Ser Ile Ala Arg Asn Thr Arg Glu His Asp Glu
    530                 535                 540

Ile Arg Gln Leu Leu Arg Thr Glu Phe Gly Met Met Asn Val Ser Arg
545                 550                 555                 560

Asn Asp Ile Ile Arg Tyr Lys Leu Tyr Glu Glu Leu Lys Asp Asn Gly
                565                 570                 575

Tyr Lys Thr Leu Tyr Ser Asn Glu Tyr Ile Pro Arg Glu Lys Ile Phe
            580                 585                 590

Ser Lys Glu Ile Asp Ile Glu His Val Ile Pro Gln Ala Arg Leu Phe
        595                 600                 605

Asp Asp Ser Leu Ser Asn Lys Thr Leu Glu Tyr Arg Ala Ile Asn Ile
    610                 615                 620

Glu Lys Gly Asn Lys Thr Ala Tyr Asp Phe Val Lys Glu Lys Tyr Gly
625                 630                 635                 640

Asn Asp Gly Leu Glu Lys Phe Leu Asn Arg Cys Glu Thr Leu Phe Lys
                645                 650                 655

Asp Lys Arg Thr Lys Leu Arg Lys Leu Lys Met Glu Glu Lys Asp Ile
```

```
            660                 665                 670

Pro Glu Gly Phe Ile Asp Arg Asp Leu Arg Asn Thr Gln Tyr Ile Ser
        675                 680                 685

Lys Lys Ala Phe Ala Met Leu Asn Glu Ile Ser Arg Arg Val Val Ala
    690                 695                 700

Thr Thr Gly Ser Ile Thr Asp Lys Leu Arg Glu Asp Trp Gln Leu Val
705                 710                 715                 720

Asp Leu Met Lys Glu Leu Asn Leu Pro Lys Tyr Glu Lys Leu Gly Met
                725                 730                 735

Val Glu Met Phe Glu Asp Lys Asp Gly Arg Lys Ile Lys Lys Ile Thr
            740                 745                 750

Asp Trp Thr Lys Arg Asn Asp His Arg His His Ala Val Asp Ala Leu
        755                 760                 765

Thr Val Ala Phe Thr Lys Asp Val Phe Ile Gln Phe Tyr Asn Asn Lys
    770                 775                 780

Asn Ala Ala Trp Met Pro Ala Ser Lys Glu His Ala Asn Ile Thr Gly
785                 790                 795                 800

Ile Lys Ala Arg Tyr Phe Glu Asn Gly Lys Ala Leu Ala Pro Met Pro
                805                 810                 815

Leu Ala Gln Phe Arg Ala Glu Ala Lys Arg His Leu Glu Asn Leu Leu
            820                 825                 830

Val Ser Ile Lys Ala Lys Asn Lys Val Ile Thr Ser Asn Val Asn Arg
        835                 840                 845

Thr Lys Asn Lys Asn Gly Glu Asn Arg Lys Leu Gln Gln Thr Pro Arg
    850                 855                 860
```

```
Gly Gln Leu His Leu Glu Thr Val Tyr Gly Ser His Arg Gln Tyr Ala
865                 870                 875                 880


Thr Lys Ile Glu Lys Val Asn Ala Ala Phe Asp Val Thr Lys Ile Ala
                885                 890                 895


Thr Val Ser Lys Leu Ala Tyr Arg Asn Ala Leu Leu Lys Arg Leu Glu
            900                 905                 910


Ala Phe Gly Asn Asp Pro Lys Lys Ala Phe Thr Gly Lys Asn Thr Leu
        915                 920                 925


Glu Lys Asn Pro Leu Tyr Leu Asp Glu Asn Gln Thr Glu Met Val Pro
    930                 935                 940


Glu Lys Val Gln Thr Val Glu Phe Glu Thr Val Tyr Thr Ile Arg Lys
945                 950                 955                 960


Pro Ile Asp Pro Asn Leu Ser Ile Asp Lys Val Val Asp Val Lys Ile
                965                 970                 975


Arg Ser Val Leu Glu Lys Arg Leu Lys Glu Tyr Gly Gly Asp Ala Lys
            980                 985                 990


Lys Ala Phe Val Asn Leu Asp Glu  Asn Pro Ile Trp Leu  Asn Glu Ala
        995                 1000                1005


Lys Gly  Ile Ser Ile Lys Arg  Val Ser Ile Arg Gly  Ile Ser Asn
    1010                1015                1020


Ala Gln  Ser Leu His Glu Lys  Lys Asp Lys Asp Gly  Asn Leu Ile
    1025                1030                1035


Leu Gly  Lys Glu Gly Arg Lys  Ile Pro Val Asp Phe  Val Asn Thr
    1040                1045                1050


Gly Asn  Asn His His Val Ala  Ile Tyr Lys Lys Pro  Val Leu Asp
```

```
    1055                1060                1065

Lys Val  Gly Gln Val Val Leu  Asp Glu Glu Gly Asn  Pro Lys Tyr
    1070                1075                1080

Glu Leu  Asp Glu Val Val Val  Ser Phe Phe Asp Ala  Val Thr Arg
    1085                1090                1095

Ala Asn  Leu Gly Gln Pro Ile  Ile Asp Lys Asp Tyr  Arg Arg Ser
    1100                1105                1110

Glu Gly  Trp Gln Phe Leu Phe  Ser Met Lys Gln Asn  Glu Tyr Phe
    1115                1120                1125

Val Phe  Pro Asn Asp Lys Thr  Gly Phe Asn Pro Lys  Glu Val Asp
    1130                1135                1140

Leu Leu  Asn Pro Glu Asn Tyr  Ala Leu Ile Ser Pro  Asn Leu Phe
    1145                1150                1155

Arg Val  Gln Lys Phe Ala Tyr  Lys Asn Tyr Val Phe  Arg His His
    1160                1165                1170

Leu Glu  Thr Thr Ile Lys Asp  Thr Ser Ser Thr Leu  Lys Gly Ile
    1175                1180                1185

Thr Trp  Thr Asp Phe Arg Ser  Ser Lys Gly Leu Asp  Lys Ile Val
    1190                1195                1200

Lys Val  Arg Val Asp His Ile  Gly Gln Ile Val Ser  Ile Gly Glu
    1205                1210                1215

Tyr
```

<210> 90
<211> 1329
<212> PRT

<213> Catenibacterium mitsuokai

<400> 90

```
Ile Val Asp Tyr Cys Ile Gly Leu Asp Leu Gly Thr Gly Ser Val Gly
1               5                  10                  15


Trp Ala Val Val Asp Met Asn His Arg Leu Met Lys Arg Asn Gly Lys
            20                  25                  30


His Leu Trp Gly Ser Arg Leu Phe Ser Asn Ala Glu Thr Ala Ala Asn
        35                  40                  45


Arg Arg Ala Ser Arg Ser Ile Arg Arg Arg Tyr Asn Lys Arg Arg Glu
    50                  55                  60


Arg Ile Arg Leu Leu Arg Ala Ile Leu Gln Asp Met Val Leu Glu Lys
65                  70                  75                  80


Asp Pro Thr Phe Phe Ile Arg Leu Glu His Thr Ser Phe Leu Asp Glu
                85                  90                  95


Glu Asp Lys Ala Lys Tyr Leu Gly Thr Asp Tyr Lys Asp Asn Tyr Asn
            100                 105                 110


Leu Phe Ile Asp Glu Asp Phe Asn Asp Tyr Thr Tyr Tyr His Lys Tyr
        115                 120                 125


Pro Thr Ile Tyr His Leu Arg Lys Ala Leu Cys Glu Ser Thr Glu Lys
    130                 135                 140


Ala Asp Pro Arg Leu Ile Tyr Leu Ala Leu His His Ile Val Lys Tyr
145                 150                 155                 160


Arg Gly Asn Phe Leu Tyr Glu Gly Gln Lys Phe Asn Met Asp Ala Ser
                165                 170                 175


Asn Ile Glu Asp Lys Leu Ser Asp Ile Phe Thr Gln Phe Thr Ser Phe
            180                 185                 190
```

```
Asn Asn Ile Pro Tyr Glu Asp Asp Glu Lys Lys Asn Leu Glu Ile Leu
        195                 200                 205

Glu Ile Leu Lys Lys Pro Leu Ser Lys Lys Ala Lys Val Asp Glu Val
    210                 215                 220

Met Thr Leu Ile Ala Pro Glu Lys Asp Tyr Lys Ser Ala Phe Lys Glu
225                 230                 235                 240

Leu Val Thr Gly Ile Ala Gly Asn Lys Met Asn Val Thr Lys Met Ile
                245                 250                 255

Leu Cys Glu Pro Ile Lys Gln Gly Asp Ser Glu Ile Lys Leu Lys Phe
            260                 265                 270

Ser Asp Ser Asn Tyr Asp Asp Gln Phe Ser Glu Val Glu Lys Asp Leu
        275                 280                 285

Gly Glu Tyr Val Glu Phe Val Asp Ala Leu His Asn Val Tyr Ser Trp
    290                 295                 300

Val Glu Leu Gln Thr Ile Met Gly Ala Thr His Thr Asp Asn Ala Ser
305                 310                 315                 320

Ile Ser Glu Ala Met Val Ser Arg Tyr Asn Lys His His Asp Asp Leu
                325                 330                 335

Lys Leu Leu Lys Asp Cys Ile Lys Asn Asn Val Pro Asn Lys Tyr Phe
            340                 345                 350

Asp Met Phe Arg Asn Asp Ser Glu Lys Ser Lys Gly Tyr Tyr Asn Tyr
        355                 360                 365

Ile Asn Arg Pro Ser Lys Ala Pro Val Asp Glu Phe Tyr Lys Tyr Val
    370                 375                 380
```

```
Lys Lys Cys Ile Glu Lys Val Asp Thr Pro Glu Ala Lys Gln Ile Leu
385                 390                 395                 400

Asn Asp Ile Glu Leu Glu Asn Phe Leu Leu Lys Gln Asn Ser Arg Thr
                405                 410                 415

Asn Gly Ser Val Pro Tyr Gln Met Gln Leu Asp Glu Met Ile Lys Ile
            420                 425                 430

Ile Asp Asn Gln Ala Glu Tyr Tyr Pro Ile Leu Lys Glu Lys Arg Glu
        435                 440                 445

Gln Leu Leu Ser Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Phe Gly Pro
    450                 455                 460

Leu Asn Glu Thr Ser Glu His Ala Trp Ile Lys Arg Leu Glu Gly Lys
465                 470                 475                 480

Glu Asn Gln Arg Ile Leu Pro Trp Asn Tyr Gln Asp Ile Val Asp Val
                485                 490                 495

Asp Ala Thr Ala Glu Gly Phe Ile Lys Arg Met Arg Ser Tyr Cys Thr
            500                 505                 510

Tyr Phe Pro Asp Glu Glu Val Leu Pro Lys Asn Ser Leu Ile Val Ser
        515                 520                 525

Lys Tyr Glu Val Tyr Asn Glu Leu Asn Lys Ile Arg Val Asp Asp Lys
    530                 535                 540

Leu Leu Glu Val Asp Val Lys Asn Asp Ile Tyr Asn Glu Leu Phe Met
545                 550                 555                 560

Lys Asn Lys Thr Val Thr Glu Lys Lys Leu Lys Asn Trp Leu Val Asn
                565                 570                 575

Asn Gln Cys Cys Ser Lys Asp Ala Glu Ile Lys Gly Phe Gln Lys Glu
            580                 585                 590
```

```
Asn Gln Phe Ser Thr Ser Leu Thr Pro Trp Ile Asp Phe Thr Asn Ile
        595                 600                 605

Phe Gly Lys Ile Asp Gln Ser Asn Phe Asp Leu Ile Glu Asn Ile Ile
    610                 615                 620

Tyr Asp Leu Thr Val Phe Glu Asp Lys Lys Ile Met Lys Arg Arg Leu
625                 630                 635                 640

Lys Lys Lys Tyr Ala Leu Pro Asp Asp Lys Val Lys Gln Ile Leu Lys
                645                 650                 655

Leu Lys Tyr Lys Asp Trp Ser Arg Leu Ser Lys Lys Leu Leu Asp Gly
            660                 665                 670

Ile Val Ala Asp Asn Arg Phe Gly Ser Ser Val Thr Val Leu Asp Val
        675                 680                 685

Leu Glu Met Ser Arg Leu Asn Leu Met Glu Ile Ile Asn Asp Lys Asp
    690                 695                 700

Leu Gly Tyr Ala Gln Met Ile Glu Glu Ala Thr Ser Cys Pro Glu Asp
705                 710                 715                 720

Gly Lys Phe Thr Tyr Glu Glu Val Glu Arg Leu Ala Gly Ser Pro Ala
                725                 730                 735

Leu Lys Arg Gly Ile Trp Gln Ser Leu Gln Ile Val Glu Glu Ile Thr
            740                 745                 750

Lys Val Met Lys Cys Arg Pro Lys Tyr Ile Tyr Ile Glu Phe Glu Arg
        755                 760                 765

Ser Glu Glu Ala Lys Glu Arg Thr Glu Ser Lys Ile Lys Lys Leu Glu
    770                 775                 780
```

```
Asn Val Tyr Lys Asp Leu Asp Glu Gln Thr Lys Lys Glu Tyr Lys Ser
785                 790                 795                 800

Val Leu Glu Glu Leu Lys Gly Phe Asp Asn Thr Lys Lys Ile Ser Ser
                805                 810                 815

Asp Ser Leu Phe Leu Tyr Phe Thr Gln Leu Gly Lys Cys Met Tyr Ser
            820                 825                 830

Gly Lys Lys Leu Asp Ile Asp Ser Leu Asp Lys Tyr Gln Ile Asp His
        835                 840                 845

Ile Val Pro Gln Ser Leu Val Lys Asp Asp Ser Phe Asp Asn Arg Val
    850                 855                 860

Leu Val Val Pro Ser Glu Asn Gln Arg Lys Leu Asp Asp Leu Val Val
865                 870                 875                 880

Pro Phe Asp Ile Arg Asp Lys Met Tyr Arg Phe Trp Lys Leu Leu Phe
                885                 890                 895

Asp His Glu Leu Ile Ser Pro Lys Lys Phe Tyr Ser Leu Ile Lys Thr
            900                 905                 910

Glu Tyr Thr Glu Arg Asp Glu Glu Arg Phe Ile Asn Arg Gln Leu Val
        915                 920                 925

Glu Thr Arg Gln Ile Thr Lys Asn Val Thr Gln Ile Ile Glu Asp His
    930                 935                 940

Tyr Ser Thr Thr Lys Val Ala Ala Ile Arg Ala Asn Leu Ser His Glu
945                 950                 955                 960

Phe Arg Val Lys Asn His Ile Tyr Lys Asn Arg Asp Ile Asn Asp Tyr
                965                 970                 975

His His Ala His Asp Ala Tyr Ile Val Ala Leu Ile Gly Gly Phe Met
            980                 985                 990
```

```
Arg Asp Arg Tyr Pro Asn Met His  Asp Ser Lys Ala Val  Tyr Ser Glu
        995                 1000                1005


Tyr Met  Lys Met Phe Arg Lys  Asn Lys Asn Asp Gln  Lys Arg Trp
    1010                1015                1020


Lys Asp  Gly Phe Val Ile Asn  Ser Met Asn Tyr Pro  Tyr Glu Val
    1025                1030                1035


Asp Gly  Lys Leu Ile Trp Asn  Pro Asp Leu Ile Asn  Glu Ile Lys
    1040                1045                1050


Lys Cys  Phe Tyr Tyr Lys Asp  Cys Tyr Cys Thr Thr  Lys Leu Asp
    1055                1060                1065


Gln Lys  Ser Gly Gln Leu Phe  Asn Leu Thr Val Leu  Ser Asn Asp
    1070                1075                1080


Ala His  Ala Asp Lys Gly Val  Thr Lys Ala Val Val  Pro Val Asn
    1085                1090                1095


Lys Asn  Arg Ser Asp Val His  Lys Tyr Gly Gly Phe  Ser Gly Leu
    1100                1105                1110


Gln Tyr  Thr Ile Val Ala Ile  Glu Gly Gln Lys Lys  Lys Gly Lys
    1115                1120                1125


Lys Thr  Glu Leu Val Lys Lys  Ile Ser Gly Val Pro  Leu His Leu
    1130                1135                1140


Lys Ala  Ala Ser Ile Asn Glu  Lys Ile Asn Tyr Ile  Glu Glu Lys
    1145                1150                1155


Glu Gly  Leu Ser Asp Val Arg  Ile Ile Lys Asp Asn  Ile Pro Val
    1160                1165                1170
```

```
Asn Gln  Met Ile Glu Met Asp  Gly Gly Glu Tyr Leu  Leu Thr Ser
    1175                 1180                 1185

Pro Thr  Glu Tyr Val Asn Ala  Arg Gln Leu Val Leu  Asn Glu Lys
    1190                 1195                 1200

Gln Cys  Ala Leu Ile Ala Asp  Ile Tyr Asn Ala Ile  Tyr Lys Gln
    1205                 1210                 1215

Asp Tyr  Asp Asn Leu Asp Asp  Ile Leu Met Ile Gln  Leu Tyr Ile
    1220                 1225                 1230

Glu Leu  Thr Asn Lys Met Lys  Val Leu Tyr Pro Ala  Tyr Arg Gly
    1235                 1240                 1245

Ile Ala  Glu Lys Phe Glu Ser  Met Asn Glu Asn Tyr  Val Val Ile
    1250                 1255                 1260

Ser Lys  Glu Glu Lys Ala Asn  Ile Ile Lys Gln Met  Leu Ile Val
    1265                 1270                 1275

Met His  Arg Gly Pro Gln Asn  Gly Asn Ile Val Tyr  Asp Asp Phe
    1280                 1285                 1290

Lys Ile  Ser Asp Arg Ile Gly  Arg Leu Lys Thr Lys  Asn His Asn
    1295                 1300                 1305

Leu Asn  Asn Ile Val Phe Ile  Ser Gln Ser Pro Thr  Gly Ile Tyr
    1310                 1315                 1320

Thr Lys  Lys Tyr Lys Leu
    1325
```

<210> 91
<211> 1152
<212> PRT
<213> Roseburia inulinivorans

<400> 91

```
Met Asn Ala Glu His Gly Lys Glu Gly Leu Leu Ile Met Glu Glu Asn
1               5                  10                  15

Phe Gln Tyr Arg Ile Gly Leu Asp Ile Gly Ile Thr Ser Val Gly Trp
            20                  25                  30

Ala Val Leu Gln Asn Asn Ser Gln Asp Glu Pro Val Arg Ile Thr Asp
        35                  40                  45

Leu Gly Val Arg Ile Phe Asp Val Ala Glu Asn Pro Lys Asn Gly Asp
    50                  55                  60

Ala Leu Ala Ala Pro Arg Arg Asp Ala Arg Thr Thr Arg Arg Arg Leu
65                  70                  75                  80

Arg Arg Arg Arg His Arg Leu Glu Arg Ile Lys Phe Leu Leu Gln Glu
                85                  90                  95

Asn Gly Leu Ile Glu Met Asp Ser Phe Met Glu Arg Tyr Tyr Lys Gly
            100                 105                 110

Asn Leu Pro Asp Val Tyr Gln Leu Arg Tyr Glu Gly Leu Asp Arg Lys
        115                 120                 125

Leu Lys Asp Glu Glu Leu Ala Gln Val Leu Ile His Ile Ala Lys His
    130                 135                 140

Arg Gly Phe Arg Ser Thr Arg Lys Ala Glu Thr Lys Glu Lys Glu Gly
145                 150                 155                 160

Gly Ala Val Leu Lys Ala Thr Thr Glu Asn Gln Lys Ile Met Gln Glu
                165                 170                 175

Lys Gly Tyr Arg Thr Val Gly Glu Met Leu Tyr Leu Asp Glu Ala Phe
            180                 185                 190

His Thr Glu Cys Leu Trp Asn Glu Lys Gly Tyr Val Leu Thr Pro Arg
```

```
        195                 200                 205

Asn Arg Pro Asp Asp Tyr Lys His Thr Ile Leu Arg Ser Met Leu Val
    210                 215                 220

Glu Glu Val His Ala Ile Phe Ala Ala Gln Arg Ala His Gly Asn Gln
225                 230                 235                 240

Lys Ala Thr Glu Gly Leu Glu Glu Ala Tyr Val Glu Ile Met Thr Ser
                245                 250                 255

Gln Arg Ser Phe Asp Met Gly Pro Gly Leu Gln Pro Asp Gly Lys Pro
            260                 265                 270

Ser Pro Tyr Ala Met Glu Gly Phe Gly Asp Arg Val Gly Lys Cys Thr
        275                 280                 285

Phe Glu Lys Asp Glu Tyr Arg Ala Pro Lys Ala Thr Tyr Thr Ala Glu
    290                 295                 300

Leu Phe Val Ala Leu Gln Lys Ile Asn His Thr Lys Leu Ile Asp Glu
305                 310                 315                 320

Phe Gly Thr Gly Arg Phe Phe Ser Glu Glu Glu Arg Lys Thr Ile Ile
                325                 330                 335

Gly Leu Leu Leu Ser Ser Lys Glu Leu Lys Tyr Gly Thr Ile Arg Lys
            340                 345                 350

Lys Leu Asn Ile Asp Pro Ser Leu Lys Phe Asn Ser Leu Asn Tyr Ser
        355                 360                 365

Ala Lys Lys Glu Gly Glu Thr Glu Glu Glu Arg Val Leu Asp Thr Glu
    370                 375                 380

Lys Ala Lys Phe Ala Ser Met Phe Trp Thr Tyr Glu Tyr Ser Lys Cys
385                 390                 395                 400
```

```
Leu Lys Asp Arg Thr Glu Glu Met Pro Val Gly Glu Lys Ala Asp Leu
               405                 410                 415

Phe Asp Arg Ile Gly Glu Ile Leu Thr Ala Tyr Lys Asn Asp Asp Ser
            420                 425                 430

Arg Ser Ser Arg Leu Lys Glu Leu Gly Leu Ser Gly Glu Glu Ile Asp
        435                 440                 445

Gly Leu Leu Asp Leu Ser Pro Ala Lys Tyr Gln Arg Val Ser Leu Lys
    450                 455                 460

Ala Met Arg Lys Met Gln Pro Tyr Leu Glu Asp Gly Leu Ile Tyr Asp
465                 470                 475                 480

Lys Ala Cys Glu Ala Ala Gly Tyr Asp Phe Arg Ala Leu Asn Asp Gly
               485                 490                 495

Asn Lys Lys His Leu Leu Lys Gly Glu Glu Ile Asn Ala Ile Val Asn
            500                 505                 510

Asp Ile Thr Asn Pro Val Val Lys Arg Ser Val Ser Gln Thr Ile Lys
        515                 520                 525

Val Ile Asn Ala Ile Ile Gln Lys Tyr Gly Ser Pro Gln Ala Val Asn
    530                 535                 540

Ile Glu Leu Ala Arg Glu Met Ser Lys Asn Phe Gln Asp Arg Thr Asn
545                 550                 555                 560

Leu Glu Lys Glu Met Lys Lys Arg Gln Gln Glu Asn Glu Arg Ala Lys
               565                 570                 575

Gln Gln Ile Ile Glu Leu Gly Lys Gln Asn Pro Thr Gly Gln Asp Ile
            580                 585                 590

Leu Lys Tyr Arg Leu Trp Asn Asp Gln Gly Gly Tyr Cys Leu Tyr Ser
```

```
        595                 600                 605

Gly Lys Lys Ile Pro Leu Glu Glu Leu Phe Asp Gly Gly Tyr Asp Ile
    610                 615                 620

Asp His Ile Leu Pro Tyr Ser Ile Thr Phe Asp Asp Ser Tyr Arg Asn
625                 630                 635                 640

Lys Val Leu Val Thr Ala Gln Glu Asn Arg Gln Lys Gly Asn Arg Thr
                645                 650                 655

Pro Tyr Glu Tyr Phe Gly Ala Asp Glu Lys Arg Trp Glu Asp Tyr Glu
            660                 665                 670

Ala Ser Val Arg Leu Leu Val Arg Asp Tyr Lys Lys Gln Gln Lys Leu
        675                 680                 685

Leu Lys Lys Asn Phe Thr Glu Glu Glu Arg Lys Glu Phe Lys Glu Arg
    690                 695                 700

Asn Leu Asn Asp Thr Lys Tyr Ile Thr Arg Val Val Tyr Asn Met Ile
705                 710                 715                 720

Arg Gln Asn Leu Glu Leu Glu Pro Phe Asn His Pro Glu Lys Lys Lys
                725                 730                 735

Gln Val Trp Ala Val Asn Gly Ala Val Thr Ser Tyr Leu Arg Lys Arg
            740                 745                 750

Trp Gly Leu Met Gln Lys Asp Arg Ser Thr Asp Arg His His Ala Met
        755                 760                 765

Asp Ala Val Val Ile Ala Cys Cys Thr Asp Gly Met Ile His Lys Ile
    770                 775                 780

Ser Arg Tyr Met Gln Gly Arg Glu Leu Ala Tyr Ser Arg Asn Phe Lys
785                 790                 795                 800
```

```
Phe Pro Asp Glu Glu Thr Gly Glu Ile Leu Asn Arg Asp Asn Phe Thr
                805                 810                 815

Arg Glu Gln Trp Asp Glu Lys Phe Gly Val Lys Val Pro Leu Pro Trp
            820                 825                 830

Asn Ser Phe Arg Asp Glu Leu Asp Ile Arg Leu Leu Asn Glu Asp Pro
        835                 840                 845

Lys Asn Phe Leu Leu Thr His Ala Asp Val Gln Arg Glu Leu Asp Tyr
    850                 855                 860

Pro Gly Trp Met Tyr Gly Glu Glu Glu Ser Pro Ile Glu Glu Gly Arg
865                 870                 875                 880

Tyr Ile Asn Tyr Ile Arg Pro Leu Phe Val Ser Arg Met Pro Asn His
                885                 890                 895

Lys Val Thr Gly Ser Ala His Asp Ala Thr Ile Arg Ser Ala Arg Asp
            900                 905                 910

Tyr Glu Thr Arg Gly Val Val Ile Thr Lys Val Pro Leu Thr Asp Leu
        915                 920                 925

Lys Leu Asn Lys Asp Asn Glu Ile Glu Gly Tyr Tyr Asp Lys Asp Ser
    930                 935                 940

Asp Arg Leu Leu Tyr Gln Ala Leu Val Arg Gln Leu Leu Leu His Gly
945                 950                 955                 960

Asn Asp Gly Lys Lys Ala Phe Ala Glu Asp Phe His Lys Pro Lys Ala
                965                 970                 975

Asp Gly Thr Glu Gly Pro Val Val Arg Lys Val Lys Ile Glu Lys Lys
            980                 985                 990

Gln Thr Ser Gly Val Met Val Arg  Gly Gly Thr Gly Ile  Ala Ala Asn
```

995 1000 1005

Gly Glu Met Val Arg Ile Asp Val Phe Arg Glu Asn Gly Lys Tyr
1010 1015 1020

Tyr Phe Val Pro Val Tyr Thr Ala Asp Val Val Arg Lys Val Leu
1025 1030 1035

Pro Asn Arg Ala Ala Thr His Thr Lys Pro Tyr Ser Glu Trp Arg
1040 1045 1050

Val Met Asp Asp Ala Asn Phe Val Phe Ser Leu Tyr Ser Arg Asp
1055 1060 1065

Leu Ile His Val Lys Ser Lys Lys Asp Ile Lys Thr Asn Leu Val
1070 1075 1080

Asn Gly Gly Leu Leu Leu Gln Lys Glu Ile Phe Ala Tyr Tyr Thr
1085 1090 1095

Gly Ala Asp Ile Ala Thr Ala Ser Ile Ala Gly Phe Ala Asn Asp
1100 1105 1110

Ser Asn Phe Lys Phe Arg Gly Leu Gly Ile Gln Ser Leu Glu Ile
1115 1120 1125

Phe Glu Lys Cys Gln Val Asp Ile Leu Gly Asn Ile Ser Val Val
1130 1135 1140

Arg His Glu Asn Arg Gln Glu Phe His
1145 1150

<210> 92
<211> 686
<212> PRT
<213> Coprococcus comes

<400> 92

```
Met Lys Lys Gln Asp Ser Pro Lys Asn Asn Met Gly Tyr Thr Ala Tyr
1               5                  10                  15

Asn Leu Asn Val Leu Gly Tyr Glu Glu Phe Ala Lys Arg Val Glu Leu
            20                  25                  30

Leu Phe Lys Asp Thr Asp Ala Val Lys Arg Leu Asn Asp Ser His Met
        35                  40                  45

Gln Met Ala Glu Gly Phe Asp Leu Asn Ala Leu Pro Gly Ser Pro Ala
    50                  55                  60

Leu Arg Arg Gly Val Ser Gln Ala Ile Lys Val Leu Asp Asp Ile Val
65                  70                  75                  80

Ser Val Ala Gly Lys Ala Pro Asp Arg Ile Tyr Leu Lys Val Thr Arg
                85                  90                  95

Thr Ala Ser Asn Ser Arg Lys Gly Lys Arg Thr Ala Lys Arg Ser Asp
            100                 105                 110

Lys Ile Lys Gln Ala Leu Lys Ala Leu Asp Ala Asp Ala Ala Ala Asp
        115                 120                 125

Leu Gly Ala Ala Lys Leu Leu Arg Glu Leu Gly Met Phe Asp Glu Lys
    130                 135                 140

Glu Ile Asn Glu Arg Ile Tyr Leu Tyr Phe His Gln Ala Gly Lys Cys
145                 150                 155                 160

Leu Tyr Thr Gly Lys Pro Ile Asp Ile Thr Arg Ile Ala Ser Asn Asp
                165                 170                 175

Tyr Tyr Val Asp His Val Val Pro Leu Ala Tyr Arg Lys Asp Glu Ser
            180                 185                 190

Leu Asp Asn Lys Val Leu Val Tyr Ala Glu Ala Ser Arg Tyr Lys Ser
        195                 200                 205
```

```
Glu Thr Leu Leu Val Ser Pro Ala Val Gln Arg Lys Met Leu Pro Phe
    210                 215                 220

Trp Arg Met Leu Arg Asn Ala Gly Leu Met Ser Glu Arg Lys Leu Asn
225                 230                 235                 240

Ala Leu Ile Arg Thr Glu Ile Ser Glu Gly Met Leu Lys Ser Ile Ile
                245                 250                 255

Gly Arg Gln Phe Thr Glu Asn Ser Trp Glu Ala Lys Leu Phe Thr Ala
            260                 265                 270

Ala Ile Ala Ala Lys Tyr Pro Gly Thr Val Val Ile Pro Val Lys Ala
        275                 280                 285

Gly Val Ile Gly Ala Val Arg Ser Arg Ile Gly Ile Pro Lys Ser Leu
    290                 295                 300

Lys Ala Asn Gln Phe Tyr His Ala His Asp Ala Leu Leu Ala Ala Glu
305                 310                 315                 320

Val Gly Arg Tyr Met Glu Leu Ala Lys Pro Ala Phe Val His Asn Arg
                325                 330                 335

Val Lys Tyr Glu Gln Tyr Met Arg Lys Ile Lys Leu Val Asn Glu Glu
            340                 345                 350

Asn Lys Lys Ala Pro Lys Ser Gln Leu Asp Phe Phe Ala Gly Gly Phe
        355                 360                 365

Phe Phe Asp Arg Val Asp Lys Asp Thr Gly Glu Val Tyr Trp Asn Lys
    370                 375                 380

Asp Glu Glu Val Glu Arg Ile Tyr Arg Ala Cys Gly Trp Lys Asn Leu
385                 390                 395                 400
```

```
Arg Val Thr Tyr Ala Ala Phe Glu Asp Gly Gly Ala Phe Trp Lys Gln
                405                 410                 415

Thr Ile Tyr Ser Pro Arg Glu Lys Ser Lys Leu Ile Ala Thr Lys Ser
            420                 425                 430

Asp Arg Pro Ala Glu Ile Tyr Gly Gly Tyr Ser Ser Gln Thr Phe Ala
        435                 440                 445

Asn Phe Phe Val Tyr Glu Val Met Lys Lys Lys Val Lys Gln Leu Arg
    450                 455                 460

Phe Gly Ala Val Pro Ala Ala Ile Ala Ser Lys Ser Asp Pro Asp Thr
465                 470                 475                 480

Tyr Asn Ala Met Leu Glu Met Tyr Ala Arg Gly Leu Ala Lys Thr Ala
                485                 490                 495

Lys Glu Lys Phe Val Arg Ile Val Arg Ala Arg Val Leu Lys Asn Thr
            500                 505                 510

Met Ile Glu Leu Tyr Gly Glu Arg Phe Arg Ile Ala Gly Glu Lys Gln
        515                 520                 525

Val Tyr Pro Val Arg Gln Met Pro Leu Ala Ile Asp Glu Val Tyr Leu
    530                 535                 540

Leu Lys Gly Val Glu Thr Ile Ala Ala Ala Gly Asn Ala Gly Ala Ser
545                 550                 555                 560

Ala Lys Ile Asp Phe Glu Lys Ala Ala Glu Ser Leu Val Gly Phe Trp
                565                 570                 575

Asp Leu Leu Leu Glu Lys Leu Pro Val Asn Tyr Pro Lys Leu Thr Val
            580                 585                 590

Gln Leu Lys Leu Gly Leu Leu Lys His Pro Lys Asp Ile Leu Ala Ala
        595                 600                 605
```

```
Thr Ser Glu Ser Glu Phe Pro Ala Ile Val Tyr Lys Ile Ala Glu Ala
    610                 615                 620

Glu Ile Gln Val Met Glu Gln Ala Ser Gly Leu Arg Asn Met Ser Asp
625                 630                 635                 640

Thr Lys Ile Leu Gly Gly Asn Thr Phe Gly Gly Ser Leu Val Phe Thr
                645                 650                 655

Phe Asn Lys Val Leu Asn Asp Pro Lys Ser Lys Ala Cys Phe Ile Asp
            660                 665                 670

Thr Thr Pro Ala Gly Leu Tyr Glu Val Lys Thr Lys Ile Trp
        675                 680                 685
```

<210> 93
<211> 1105
<212> PRT
<213> Actinomyces coleocanis

<400> 93

```
Met Asp Asn Lys Asn Tyr Arg Ile Gly Ile Asp Val Gly Leu Asn Ser
1               5                   10                  15

Ile Gly Phe Cys Ala Val Glu Val Asp Gln His Asp Thr Pro Leu Gly
            20                  25                  30

Phe Leu Asn Leu Ser Val Tyr Arg His Asp Ala Gly Ile Asp Pro Asn
        35                  40                  45

Gly Lys Lys Thr Asn Thr Thr Arg Leu Ala Met Ser Gly Val Ala Arg
    50                  55                  60

Arg Thr Arg Arg Leu Phe Arg Lys Arg Lys Arg Arg Leu Ala Ala Leu
65                  70                  75                  80

Asp Arg Phe Ile Glu Ala Gln Gly Trp Thr Leu Pro Asp His Ala Asp
```

```
                85                  90                  95

Tyr Lys Asp Pro Tyr Thr Pro Trp Leu Val Arg Ala Glu Leu Ala Gln
            100                 105                 110

Thr Pro Ile Arg Asp Glu Asn Asp Leu His Glu Lys Leu Ala Ile Ala
        115                 120                 125

Val Arg His Ile Ala Arg His Arg Gly Trp Arg Ser Pro Trp Val Pro
    130                 135                 140

Val Arg Ser Leu His Val Glu Gln Pro Pro Ser Asp Gln Tyr Leu Ala
145                 150                 155                 160

Leu Lys Glu Arg Val Glu Ala Lys Thr Leu Leu Gln Met Pro Glu Gly
                165                 170                 175

Ala Thr Pro Ala Glu Met Val Val Ala Leu Asp Leu Ser Val Asp Val
            180                 185                 190

Asn Leu Arg Pro Lys Asn Arg Glu Lys Thr Asp Thr Arg Pro Glu Asn
        195                 200                 205

Lys Lys Pro Gly Phe Leu Gly Gly Lys Leu Met Gln Ser Asp Asn Ala
    210                 215                 220

Asn Glu Leu Arg Lys Ile Ala Lys Ile Gln Gly Leu Asp Asp Ala Leu
225                 230                 235                 240

Leu Arg Glu Leu Ile Glu Leu Val Phe Ala Ala Asp Ser Pro Lys Gly
                245                 250                 255

Ala Ser Gly Glu Leu Val Gly Tyr Asp Val Leu Pro Gly Gln His Gly
            260                 265                 270

Lys Arg Arg Ala Glu Lys Ala His Pro Ala Phe Gln Arg Tyr Arg Ile
        275                 280                 285
```

```
Ala Ser Ile Val Ser Asn Leu Arg Ile Arg His Leu Gly Ser Gly Ala
    290                 295                 300

Asp Glu Arg Leu Asp Val Glu Thr Gln Lys Arg Val Phe Glu Tyr Leu
305                 310                 315                 320

Leu Asn Ala Lys Pro Thr Ala Asp Ile Thr Trp Ser Asp Val Ala Glu
                325                 330                 335

Glu Ile Gly Val Glu Arg Asn Leu Leu Met Gly Thr Ala Thr Gln Thr
            340                 345                 350

Ala Asp Gly Glu Arg Ala Ser Ala Lys Pro Pro Val Asp Val Thr Asn
        355                 360                 365

Val Ala Phe Ala Thr Cys Lys Ile Lys Pro Leu Lys Glu Trp Trp Leu
    370                 375                 380

Asn Ala Asp Tyr Glu Ala Arg Cys Val Met Val Ser Ala Leu Ser His
385                 390                 395                 400

Ala Glu Lys Leu Thr Glu Gly Thr Ala Ala Glu Val Glu Val Ala Glu
                405                 410                 415

Phe Leu Gln Asn Leu Ser Asp Glu Asp Asn Glu Lys Leu Asp Ser Phe
            420                 425                 430

Ser Leu Pro Ile Gly Arg Ala Ala Tyr Ser Val Asp Ser Leu Glu Arg
        435                 440                 445

Leu Thr Lys Arg Met Ile Glu Asn Gly Glu Asp Leu Phe Glu Ala Arg
    450                 455                 460

Val Asn Glu Phe Gly Val Ser Glu Asp Trp Arg Pro Pro Ala Glu Pro
465                 470                 475                 480

Ile Gly Ala Arg Val Gly Asn Pro Ala Val Asp Arg Val Leu Lys Ala
```

```
                485                 490                 495

Val Asn Arg Tyr Leu Met Ala Ala Glu Ala Glu Trp Gly Ala Pro Leu
            500                 505                 510

Ser Val Asn Ile Glu His Val Arg Glu Gly Phe Ile Ser Lys Arg Gln
        515                 520                 525

Ala Val Glu Ile Asp Arg Glu Asn Gln Lys Arg Tyr Gln Arg Asn Gln
    530                 535                 540

Ala Val Arg Ser Gln Ile Ala Asp His Ile Asn Ala Thr Ser Gly Val
545                 550                 555                 560

Arg Gly Ser Asp Val Thr Arg Tyr Leu Ala Ile Gln Arg Gln Asn Gly
                565                 570                 575

Glu Cys Leu Tyr Cys Gly Thr Ala Ile Thr Phe Val Asn Ser Glu Met
            580                 585                 590

Asp His Ile Val Pro Arg Ala Gly Leu Gly Ser Thr Asn Thr Arg Asp
        595                 600                 605

Asn Leu Val Ala Thr Cys Glu Arg Cys Asn Lys Ser Lys Ser Asn Lys
    610                 615                 620

Pro Phe Ala Val Trp Ala Ala Glu Cys Gly Ile Pro Gly Val Ser Val
625                 630                 635                 640

Ala Glu Ala Leu Lys Arg Val Asp Phe Trp Ile Ala Asp Gly Phe Ala
                645                 650                 655

Ser Ser Lys Glu His Arg Glu Leu Gln Lys Gly Val Lys Asp Arg Leu
            660                 665                 670

Lys Arg Lys Val Ser Asp Pro Glu Ile Asp Asn Arg Ser Met Glu Ser
        675                 680                 685
```

```
Val Ala Trp Met Ala Arg Glu Leu Ala His Arg Val Gln Tyr Tyr Phe
    690                 695                 700

Asp Glu Lys His Thr Gly Thr Lys Val Arg Val Phe Arg Gly Ser Leu
705                 710                 715                 720

Thr Ser Ala Ala Arg Lys Ala Ser Gly Phe Glu Ser Arg Val Asn Phe
                725                 730                 735

Ile Gly Gly Asn Gly Lys Thr Arg Leu Asp Arg Arg His His Ala Met
            740                 745                 750

Asp Ala Ala Thr Val Ala Met Leu Arg Asn Ser Val Ala Lys Thr Leu
        755                 760                 765

Val Leu Arg Gly Asn Ile Arg Ala Ser Glu Arg Ala Ile Gly Ala Ala
    770                 775                 780

Glu Thr Trp Lys Ser Phe Arg Gly Glu Asn Val Ala Asp Arg Gln Ile
785                 790                 795                 800

Phe Glu Ser Trp Ser Glu Asn Met Arg Val Leu Val Glu Lys Phe Asn
                805                 810                 815

Leu Ala Leu Tyr Asn Asp Glu Val Ser Ile Phe Ser Ser Leu Arg Leu
            820                 825                 830

Gln Leu Gly Asn Gly Lys Ala His Asp Asp Thr Ile Thr Lys Leu Gln
        835                 840                 845

Met His Lys Val Gly Asp Ala Trp Ser Leu Thr Glu Ile Asp Arg Ala
    850                 855                 860

Ser Thr Pro Ala Leu Trp Cys Ala Leu Thr Arg Gln Pro Asp Phe Thr
865                 870                 875                 880

Trp Lys Asp Gly Leu Pro Ala Asn Glu Asp Arg Thr Ile Ile Val Asn
```

```
               885                 890                 895

Gly Thr His Tyr Gly Pro Leu Asp Lys Val Gly Ile Phe Gly Lys Ala
            900                 905                 910

Ala Ala Ser Leu Leu Val Arg Gly Gly Ser Val Asp Ile Gly Ser Ala
        915                 920                 925

Ile His His Ala Arg Ile Tyr Arg Ile Ala Gly Lys Lys Pro Thr Tyr
    930                 935                 940

Gly Met Val Arg Val Phe Ala Pro Asp Leu Leu Arg Tyr Arg Asn Glu
945                 950                 955                 960

Asp Leu Phe Asn Val Glu Leu Pro Pro Gln Ser Val Ser Met Arg Tyr
                965                 970                 975

Ala Glu Pro Lys Val Arg Glu Ala Ile Arg Glu Gly Lys Ala Glu Tyr
            980                 985                 990

Leu Gly Trp Leu Val Val Gly Asp  Glu Leu Leu Leu Asp  Leu Ser Ser
        995                 1000                1005

Glu Thr  Ser Gly Gln Ile Ala  Glu Leu Gln Gln Asp  Phe Pro Gly
    1010                1015                1020

Thr Thr  His Trp Thr Val Ala  Gly Phe Phe Ser Pro  Ser Arg Leu
    1025                1030                1035

Arg Leu  Arg Pro Val Tyr Leu  Ala Gln Glu Gly Leu  Gly Glu Asp
    1040                1045                1050

Val Ser  Glu Gly Ser Lys Ser  Ile Ile Ala Gly Gln  Gly Trp Arg
    1055                1060                1065

Pro Ala  Val Asn Lys Val Phe  Gly Ser Ala Met Pro  Glu Val Ile
    1070                1075                1080
```

```
Arg Arg  Asp Gly Leu Gly Arg  Lys Arg Arg Phe Ser  Tyr Ser Gly
    1085                1090                1095


Leu Pro  Val Ser Trp Gln Gly
    1100                1105


<210>  94
<211>  1361
<212>  PRT
<213>  Anaerococcus tetradius

<400>  94

Met Gly Asn Tyr Tyr Leu Gly Leu Asp Ile Gly Thr Asn Ser Val Gly
1               5                   10                  15


Trp Ala Val Thr Asp Glu Asn Tyr Asn Ile Glu Arg Phe Lys Lys Lys
            20                  25                  30


Asn Met Trp Gly Ile Arg Leu Phe Asp Glu Ala Lys Thr Ala Glu Ser
        35                  40                  45


Arg Arg Ile His Arg Gln Ala Arg Arg Met Arg Gln Arg Lys Ile Gln
    50                  55                  60


Arg Leu Asn Leu Leu Met Glu Leu Phe Asp Val Glu Ile Ser Lys Val
65                  70                  75                  80


Asp Glu Ser Phe Phe Ile Arg Lys Lys Glu Ser Asp Leu His Tyr Glu
                85                  90                  95


Asp Lys Ser Gln Asp Ser Arg Tyr Ala Leu Phe Asn Asp Lys Glu Phe
            100                 105                 110


Asn Asp Lys Asp Tyr His Asn Lys Tyr Pro Thr Ile Phe His Leu Ile
        115                 120                 125


Met Asp Leu Ile Glu Asn Asp Glu Lys Lys Asp Ile Arg Leu Leu Tyr
    130                 135                 140
```

```
Leu Ala Cys His Tyr Leu Ile Lys Asn Arg Gly His Phe Ile Phe Glu
145                 150                 155                 160

Gly Gln Lys Phe Asp Val Asn Ser Ser Leu Asn Asn Asn Ile Asn Lys
                165                 170                 175

Leu Lys Ser His Leu Asp Gln Phe Tyr Asn Ile Cys Leu Asp Phe Asp
            180                 185                 190

Asn Asp Lys Leu Ile Glu Ile Leu Val Asn Gln Asn Leu Asn Ile Ser
        195                 200                 205

Glu Lys Ser Lys Lys Ile Lys Glu Leu Leu Arg Lys Thr Asn Leu Glu
    210                 215                 220

Val Gly Ile Ala Asn Leu Ile Ala Gly Gly Ser Ile Lys Leu Ser Asn
225                 230                 235                 240

Met Phe Asp Asp Asp Glu Leu Lys Asn Leu Asp Tyr Asn Ser Leu Ser
                245                 250                 255

Phe Lys Asn Ser Asn Phe Asp Glu Gly Arg Glu Leu Phe Glu Glu Val
            260                 265                 270

Leu Glu Asp Arg Phe Glu Leu Val Glu Ile Leu Lys Asp Ile His Asp
        275                 280                 285

Ala Ser Val Leu Glu Thr Met Leu Ser Ser Ala Ser Ile Ser Pro Asp
    290                 295                 300

Gly Gly Lys Tyr Ile Ser Ser Ser Met Ile Asn Ser Tyr Asn Lys His
305                 310                 315                 320

Lys Arg Asp Leu Lys Leu Leu Lys Lys Ile Ile Lys Lys Tyr Lys Lys
                325                 330                 335
```

```
Ser Glu Tyr Asp Asn Ile Phe Arg Asp Glu Asn Ile Lys Asn Asn Tyr
            340                 345                 350

Leu Ser Tyr Thr Arg Thr Gly Ile Asn Lys Asn Lys Lys Val Gln Ala
        355                 360                 365

Glu Asp Asn Thr Asp Ser Asp Gly Phe Tyr Lys Tyr Ile Val Lys Ile
    370                 375                 380

Leu Lys Asp Ile Lys Glu Asn Asp Ser Asp Glu Asp Ile Lys Tyr Ile
385                 390                 395                 400

Leu Ser Glu Ile Asp Lys Lys Asn Phe Val Pro Lys Gln Arg Thr Lys
                405                 410                 415

Glu Asn Ser Val Ile Pro Tyr Gln Leu Arg Glu Ile Glu Leu Arg Lys
            420                 425                 430

Ile Ile Asp Asn Gln Ser Lys Tyr His Lys Phe Leu Asn Glu Val Asp
        435                 440                 445

Glu Lys Gly Ile Ser Val Lys Glu Lys Ile Ile Ser Leu Leu Thr Phe
    450                 455                 460

Arg Ile Pro Tyr Tyr Ile Gly Pro Leu Asn Pro Ser Tyr Asn Glu Glu
465                 470                 475                 480

Lys Asn Phe Thr Thr Ser Trp Val Lys Arg Leu Ala Lys Gly Lys Val
                485                 490                 495

Thr Pro Trp Asn Phe Glu Asp Met Val Asp Ile Asp Ala Ser Arg Glu
            500                 505                 510

Ala Phe Ile Glu Asn Lys Leu Asn Lys Cys Ser Phe Leu Leu Asp Glu
        515                 520                 525

Thr Val Leu Pro Lys Asp Ser Leu Leu Tyr Gln Glu Tyr Met Val Leu
    530                 535                 540
```

```
Asn Glu Leu Asn Asn Leu Lys Ile Asn Gly Gln Ser Ile Asn Thr Asp
545                 550                 555                 560

Leu Lys Lys Ser Ile Tyr Glu Glu Leu Phe Lys Lys Tyr Lys Lys Val
                565                 570                 575

Thr Arg Lys Arg Leu Ile Ser Tyr Ile Lys Glu Lys Glu Asn Met Ser
            580                 585                 590

Gly Asp Ile Val Ile Thr Gly Ile Asp Gly Asp Phe Lys Gln Gly Leu
        595                 600                 605

Lys Ser Tyr Ile Ala Phe Lys Asp Ile Ile Gly Glu Lys Ile Asp Asp
    610                 615                 620

Asp Ile Tyr Arg Lys Glu Val Glu Lys Ile Ile Arg Asp Ile Ser Leu
625                 630                 635                 640

Tyr Gly Asp Asp Lys Ser Phe Ile Gln Lys Lys Ile Lys Asn Glu Asn
                645                 650                 655

Lys Leu Asp Leu Ser Asp Asp Gln Ile Ser Lys Ile Ala Lys Leu Lys
            660                 665                 670

Phe Lys Asp Trp Gly Arg Phe Ser Lys Lys Leu Leu Val Gly Ile Lys
        675                 680                 685

Ala Ser Asp Lys Asn Thr Gly Glu Ile Asp Asn Ile Ile Gly Phe Met
    690                 695                 700

Arg Asn Tyr Asn Tyr Asn Ile Met Gln Leu Met Ala Asn Val Phe Thr
705                 710                 715                 720

Phe Lys Asp Glu Ile Glu Lys Leu Asn Ser Lys Tyr Tyr Thr Asp Glu
                725                 730                 735
```

```
Lys Ile Asn Ile Asp Tyr Leu Asp Asp Leu Tyr Leu Ser Ser Pro Ala
            740                 745                 750

Lys Arg Met Leu Trp Gln Ser Phe Gln Ile Val Asp Glu Ile Lys Asn
        755                 760                 765

Ile Lys Asn Ser Asp Pro Lys Lys Ile Phe Ile Glu Met Ala Arg Ser
    770                 775                 780

Lys Glu Asp Lys Pro Thr Arg Lys Met Ser Arg Lys Ser Arg Leu Glu
785                 790                 795                 800

Lys Leu Tyr Thr Asp Ser Lys Lys Gln Phe Ile Lys Leu Phe Gly Pro
                805                 810                 815

Asp Glu Tyr Asp Lys Leu Asn Asn Glu Ile Lys Asn Lys Ser Glu Ser
            820                 825                 830

Asp Phe Arg Trp Asp Asn Leu Tyr Leu Tyr Tyr Thr Gln Phe Gly Arg
        835                 840                 845

Cys Met Tyr Ser Leu Asp Pro Ile Asp Leu Glu Glu Leu Ser Asn Lys
    850                 855                 860

Asn Leu Tyr Asp Gln Asp His Ile Tyr Pro Lys Ser Lys Ile Tyr Asp
865                 870                 875                 880

Asp Ser Ile Glu Asn Arg Val Leu Val Lys Lys Gln Leu Asn Leu Asp
                885                 890                 895

Lys Ser Asn Glu Tyr Pro Ile Pro Asp Arg Val Leu Asn Lys Asp Lys
            900                 905                 910

Asn Lys Leu Leu Ala Phe Trp Lys Met Leu Asn Glu Lys Glu Leu Ile
        915                 920                 925

Gly Asp Lys Lys Tyr Ala Arg Leu Ile Arg Lys Ser Pro Phe Thr Asp
    930                 935                 940
```

```
Glu Glu Leu Gly Asp Phe Ile Ala Arg Gln Leu Val Glu Thr Arg Gln
945                 950                 955                 960


Ala Thr Lys Glu Thr Ala Asn Met Leu Lys Arg Leu Cys Pro Asp Ser
                965                 970                 975


Lys Ile Val Tyr Val Lys Ala Lys Asn Val Ser Asp Phe Arg Arg Lys
            980                 985                 990


Phe Asp Ile Leu Lys Cys Arg Ser  Ile Asn Asp Leu His  His Ala His
        995                 1000                1005


Asp Ala  Tyr Leu Asn Ile Val  Val Gly Asn Val Phe  Asp Thr Lys
    1010                1015                1020


Phe Thr  Ser Asn Pro Leu Asn  Phe Ile Lys Asn Asn  Ser Lys Asn
    1025                1030                1035


Arg Ser  Tyr Asn Leu Glu Lys  Ile Tyr Asp Tyr Asp  Val Ile Arg
    1040                1045                1050


Asn Glu  Lys Ile Ala Trp Leu  Ala Glu Arg Lys Glu  Glu Asn Gln
    1055                1060                1065


Asp Gly  Ser Ile Ala Thr Val  Leu Lys Asn Leu Ser  Lys Asn Asp
    1070                1075                1080


Ile Arg  Val Thr Arg Arg Thr  Tyr Ile Lys Cys Glu  Asp Leu Phe
    1085                1090                1095


Asp Glu  Asn Ile Val Arg Lys  Gly Asn Gly Lys Phe  Pro Ile Lys
    1100                1105                1110


Glu Asn  Asn Asn Lys Ser Asp  Thr Asn Lys Tyr Gly  Gly Tyr Ser
    1115                1120                1125
```

```
Gly Ile  Lys Asn Ala Tyr Phe  Val Leu Leu Glu Asp  Glu Lys His
    1130                1135                1140

Asn Arg  Ile Leu Glu Ala Ile  Pro Ser Phe Ile Tyr  Lys Lys Glu
    1145                1150                1155

Lys Asn  Gly Glu Lys Gly Ser  Val Ile Asn Tyr Leu  Gln Asn Ile
    1160                1165                1170

Leu Gly  Ile Lys Ser Ala Lys  Ile Leu Arg Asp Lys  Ile Lys Ile
    1175                1180                1185

Gly Ser  Leu Leu Lys Ile Asp  Lys Phe Pro Tyr Asn  Leu Ala Gly
    1190                1195                1200

Lys Ser  Gly Asn Gly Ile Leu  Ile Ser Gly Gly Val  Gln Leu Ile
    1205                1210                1215

Leu Asp  Lys Asn Thr Ser Lys  Tyr Ile Lys Lys Ile  Glu Asn Tyr
    1220                1225                1230

Lys Tyr  Lys Leu Asp Glu Asn  Lys Asp Tyr Gln Ile  Asn Ile Phe
    1235                1240                1245

Asp Lys  Leu Ser Lys Glu Glu  Asn Ile Lys Leu Phe  Asp Leu Phe
    1250                1255                1260

Val Asp  Lys Phe Glu Asn Ser  Ile Tyr Lys Asn Arg  Val Asn Ile
    1265                1270                1275

Lys Leu  Lys Glu Ile Lys Leu  Ala Arg Pro Lys Phe  Glu His Leu
    1280                1285                1290

Ser Ile  Glu Glu Gln Ile Lys  Thr Leu Thr Gln Met  Leu Ile Leu
    1295                1300                1305

Phe Gly  Arg Glu Asn Asn Ala  Val Asn Leu Glu Tyr  Ile Gly Leu
    1310                1315                1320
```

```
Pro Lys  Asn Thr Gly Lys Thr  Lys Ile Asn Lys Lys  Ile Asn Asn
    1325                1330                1335


Lys Asp  Ile Lys Ile Ile Asn  Gln Ser Ile Thr Gly  Leu Tyr Glu
    1340                1345                1350


Thr Glu  Glu Asp Leu Ala Asn  Ile
    1355                1360
```

<210> 95
<211> 1377
<212> PRT
<213> Lactobacillus brevis

<400> 95

```
Met Glu Ser Asn His Asp Gly Glu Gln Val Lys Tyr Thr Leu Gly Leu
1               5                   10                  15


Asp Ile Gly Thr Ser Ser Ile Gly Tyr Ala Ala Ile Asp Lys His Gln
            20                  25                  30


Lys Pro Ile Arg Ala Lys Gly Lys His Val Ile Gly Val Arg Leu Phe
        35                  40                  45


Gln Glu Gly Gln Thr Ala Ala Asp Arg Arg Ala Phe Arg Thr Thr Arg
    50                  55                  60


Arg Arg Leu Lys Arg Arg Lys Trp Arg Leu Asn Leu Leu Asn Arg Leu
65                  70                  75                  80


Phe Asp Pro Tyr Leu Ser Glu Val Asp Pro Asn Phe Leu Pro Arg Leu
                85                  90                  95


Arg Gln Ser Asn Leu Ser Pro Lys Asp Asp Asn Lys His Phe Asn Gly
            100                 105                 110


Ser Thr Leu Phe Pro Asp Lys Thr Asp Ala Ala Phe Tyr Arg Gln Tyr
```

```
        115                 120                 125

Pro Thr Met Tyr His Leu Arg Tyr Ala Leu Met Thr Glu Lys Arg Lys
    130                 135                 140

Phe Asp Ile Arg Glu Val Tyr Leu Ala Ile His His Ile Val Lys Tyr
145                 150                 155                 160

Arg Gly Asn Phe Leu Asn Ser Ala Thr Val Asp Ser Phe Lys Thr Ser
                165                 170                 175

Asn Ile Asp Phe Thr Ser Gln Phe Asp Arg Leu Asn Glu Leu Tyr Arg
            180                 185                 190

Gln Val Ile Leu Asp Glu Pro Phe Gln Ile Asn Met Asp Gln Val Asp
        195                 200                 205

Glu Met Thr Asn Lys Leu Leu Asp Asn Asp Ala Leu Lys Leu Asp Thr
    210                 215                 220

Gln Lys Gln Val Ala Lys Leu Leu Pro Val Ile Tyr Asn Asp Lys Pro
225                 230                 235                 240

Ile Asp Lys Gln Tyr Thr Arg Ile Ala Thr Glu Phe Ser Lys Ala Ile
                245                 250                 255

Leu Gly Tyr Lys Thr Lys Leu Asp Val Ile Leu Asn Leu Asp Thr Gln
            260                 265                 270

Asn Ala Lys Asp Trp Val Ile Arg Leu Asp Asp Glu Asp Ile Asp Asp
        275                 280                 285

Lys Leu Pro Ala Leu Val Glu Asn Leu Asp Glu Ser Arg Gln Glu Ile
    290                 295                 300

Val Thr Ile Ile Arg Asp Leu Tyr Ala Gln Ile Thr Leu Asn Ala Ile
305                 310                 315                 320
```

```
Val Pro Lys Gly Lys Ser Leu Ser Glu Ser Met Val Asp Lys Tyr Asn
                325                 330                 335

Asp His Lys Asp His Leu Asp Leu Leu Met Gly Leu Ile His Glu Leu
            340                 345                 350

Gly Asp Asp Ser Ala Lys Gly Ile Lys Leu Arg Glu Ala Tyr Thr Gln
        355                 360                 365

Tyr Val Gly Lys Ser Asp Asp Lys Thr Leu Asn Gln Asp Asp Phe Tyr
    370                 375                 380

Ala Ala Ile Lys Lys Asn Leu Asp Glu Asp Ser Lys Arg Ser Pro Lys
385                 390                 395                 400

Ile Gln Arg Leu Ile Glu Gln Ala Ser Phe Met Pro Lys Gln Arg Thr
                405                 410                 415

Ser Ala Asn Gly Val Ile Pro His Gln Leu His Gln Leu Glu Leu Asp
            420                 425                 430

Arg Ile Ile Glu Asn Gln Gly Arg Tyr Tyr Pro Phe Leu Lys Lys Pro
        435                 440                 445

Asn Pro Asn Thr His Lys Pro Asn Gly Gly Lys Tyr Lys Leu Asp Glu
    450                 455                 460

Leu Val Ala Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ile Thr Lys
465                 470                 475                 480

Arg Asp Gln Glu Lys Thr Ser Gly Ala Asp Phe Ala Trp Met Ile Arg
                485                 490                 495

Lys Pro Gly Gln Glu Gly Glu Ile Thr Pro Trp Asn Phe Asp Gln Lys
            500                 505                 510

Val Asp Arg Met Ala Ser Ala Asn Arg Phe Ile Arg Arg Met Thr Thr
```

```
        515                 520                 525

Lys Asp Ser Tyr Leu Val Ala Glu Asp Val Leu Pro Asp Ala Ser Leu
    530                 535                 540

Ile Tyr Glu Lys Phe Lys Ala Leu Asn Glu Leu Asn Met Leu Lys Val
545                 550                 555                 560

Asn Asp Ser Arg Leu Ser Pro Ser Gln Lys Gln Asp Leu Phe Asn Asn
                565                 570                 575

Leu Phe Lys Lys Gln Lys Thr Ile Arg Thr Lys Lys Leu Gln Thr Tyr
            580                 585                 590

Ile Arg Thr Asn Trp Glu Leu Pro Ser Val Met Ile Ser Gly Leu Ala
        595                 600                 605

Asp Pro Asp Lys Phe Asn Ser Ser Leu Ser Thr Tyr Ile Asp Phe Arg
    610                 615                 620

Asp Ile Phe Gly Glu Lys Val Asp Asp Pro Asn Arg Gln Ala Asp Tyr
625                 630                 635                 640

Glu Glu Ile Ile Glu Trp Ser Thr Val Phe Glu Asp Arg Lys Ile Tyr
                645                 650                 655

Gln Ala Lys Leu Asn Gln Leu Asp Trp Leu Thr Glu Pro Gln Arg Lys
            660                 665                 670

Ala Leu Leu Thr Lys Arg Tyr Thr Gly Trp Gly Arg Leu Ser Lys Lys
        675                 680                 685

Leu Leu Thr Gly Leu Lys Asp Gln Asn Gly Asp Ser Ile Leu Asp Gln
    690                 695                 700

Leu Trp Lys Thr Asn Asp Asn Phe Met Gln Ile Gln Ser Arg Asp Glu
705                 710                 715                 720
```

```
Phe Ala Lys Gln Ile His Asp Glu Asn Ala Lys Gln Phe His Glu Ala
               725                 730                 735

Asn Asn Val Asp Asp Ile Leu Asp Asp Ala Phe Thr Ser Pro Gln Asn
            740                 745                 750

Lys Lys Ala Ile Arg Gln Val Asp Lys Val Val Gln Asp Val Val Lys
        755                 760                 765

Ala Val Gly Tyr Ala Pro Asp Lys Ile Ala Ile Glu Phe Thr Arg Ser
    770                 775                 780

Leu Glu Asn Asn Pro Gln Arg Thr Val Ser Arg Gln Arg Gln Leu Gln
785                 790                 795                 800

Ala Ala Tyr Lys Asn Ile Pro Arg Glu Ile Met Lys Ser Gly Leu Met
               805                 810                 815

Ala Glu Leu Gly Ser Val Ala Asp Ser Lys Lys Val Leu Ser Asp Lys
            820                 825                 830

Leu Tyr Leu Tyr Phe Thr Gln Met Gly Lys Asp Met Tyr Glu Asp Lys
        835                 840                 845

Thr Ile Asn Ile Asp Asn Leu Pro Asn Tyr Asp Ile Asp His Ile Leu
    850                 855                 860

Pro Gln Ala Phe Ile Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Ile
865                 870                 875                 880

Ser Lys Glu Glu Asn Ala Arg Lys Ser Asn Arg Val Pro Leu Lys Phe
               885                 890                 895

Phe Gly Ala Lys Arg Met Gly Phe Trp Lys Asp Leu Leu Asn Asn Gly
            900                 905                 910

Leu Ile Ser Asn Arg Lys Phe Gln Asn Leu Thr Thr Asp Pro Glu Lys
```

```
        915                 920                 925

Ile Ser Lys Tyr Ser Ala Lys Gly Phe Ile His Arg Gln Leu Val Glu
    930                 935                 940

Thr Ser Gln Val Ile Arg Leu Val Ala Asn Ile Leu Gly Asn Glu Tyr
945                 950                 955                 960

Ser Gln Ala Gly Thr Thr Ile Ile Glu Val Ser Ala Lys Met Asn Arg
                965                 970                 975

Gln Leu Arg Glu Asp Phe His Leu Ile Lys Asn Arg Asn Val Asn Asp
            980                 985                 990

Tyr His His Ala Met Asp Ala Tyr  Leu Thr Ala Tyr Val  Gly Asp Tyr
        995                 1000                1005

Leu Tyr  Leu Arg Tyr Pro Lys  Leu Arg Pro Tyr Phe  Val Tyr Gly
    1010                1015                1020

Asp Phe  Lys Lys Ala Glu Asp  Gln Asp Leu Asn Ile  Arg Asn Phe
    1025                1030                1035

Asn Phe  Leu His Asp Leu Lys  Asp Asn Glu Ser Leu  Asp Lys Ile
    1040                1045                1050

Val Asp  Ser Glu Thr Gly Glu  Ile Val Trp Glu Lys  His Gly Ser
    1055                1060                1065

Val Lys  Gln Leu Lys Lys Val  Tyr His Tyr Lys Phe  Met Leu Val
    1070                1075                1080

Ser Gln  Glu Val Tyr Thr Arg  Gln Asp Ala Leu Phe  Asn Gln Thr
    1085                1090                1095

Ile Tyr  Pro Ala Ser Asp Ala  Asp Lys Arg Lys Leu  Ile Pro Ile
    1100                1105                1110
```

```
Lys Asn  Ser Lys Pro Val Asp  Val Tyr Gly Gly Tyr  Ser Gly Asn
    1115                1120                1125

Ile Asp  Ala Tyr Met Ala Ile  Val Arg Val His Gly  Lys Lys Glu
    1130                1135                1140

Asp Asn  Tyr Lys Val Val Gly  Ile Pro Met Arg Ala  Val Thr Lys
    1145                1150                1155

Leu Lys  Lys Ala Glu Lys Glu  Gly His Asp Ser Tyr  Leu Asn Ala
    1160                1165                1170

Val His  Glu Val Leu Lys Pro  Gln Phe Thr Lys Lys  Lys Lys Asn
    1175                1180                1185

Arg Lys  Thr Gly Glu Ile Thr  Glu Thr Val Asp Glu  Phe Asp Val
    1190                1195                1200

Leu Leu  Gly Lys Val Tyr Tyr  Arg Gln Leu Ile Val  Asp Gly Asn
    1205                1210                1215

Lys Lys  Phe Met Leu Gly Ser  Ser Ser Tyr Gln Tyr  Asn Ala Lys
    1220                1225                1230

Gln Leu  Val Leu Ser Asp Lys  Ala Met Gln Val Leu  Ser Lys Asn
    1235                1240                1245

Gly Lys  Val Lys Ser Gln Asp  Glu Asn Gln Asn Leu  Ile Asp Val
    1250                1255                1260

Tyr Asp  Glu Ile Leu Glu Lys  Val Asp Gln Tyr Phe  Glu Leu Tyr
    1265                1270                1275

Asp Gln  Arg His Tyr Arg Glu  Ser Leu His Lys Gly  Arg Gly Ile
    1280                1285                1290

Phe Val  Asn Leu Pro Leu Ser  Asn Gln Tyr Asp Gly  Ser Lys Leu
```

```
    1295                1300                1305

Thr Ser  Tyr Gly Lys Tyr Glu  Thr Ile Asp Ala Ile  Leu Asn Gly
    1310                1315                1320

Leu His  Ala Asn Ala Thr Met  Ser Asn Leu Arg Tyr  Leu Gly Ile
    1325                1330                1335

Ser Ser  Pro Phe Gly Lys Met  Gln Ala Ser Asn Gly  Leu Thr Ile
    1340                1345                1350

Asp Pro  Asp Ser Ile Ile Cys  Tyr Gln Ser Pro Thr  Gly Leu Phe
    1355                1360                1365

Glu Arg  Gln Ile Lys Leu Ser  Asp Leu
    1370                1375
```

<210> 96
<211> 1239
<212> PRT
<213> Lactobacillus buchneri

<400> 96

```
Met Thr Glu Lys Arg Lys Phe Asp Ile Arg Glu Val Tyr Leu Ala Ile
1               5                   10                  15

His His Ile Val Lys Tyr Arg Gly Asn Phe Leu Asn Ser Ala Thr Val
            20                  25                  30

Asp Ser Phe Lys Thr Ser Asn Ile Asp Phe Thr Ser Gln Phe Asp Arg
        35                  40                  45

Leu Asn Glu Leu Tyr Arg Gln Val Ile Leu Glu Glu Pro Phe Gln Ile
    50                  55                  60

Asn Met Asn Gln Val Asp Lys Met Thr Asn Lys Leu Leu Asp Asn Asp
65                  70                  75                  80
```

```
Ala Leu Lys Leu Asp Thr Gln Lys Gln Val Ala Lys Leu Leu Pro Val
                85                  90                  95

Ile Tyr Asn Asp Lys Pro Val Asp Lys Gln Tyr Thr Arg Leu Ala Thr
            100                 105                 110

Glu Phe Ser Lys Ala Ile Leu Gly Tyr Lys Thr Lys Leu Asp Val Ile
        115                 120                 125

Leu Asn Leu Asp Thr Gln Asn Ala Lys Asp Trp Ala Ile Arg Leu Asp
    130                 135                 140

Asp Glu Asp Ile Asp Asp Lys Leu Pro Ala Leu Val Glu Asn Leu Asp
145                 150                 155                 160

Glu Ser Arg Gln Glu Ile Val Thr Ile Ile Arg Asp Leu Tyr Ala Gln
                165                 170                 175

Ile Thr Leu Asn Ala Ile Val Pro Lys Gly Lys Ser Leu Ser Glu Ser
            180                 185                 190

Met Val Asp Lys Tyr Asn Asp His Lys Asp His Leu Asp Leu Leu Met
        195                 200                 205

Gly Leu Ile His Glu Leu Gly Asp Asp Ser Ala Lys Gly Ile Lys Leu
    210                 215                 220

Arg Glu Ala Tyr Thr Gln Tyr Val Gly Lys Ser Gly Asp Lys Thr Leu
225                 230                 235                 240

Asn Gln Asp Asp Phe Tyr Ala Ala Ile Lys Lys Asn Leu Asp Glu Asp
                245                 250                 255

Ser Lys Arg Ser Pro Lys Ile Gln Arg Leu Ile Glu Gln Ala Ser Phe
            260                 265                 270

Met Pro Lys Gln Arg Thr Ser Ala Asn Gly Val Ile Pro His Gln Leu
        275                 280                 285
```

```
His Gln Leu Glu Leu Asp Arg Ile Ile Glu Asn Gln Gly Arg Tyr Tyr
    290                 295                 300

Pro Phe Leu Lys Glu Pro Asn Ser Asn Thr His Lys Pro Asn Gly Gly
305                 310                 315                 320

Lys Tyr Lys Leu Asp Glu Leu Val Ala Phe Arg Ile Pro Tyr Tyr Val
                325                 330                 335

Gly Pro Leu Ile Thr Lys Gln Asp Gln Glu Lys Thr Ser Gly Ala Asp
            340                 345                 350

Phe Ala Trp Met Ile Arg Lys Pro Gly Gln Gly Gly Glu Ile Thr Pro
        355                 360                 365

Trp Asn Phe Asp Gln Glu Val Asp Arg Met Ala Ser Ala Asn Thr Phe
    370                 375                 380

Ile Arg Arg Met Thr Thr Lys Asp Ser Tyr Leu Val Ala Glu Asp Val
385                 390                 395                 400

Leu Pro Asp Ser Ser Leu Ile Tyr Glu Lys Phe Lys Val Leu Asn Glu
                405                 410                 415

Leu Asn Met Leu Lys Val Asn Asp Arg Arg Leu Ser Ile Ser Gln Lys
            420                 425                 430

Gln Asp Leu Phe Asn Asn Leu Phe Lys Lys Gln Lys Thr Ile Arg Thr
        435                 440                 445

Lys Lys Leu Gln Thr Tyr Ile Arg Thr Lys Trp Glu Leu Pro Ser Val
    450                 455                 460

Met Ile Ser Gly Leu Ser Asp Pro Asp Lys Phe Asn Ser Ser Leu Ala
465                 470                 475                 480
```

```
Thr Tyr Ile Asp Phe Arg Asp Val Phe Gly Glu Lys Val Asp Asp Pro
                485                 490                 495

Asn Arg Gln Ala Asp Tyr Glu Lys Ile Ile Glu Trp Ser Thr Val Phe
            500                 505                 510

Glu Asp Arg Lys Ile Tyr Gln Ala Lys Leu Asn Gln Leu Asp Trp Leu
        515                 520                 525

Thr Glu Ser Gln Ser Lys Ala Leu Leu Thr Lys His Tyr Thr Gly Trp
    530                 535                 540

Gly Arg Leu Ser Lys Lys Leu Leu Thr Gly Leu Lys Asp Gln Asn Gly
545                 550                 555                 560

Asp Ser Ile Leu Asp Gln Leu Trp Lys Thr Asn Asp Asn Phe Met Gln
                565                 570                 575

Ile Gln Ser Arg Asp Glu Phe Ala Lys Gln Ile His Asp Glu Asn Ala
            580                 585                 590

Lys Gln Phe His Glu Ala Asn Asn Val Asp Asp Ile Leu Asp Asp Ala
        595                 600                 605

Phe Thr Ser Pro Gln Asn Lys Lys Ala Ile Arg Gln Val Asp Lys Val
    610                 615                 620

Val Gln Asp Val Val Lys Ala Val Gly Tyr Ala Pro Asp Lys Ile Ala
625                 630                 635                 640

Ile Glu Phe Thr Arg Ser Pro Gln Asp Arg Pro Gln Arg Thr Phe Ser
                645                 650                 655

Arg Gln Arg Gln Leu Gln Ser Thr Tyr Leu Asn Val Ala Lys Ala Leu
            660                 665                 670

Met Lys Ser Asn Leu Asn Gln Glu Leu Lys Ser Val Ile Asp Ser Gln
        675                 680                 685
```

```
Gln Thr Leu Thr Asp Lys Leu Tyr Leu Tyr Phe Thr Gln Leu Gly Gln
    690                 695                 700

Asp Met Tyr Thr Gly Lys Glu Ile Asn Phe Asp Glu Leu Val Asn Tyr
705                 710                 715                 720

Gln Ile Asp His Ile Leu Pro Gln Ala Phe Ile Lys Asp Asp Ser Leu
                725                 730                 735

Asp Asn Arg Val Leu Val Ser Ala Pro Ile Asn Asn Ala Lys Ser Asp
            740                 745                 750

Asn Val Pro Val Lys Lys Phe Gly Ala Lys Met Gly Tyr Phe Trp Lys
        755                 760                 765

Gln Leu Ala Glu Asn His Leu Ile Ser Lys Arg Lys Leu Asn Asn Leu
    770                 775                 780

Thr Thr Asp Pro Asp Lys Ile Gly Lys Phe Thr Ala Gln Gly Phe Ile
785                 790                 795                 800

His Arg Gln Leu Val Glu Thr Ser Gln Val Ile Arg Leu Val Ala Asn
                805                 810                 815

Ile Leu Gly Asn Glu Tyr Gly His Asp Gly Thr Thr Ile Ile Glu Val
            820                 825                 830

Thr Ala Lys Met Asn His Gln Met Arg Lys Asp Phe Asp Leu Ile Lys
        835                 840                 845

Ile Arg Asp Val Asn Asp Tyr His His Ala Met Asp Ala Tyr Leu Thr
    850                 855                 860

Ala Tyr Val Gly Asp Tyr Leu Tyr Leu Arg Tyr Pro Lys Leu Arg Ser
865                 870                 875                 880
```

```
Tyr Phe Val Tyr Gly Asp Phe Lys Lys Leu Lys Asp Gln Ser Leu Lys
                885                 890                 895


Ile Arg Asn Phe Asn Phe Leu His Asp Leu Thr Asn Asp Glu Ala Gly
            900                 905                 910


Asp Lys Ile Val Asp Gln Glu Thr Gly Glu Ile Ile Trp Asp Lys His
        915                 920                 925


Glu Ser Val Lys Gln Leu Lys Lys Val Tyr His Tyr Lys Phe Met Leu
    930                 935                 940


Val Ser Gln Glu Val Tyr Thr Arg Gln Asp Ala Leu Phe Asn Gln Thr
945                 950                 955                 960


Ile Tyr Pro Ala Ser Asp Ala Asp Lys Arg Lys Leu Ile Pro Ile Lys
                965                 970                 975


Asn Asn Lys Pro Val Asp Val Tyr Gly Gly Tyr Ser Gly Asn Val Asp
            980                 985                 990


Ala Tyr Met Ala Ile Val Arg Ile  His Gly Lys Lys Glu  Asp Lys Tyr
        995                 1000                1005


Lys Val  Val Gly Val Pro Met  Arg Ala Val Ala Asp  Leu Lys Lys
    1010                1015                1020


Ala Glu  Ser Lys Gly Arg Asp  Asn Tyr Leu Asn Ala  Val His Glu
    1025                1030                1035


Val Leu  Lys Pro Gln Phe Thr  Lys Lys Lys Lys Asp  Arg Lys Thr
    1040                1045                1050


Gly Glu  Ile Thr Glu Met Met  Asp Asp Phe Asp Val  Leu Leu Gly
    1055                1060                1065


Lys Val  Tyr Tyr Arg Gln Leu  Ile Val Asp Gly Asn  Lys Lys Phe
    1070                1075                1080
```

```
Met Leu  Gly Ser Ser Thr Tyr  Gln Tyr Asn Ala Lys  Gln Leu Val
    1085                1090                1095

Leu Ser  Asp Lys Ala Met Gln  Val Leu Ser Lys Asp  Asp Lys Leu
    1100                1105                1110

Lys Asn  Gln Asp Glu Asn Gln  Asn Leu Ile Asp Val  Tyr Asp Glu
    1115                1120                1125

Ile Leu  Glu Lys Val Asp Gln  Tyr Phe Glu Leu Tyr  Asp Ile Asn
    1130                1135                1140

Lys Phe  Arg Gln Lys Leu His  Asp Gly Arg Lys Lys  Phe Ile Glu
    1145                1150                1155

Leu Pro  Val Asp Asn Asp Phe  Asn Gly Lys Lys Leu  Ile Ser Tyr
    1160                1165                1170

Gly Lys  Arg Ala Thr Ile Ile  Ser Ile Leu Asn Gly  Leu His Ala
    1175                1180                1185

Asn Ala  Thr Met Ser Asn Leu  Lys Tyr Leu Gly Ile  Ser Ser Pro
    1190                1195                1200

Phe Gly  Met Leu Gln Val Pro  Asn Gly Ile Ile Leu  Ser Pro Ala
    1205                1210                1215

Ser Arg  Ile Cys Tyr Gln Ser  Pro Thr Gly Leu Phe  Glu Arg Lys
    1220                1225                1230

Val Lys  Leu Ser Asp Leu
    1235
```

<210> 97
<211> 1381
<212> PRT
<213> Lactobacillus fermentum

<400> 97

```
Met Asp Tyr Val Lys Glu Tyr His Ile Gly Leu Asp Ile Gly Thr Ser
1               5                  10                  15

Ser Ile Gly Trp Ala Val Thr Asp Ser Gln Phe Lys Leu Met Arg Ile
            20                  25                  30

Lys Gly Lys Thr Ala Ile Gly Val Arg Leu Phe Glu Glu Gly Lys Thr
        35                  40                  45

Ala Ala Glu Arg Arg Thr Phe Arg Thr Thr Arg Arg Arg Leu Lys Arg
    50                  55                  60

Arg Lys Trp Arg Leu His Tyr Leu Asp Lys Ile Phe Ala Pro His Leu
65                  70                  75                  80

Gln Glu Val Asp Glu Asn Phe Leu Arg Arg Leu Lys Gln Ser Asn Ile
                85                  90                  95

His Pro Glu Asp Pro Ala Lys Asn Gln Ala Phe Ile Gly Lys Leu Leu
            100                 105                 110

Phe Pro Asp Leu Leu Lys Lys Asn Glu Arg Gly Tyr Pro Thr Leu Ile
        115                 120                 125

Lys Met Arg Asp Glu Leu Pro Val Glu Gln Arg Ala His Tyr Pro Val
    130                 135                 140

Thr Asn Ile Tyr Lys Leu Arg Glu Ala Met Ile Asn Glu Asp Arg Gln
145                 150                 155                 160

Phe Asp Leu Arg Glu Val Tyr Leu Ala Val His His Ile Val Lys Tyr
                165                 170                 175

Arg Gly His Phe Leu Asn Asn Ala Ser Val Asp Lys Phe Lys Val Gly
            180                 185                 190
```

```
Arg Ile Asp Phe Asp Lys Ser Phe Asn Val Leu Asn Glu Ala Tyr Glu
        195                 200                 205

Glu Leu Gln Asn Gly Glu Gly Ser Phe Thr Ile Glu Pro Ser Lys Val
    210                 215                 220

Glu Lys Ile Gly Gln Leu Leu Leu Asp Thr Lys Met Arg Lys Leu Asp
225                 230                 235                 240

Arg Gln Lys Ala Val Ala Lys Leu Leu Glu Val Lys Val Ala Asp Lys
                245                 250                 255

Glu Glu Thr Lys Arg Asn Lys Gln Ile Ala Thr Ala Met Ser Lys Leu
            260                 265                 270

Val Leu Gly Tyr Lys Ala Asp Phe Ala Thr Val Ala Met Ala Asn Gly
        275                 280                 285

Asn Glu Trp Lys Ile Asp Leu Ser Ser Glu Thr Ser Glu Asp Glu Ile
    290                 295                 300

Glu Lys Phe Arg Glu Glu Leu Ser Asp Ala Gln Asn Asp Ile Leu Thr
305                 310                 315                 320

Glu Ile Thr Ser Leu Phe Ser Gln Ile Met Leu Asn Ala Ile Val Pro
                325                 330                 335

Asn Gly Met Ser Ile Ser Glu Ser Met Met Asp Arg Tyr Trp Thr His
            340                 345                 350

Glu Arg Gln Leu Ala Glu Val Lys Glu Tyr Leu Ala Thr Gln Pro Ala
        355                 360                 365

Ser Ala Arg Lys Glu Phe Asp Gln Val Tyr Asn Lys Tyr Ile Gly Gln
    370                 375                 380

Val Pro Lys Glu Lys Gly Phe Asp Leu Glu Lys Gly Leu Lys Lys Ile
```

```
385                 390                 395                 400

Leu Ser Lys Lys Glu Asn Trp Lys Glu Ile Asp Glu Leu Leu Lys Ala
                405                 410                 415

Gly Asp Phe Leu Pro Lys Gln Arg Thr Ser Ala Asn Gly Val Ile Pro
            420                 425                 430

His Gln Met His Gln Gln Glu Leu Asp Arg Ile Ile Glu Lys Gln Ala
        435                 440                 445

Lys Tyr Tyr Pro Trp Leu Ala Thr Glu Asn Pro Ala Thr Gly Glu Arg
    450                 455                 460

Asp Arg His Gln Ala Lys Tyr Glu Leu Asp Gln Leu Val Ser Phe Arg
465                 470                 475                 480

Ile Pro Tyr Tyr Val Gly Pro Leu Val Thr Pro Glu Val Gln Lys Ala
                485                 490                 495

Thr Ser Gly Ala Lys Phe Ala Trp Ala Lys Arg Lys Glu Asp Gly Glu
            500                 505                 510

Ile Thr Pro Trp Asn Leu Trp Asp Lys Ile Asp Arg Ala Glu Ser Ala
        515                 520                 525

Glu Ala Phe Ile Lys Arg Met Thr Val Lys Asp Thr Tyr Leu Leu Asn
    530                 535                 540

Glu Asp Val Leu Pro Ala Asn Ser Leu Leu Tyr Gln Lys Tyr Asn Val
545                 550                 555                 560

Leu Asn Glu Leu Asn Asn Val Arg Val Asn Gly Arg Arg Leu Ser Val
                565                 570                 575

Gly Ile Lys Gln Asp Ile Tyr Thr Glu Leu Phe Lys Lys Lys Lys Thr
            580                 585                 590
```

```
Val Lys Ala Gly Asp Val Ala Ser Leu Val Met Ala Lys Thr Arg Gly
        595                 600                 605

Val Asn Lys Pro Ser Val Glu Gly Leu Ser Asp Pro Lys Lys Phe Asn
    610                 615                 620

Ser Asn Leu Ala Thr Tyr Leu Asp Leu Lys Ser Ile Met Gly Asp Lys
625                 630                 635                 640

Val Asp Asp Asn Arg Tyr Gln Met Asp Leu Glu Asn Ile Ile Glu Trp
                645                 650                 655

Arg Ser Val Phe Glu Asp Gly Glu Ile Phe Ala Asp Lys Leu Thr Glu
            660                 665                 670

Val Glu Trp Leu Thr Asp Glu Gln Arg Ser Ala Leu Val Lys Lys Arg
        675                 680                 685

Tyr Lys Gly Trp Gly Arg Leu Ser Lys Lys Leu Leu Thr Gly Ile Val
    690                 695                 700

Asp Glu Asn Gly Gln Arg Ile Ile Asp Leu Met Trp Asn Thr Asp Gln
705                 710                 715                 720

Asn Phe Met Gln Ile Val Asn Gln Pro Val Phe Lys Glu Gln Ile Asp
                725                 730                 735

Gln Leu Asn Gln Lys Ala Ile Thr Asn Asp Gly Met Thr Leu Arg Glu
            740                 745                 750

Arg Val Glu Ser Val Leu Asp Asp Ala Tyr Thr Ser Pro Gln Asn Lys
        755                 760                 765

Lys Ala Ile Trp Gln Val Val Arg Val Val Glu Asp Ile Val Lys Ala
    770                 775                 780

Val Gly Asn Ala Pro Lys Ser Ile Ser Ile Glu Phe Ala Arg Asn Glu
```

785 790 795 800

Gly Asn Lys Gly Glu Ile Thr Arg Ser Arg Arg Thr Gln Leu Gln Lys
805 810 815

Leu Phe Glu Asp Gln Ala His Glu Leu Val Lys Asp Thr Ser Leu Thr
820 825 830

Glu Glu Leu Glu Lys Ala Pro Asp Leu Ser Asp Arg Tyr Tyr Phe Tyr
835 840 845

Phe Thr Gln Gly Gly Lys Asp Met Tyr Thr Gly Asp Pro Ile Asn Phe
850 855 860

Asp Glu Ile Ser Thr Lys Tyr Asp Ile Asp His Ile Leu Pro Gln Ser
865 870 875 880

Phe Val Lys Asp Asp Ser Leu Asp Asn Arg Val Leu Val Ser Arg Ala
885 890 895

Glu Asn Asn Lys Lys Ser Asp Arg Val Pro Ala Lys Leu Tyr Ala Ala
900 905 910

Lys Met Lys Pro Tyr Trp Asn Gln Leu Leu Lys Gln Gly Leu Ile Thr
915 920 925

Gln Arg Lys Phe Glu Asn Leu Thr Met Asp Val Asp Gln Asn Ile Lys
930 935 940

Tyr Arg Ser Leu Gly Phe Val Lys Arg Gln Leu Val Glu Thr Arg Gln
945 950 955 960

Val Ile Lys Leu Thr Ala Asn Ile Leu Gly Ser Met Tyr Gln Glu Ala
965 970 975

Gly Thr Asp Ile Ile Glu Thr Arg Ala Gly Leu Thr Lys Gln Leu Arg
980 985 990

```
Glu Glu Phe Asp Leu Pro Lys Val  Arg Glu Val Asn Asp  Tyr His His
        995                 1000                1005


Ala Val  Asp Ala Tyr Leu Thr  Thr Phe Ala Gly Gln  Tyr Leu Asn
    1010                1015                1020


Arg Arg  Tyr Pro Lys Leu Arg  Ser Phe Phe Val Tyr  Gly Glu Tyr
    1025                1030                1035


Met Lys  Phe Lys His Gly Ser  Asp Leu Lys Leu Arg  Asn Phe Asn
    1040                1045                1050


Phe Phe  His Glu Leu Met Glu  Gly Asp Lys Ser Gln  Gly Lys Val
    1055                1060                1065


Val Asp  Gln Gln Thr Gly Glu  Leu Ile Thr Thr Arg  Asp Glu Val
    1070                1075                1080


Ala Lys  Ser Phe Asp Arg Leu  Leu Asn Met Lys Tyr  Met Leu Val
    1085                1090                1095


Ser Lys  Glu Val His Asp Arg  Ser Asp Gln Leu Tyr  Gly Ala Thr
    1100                1105                1110


Ile Val  Thr Ala Lys Glu Ser  Gly Lys Leu Thr Ser  Pro Ile Glu
    1115                1120                1125


Ile Lys  Lys Asn Arg Pro Val  Asp Leu Tyr Gly Ala  Tyr Thr Asn
    1130                1135                1140


Gly Thr  Ser Ala Phe Met Thr  Ile Ile Lys Phe Thr  Gly Asn Lys
    1145                1150                1155


Pro Lys  Tyr Lys Val Ile Gly  Val Pro Thr Thr Ser  Ala Val Gly
    1160                1165                1170


Leu Lys  Arg Val Gly Lys Pro  Gly Ser Glu Ser Tyr  Asn Gln Glu
```

```
    1175                1180                1185

Leu His  Arg Ile Ile Lys Ser  Asn Pro Lys Val Lys  Lys Asp Phe
    1190                1195                1200

Glu Ile  Val Val Pro His Val  Ser Tyr Ser Gln Leu  Ile Val Asp
    1205                1210                1215

Gly Asp  Cys Lys Phe Thr Leu  Ala Ser Asp Thr Tyr  Gln His Pro
    1220                1225                1230

Ala Thr  Gln Leu Val Leu Ser  Lys Glu Ser Met Glu  Ile Ile Ala
    1235                1240                1245

Asp Asp  Phe Lys Phe Val Lys  Glu Asn Pro Ala Thr  Ala Asp Glu
    1250                1255                1260

Gln Leu  Val Arg Val Phe Asp  Glu Ile Val Asn Gln  Met Asn His
    1265                1270                1275

Tyr Phe  Thr Ile Phe Asp Gln  Arg Ser Asn Arg Gln  Lys Val Thr
    1280                1285                1290

Lys Ala  Arg Asp Lys Phe Val  Ser Leu Pro Thr Glu  Ser Glu Tyr
    1295                1300                1305

Glu Gly  Ala Lys Lys Thr Gln  Val Gly Lys Thr Glu  Val Ile Thr
    1310                1315                1320

Asn Leu  Leu Met Gly Leu His  Ala Asn Ala Ala Gln  Gly Asp Leu
    1325                1330                1335

Lys Val  Leu Gly Leu Ser Thr  Phe Gly Phe Phe Gln  Ser Ser Gly
    1340                1345                1350

Gly Leu  Asn Leu Ser Glu Asp  Ala Met Ile Val Tyr  Gln Ser Pro
    1355                1360                1365
```

```
Thr Gly  Leu Phe Glu Arg Arg  Ile Cys Leu Lys Asp  Ile
    1370                1375                1380


<210>  98
<211>  1306
<212>  PRT
<213>  Sphingobacterium spiritivorum

<400>  98

Met Lys His Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Leu Ile Lys Gln Asn Phe Glu Asn Lys Gln Gly Glu Ile Leu Gly
            20                  25                  30


Met Gly Ser Arg Ile Ile Pro Met Gly Ala Glu Leu Ser Lys Phe Glu
        35                  40                  45


Gln Gly Gln Ala Gln Thr Lys Asn Ala Asn Arg Arg Ile Ala Arg Gly
    50                  55                  60


Thr Arg Lys Leu Asn Lys Arg Tyr Lys Gln Arg Arg Asn Lys Leu Ile
65                  70                  75                  80


Tyr Ile Leu Gln Gly Leu Gly Met Leu Pro Asp Gln Ile Lys Leu Val
                85                  90                  95


Asn Gln Phe Ser Asp Pro Asn Lys Leu Asp Lys Ile Ser Ile Leu Pro
            100                 105                 110


Ile Ser Lys Asn Gln Gln Gln Leu Thr Ala Phe Asp Leu Leu Glu Leu
        115                 120                 125


Arg Val Lys Ala Leu Thr Glu Lys Ile Glu Leu Glu Glu Leu Gly Lys
    130                 135                 140


Val Ile Tyr Lys Tyr Asn Gln Leu Arg Gly Tyr Ser Gly Gly Asn Ser
145                 150                 155                 160
```

```
Glu Pro Glu Lys Glu Glu Asn Asn Glu Asp Glu Ser Glu Glu Asn Glu
                165                 170                 175

Lys Thr Asn Asp Ser Phe Val Val Phe Ser Lys Val Leu Ser Leu Gly
            180                 185                 190

Leu Pro Glu Glu Ile Thr Phe Lys Gly Lys Lys Leu Ser Lys Arg Lys
        195                 200                 205

Ile Ala Ile Glu Thr Glu Asp Gly Ile Ile Glu Ala Glu Thr Phe Leu
    210                 215                 220

Asp Ser Leu Lys Glu Asn Asp Ser Leu Glu Leu His Val Asn Ile Arg
225                 230                 235                 240

Arg Ala Lys Ser Gly Asp Thr Ile Thr Ile Lys Leu Pro Ser Lys Thr
                245                 250                 255

Ser Trp Arg Lys Lys Met Glu Asn Ile Glu Lys Gln Leu Ala Asp Lys
            260                 265                 270

Ser Lys Glu Leu Gly Arg Glu Tyr Phe Ile Ser Glu Leu Leu Phe Asp
        275                 280                 285

Ile Leu Lys Glu Asn Lys Trp Ala Lys Ile Arg Asn Asn Val Ile Leu
    290                 295                 300

Arg Ser Arg Tyr Glu Ser Glu Phe Asp Ala Val Trp Ser Glu Gln Ser
305                 310                 315                 320

Lys Tyr Tyr Pro Ile Leu Asn His Leu Glu Thr Asp Arg Leu Gln Lys
                325                 330                 335

Ile Leu Glu Phe Ile Phe Pro Gly Gln Lys Glu Ser Gln Glu Lys Leu
            340                 345                 350
```

```
Arg Gln Thr Gly Leu Lys Glu Gly Leu Lys Tyr Val Ile Lys Asn Gln
        355                 360                 365

Val Val Phe Tyr Gln Arg Glu Leu Lys Asp Gln Ser Asp Leu Ile Ser
    370                 375                 380

Asn Cys Arg Tyr Glu Pro Thr Glu Lys Val Val Ala Lys Ser His Pro
385                 390                 395                 400

Val Phe Gln Glu Tyr Lys Ile Trp Glu Gln Ile Asn Lys Leu Val Ile
                405                 410                 415

Asn Thr Lys Ile Glu Asn Gly Val Asn Arg Lys Gly Glu Ile Arg Tyr
            420                 425                 430

Lys Tyr Ile Asp Lys Pro Ile Pro Val Ala Leu Lys Glu Trp Leu Tyr
        435                 440                 445

Glu Glu Leu Gln Ser Lys Lys Glu Val Ser Phe Asn Pro Ile Leu Thr
    450                 455                 460

Lys Leu Lys Lys Glu Phe Lys Leu Arg Glu Asn Val Asp Phe Leu Asn
465                 470                 475                 480

Gly Met Asn Ala Lys Asp Lys Leu Lys Gly Asn Glu Thr Lys Val Ile
                485                 490                 495

Leu Gln Lys Ala Leu Gly Glu Leu Trp Asn Ile Phe Gly Leu Asp Asp
            500                 505                 510

Ser Glu Arg Gln Val Glu Leu Trp Glu Ile Leu Tyr Asn Gly Lys Gly
        515                 520                 525

Asn Glu Tyr Asp Leu Thr Ser Glu Arg Thr Ser Asn Ile Leu Ala Phe
    530                 535                 540

Ile Glu Lys Tyr Ser Pro Asp Leu Glu Asn Lys Asn Asp Val Ala Ile
545                 550                 555                 560
```

```
Lys Ile Ser Lys Ile Lys Phe Ser Arg Asn Tyr Ser Asn Leu Ser Leu
               565                 570                 575

Lys Ala Ile Asp Asn Ile Leu Pro Leu Val Arg Ala Gly Lys Phe Phe
            580                 585                 590

Asp Gln Asn Phe Ser Glu Ala Leu Ser His Lys Ile Val Lys Leu Leu
        595                 600                 605

Asn Glu Asn Val Glu Asp Pro Phe Glu Lys Ser Ala Gln Glu Phe Leu
    610                 615                 620

Asp Lys Asn Gln Asp Val Leu Ser Asp Gly Gly Ile Val Asn Ala Ile
625                 630                 635                 640

Ala Thr Ile Leu Val Tyr Asp Lys His Thr Ala Lys Glu Tyr Ser Gly
               645                 650                 655

Asp Glu Leu Ile Lys Glu Phe Thr Gln Ile Ser Arg Leu Lys Gln Gly
            660                 665                 670

Glu Leu Arg Asn Pro Leu Ala Glu Gln Ile Ile Asn Glu Ala Leu Val
        675                 680                 685

Ile Val Arg Asp Ile Trp Arg Lys Tyr Gly Phe Lys Pro Asp Glu Ile
    690                 695                 700

Arg Val Glu Leu Ala Arg Glu Leu Lys Asn Asn Ala Val Glu Arg Gly
705                 710                 715                 720

Lys Met Tyr Ser Ala Asn Leu Lys Ser Gln Lys His Asn Ala Glu Ile
               725                 730                 735

Arg Asn Lys Leu Ile Glu Leu Lys Gln Glu Ile Ser Ile Ala Asn Ile
            740                 745                 750
```

```
Glu Lys Tyr Lys Leu Trp Val Ser Gln Glu Asn Leu Gln Glu Val Tyr
        755                 760                 765

Leu Lys Asn Tyr Asn Asp Pro Ser Lys Ser Glu Ile Glu Lys Leu Lys
    770                 775                 780

Leu Trp Glu Ser Gln Gly His Ile Ser Pro Tyr Thr Gly Gln Pro Ile
785                 790                 795                 800

Ser Leu Ser Glu Leu Phe Asn Arg Glu Arg Tyr Asp Val Asp His Ile
                805                 810                 815

Ile Pro Gln Ser Arg Tyr Phe Asp Asp Ser Leu Ser Asn Lys Val Ile
            820                 825                 830

Cys Glu Lys Ser Ile Asn Asn Glu Lys Gly Asn Arg Thr Ser Met Glu
        835                 840                 845

Tyr Phe Glu Val Gly Ser Val Asn Tyr Arg Ile Phe Thr Lys Asp Gln
    850                 855                 860

Phe Ile Asp His Ala Asn Lys Tyr Phe Ser Gly Lys Lys Arg Lys Asn
865                 870                 875                 880

Leu Leu Ala Thr Ser Ile Pro Glu Asp Pro Ile Gln Arg Gln Ile Lys
                885                 890                 895

Asp Thr Gln Tyr Ile Ser Ile Arg Ile Arg Glu Glu Leu Asn Lys Ile
            900                 905                 910

Val Gly Asn Glu Asn Val Lys Thr Thr Thr Gly Gly Ile Thr Asp Tyr
        915                 920                 925

Leu Arg Asn His Trp Gly Leu Thr Asp Lys Phe Lys Val Leu Leu Lys
    930                 935                 940

Glu Arg Tyr Glu Ala Val Leu Pro Lys Ile Ala Gln Leu Glu Tyr Asp
945                 950                 955                 960
```

```
Asn Tyr Lys Lys Glu Thr Glu Lys Lys Phe Thr Glu Tyr Lys Asn Ala
               965                 970                 975

Asp Val Glu Phe Asn Glu Pro Ile Leu Asp Glu Glu Ile Phe Ile Glu
           980                 985                 990

Lys Phe Arg Ser Glu Phe Ile Arg  Lys Lys Asn Asn Lys  Leu Ile Ile
        995                 1000                1005

Lys Gly  Trp Ser Lys Arg Ile  Asp His Arg His His  Ala Met Asp
    1010                1015                1020

Ala Leu  Val Ile Ala Cys Thr  Gln Pro Ala His Ile  Lys Arg Leu
    1025                1030                1035

Asn Asp  Leu Asn Gln Val Leu  Lys Glu Trp Leu Asp  Lys Asn Lys
    1040                1045                1050

Glu Lys  Phe Phe Pro Gly Phe  Ser Gly Thr Lys Thr  Glu Leu Leu
    1055                1060                1065

Asp Glu  Val Leu Asn Leu Glu  Glu Glu Lys Arg Arg  Glu Ile Phe
    1070                1075                1080

Asn Gln  Leu Glu Lys Phe Arg  Ala Ile Glu Met Pro  Trp Lys Gly
    1085                1090                1095

Phe Pro  Glu Glu Ala Glu Gln  Lys Leu Lys Glu Val  Ile Val Ser
    1100                1105                1110

His Lys  Pro Lys Asp Lys Leu  Leu Leu Gln Tyr Asp  Ile Gln Gly
    1115                1120                1125

Asn Lys  Gln Ile Lys Leu Arg  Gly Gln Leu His Glu  Gly Thr Leu
    1130                1135                1140
```

```
Tyr Gly  Leu Ser Asn Gly Lys  Glu Ile Tyr Arg Ile  Pro Ile Asn
    1145                1150                1155

Lys Leu  Ala Gly Lys Gln Phe  Ala Thr Glu Lys Thr  Ile Glu Lys
    1160                1165                1170

Ile Val  Asn Pro Phe Leu Lys  Asn Val Ile Glu Glu  His Leu Lys
    1175                1180                1185

Ser Phe  Gly Lys Lys Glu Glu  Ala Phe Ser Ala Glu  Gly Ile Leu
    1190                1195                1200

Asp Leu  Asn Lys Lys Leu Ala  Glu Arg Lys Asp Glu  Gln Gln Asn
    1205                1210                1215

Pro Lys  Pro His Pro Pro Ile  Ser Thr Ile Lys Ile  Tyr Tyr Lys
    1220                1225                1230

Asp Pro  Ser Lys Ser Lys Lys  Lys Lys Thr Asp Asp  Glu Asp Asp
    1235                1240                1245

Ile Ser  Leu Gln Lys Leu Asn  Arg Lys Lys Ser Phe  Asn Asp Ser
    1250                1255                1260

Leu Tyr  Val Lys Thr Gly Asp  Asn Tyr Leu Phe Ala  Val Met Glu
    1265                1270                1275

Lys Glu  Val Phe Asn Lys Lys  Leu Asn Lys Asp Lys  Thr Glu Arg
    1280                1285                1290

His Tyr  Asp Leu Lys Leu Phe  Leu Thr Leu Leu Ile  Phe
    1295                1300                1305
```

<210> 99
<211> 1358
<212> PRT
<213> Acidaminococcus sp.

<400> 99

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Met Gly Lys Met Tyr Tyr Leu Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Tyr Ala Val Thr Asp Pro Ser Tyr His Leu Leu Lys Phe Lys Gly
            20                  25                  30

Glu Pro Met Trp Gly Ala His Val Phe Ala Ala Gly Asn Gln Ser Ala
        35                  40                  45

Glu Arg Arg Ser Phe Arg Thr Ser Arg Arg Arg Leu Asp Arg Arg Gln
    50                  55                  60

Gln Arg Val Lys Leu Val Gln Glu Ile Phe Ala Pro Val Ile Ser Pro
65                  70                  75                  80

Ile Asp Pro Arg Phe Phe Ile Arg Leu His Glu Ser Ala Leu Trp Arg
                85                  90                  95

Asp Asp Val Ala Glu Thr Asp Lys His Ile Phe Phe Asn Asp Pro Thr
            100                 105                 110

Tyr Thr Asp Lys Glu Tyr Tyr Ser Asp Tyr Pro Thr Ile His His Leu
        115                 120                 125

Ile Val Asp Leu Met Glu Ser Ser Glu Lys His Asp Pro Arg Leu Val
    130                 135                 140

Tyr Leu Ala Val Ala Trp Leu Val Ala His Arg Gly His Phe Leu Asn
145                 150                 155                 160

Glu Val Asp Lys Asp Asn Ile Gly Asp Val Leu Ser Phe Asp Ala Phe
                165                 170                 175

Tyr Pro Glu Phe Leu Ala Phe Leu Ser Asp Asn Gly Val Ser Pro Trp
            180                 185                 190

Val Cys Glu Ser Lys Ala Leu Gln Ala Thr Leu Leu Ser Arg Asn Ser
```

```
        195                 200                 205

Val Asn Asp Lys Tyr Lys Ala Leu Lys Ser Leu Ile Phe Gly Ser Gln
    210                 215                 220

Lys Pro Glu Asp Asn Phe Asp Ala Asn Ile Ser Glu Asp Gly Leu Ile
225                 230                 235                 240

Gln Leu Leu Ala Gly Lys Lys Val Lys Val Asn Lys Leu Phe Pro Gln
                245                 250                 255

Glu Ser Asn Asp Ala Ser Phe Thr Leu Asn Asp Lys Glu Asp Ala Ile
            260                 265                 270

Glu Glu Ile Leu Gly Thr Leu Thr Pro Asp Glu Cys Glu Trp Ile Ala
        275                 280                 285

His Ile Arg Arg Leu Phe Asp Trp Ala Ile Met Lys His Ala Leu Lys
    290                 295                 300

Asp Gly Arg Thr Ile Ser Glu Ser Lys Val Lys Leu Tyr Glu Gln His
305                 310                 315                 320

His His Asp Leu Thr Gln Leu Lys Tyr Phe Val Lys Thr Tyr Leu Ala
                325                 330                 335

Lys Glu Tyr Asp Asp Ile Phe Arg Asn Val Asp Ser Glu Thr Thr Lys
            340                 345                 350

Asn Tyr Val Ala Tyr Ser Tyr His Val Lys Glu Val Lys Gly Thr Leu
        355                 360                 365

Pro Lys Asn Lys Ala Thr Gln Glu Glu Phe Cys Lys Tyr Val Leu Gly
    370                 375                 380

Lys Val Lys Asn Ile Glu Cys Ser Glu Ala Asp Lys Val Asp Phe Asp
385                 390                 395                 400
```

```
Glu Met Ile Gln Arg Leu Thr Asp Asn Ser Phe Met Pro Lys Gln Val
                405                 410                 415

Ser Gly Glu Asn Arg Val Ile Pro Tyr Gln Leu Tyr Tyr Tyr Glu Leu
            420                 425                 430

Lys Thr Ile Leu Asn Lys Ala Ala Ser Tyr Leu Pro Phe Leu Thr Gln
        435                 440                 445

Cys Gly Lys Asp Ala Ile Ser Asn Gln Asp Lys Leu Leu Ser Ile Met
    450                 455                 460

Thr Phe Arg Ile Pro Tyr Phe Val Gly Pro Leu Arg Lys Asp Asn Ser
465                 470                 475                 480

Glu His Ala Trp Leu Glu Arg Lys Ala Gly Lys Ile Tyr Pro Trp Asn
                485                 490                 495

Phe Asn Asp Lys Val Asp Leu Asp Lys Ser Glu Glu Ala Phe Ile Arg
            500                 505                 510

Arg Met Thr Asn Thr Cys Thr Tyr Tyr Pro Gly Glu Asp Val Leu Pro
        515                 520                 525

Leu Asp Ser Leu Ile Tyr Glu Lys Phe Met Ile Leu Asn Glu Ile Asn
    530                 535                 540

Asn Ile Arg Ile Asp Gly Tyr Pro Ile Ser Val Asp Val Lys Gln Gln
545                 550                 555                 560

Val Phe Gly Leu Phe Glu Lys Lys Arg Arg Val Thr Val Lys Asp Ile
                565                 570                 575

Gln Asn Leu Leu Leu Ser Leu Gly Ala Leu Asp Lys His Gly Lys Leu
            580                 585                 590

Thr Gly Ile Asp Thr Thr Ile His Ser Asn Tyr Asn Thr Tyr His His
```

```
        595                 600                 605

Phe Lys Ser Leu Met Glu Arg Gly Val Leu Thr Arg Asp Asp Val Glu
    610                 615                 620

Arg Ile Val Glu Arg Met Thr Tyr Ser Asp Asp Thr Lys Arg Val Arg
625                 630                 635                 640

Leu Trp Leu Asn Asn Asn Tyr Gly Thr Leu Thr Ala Asp Asp Val Lys
                645                 650                 655

His Ile Ser Arg Leu Arg Lys His Asp Phe Gly Arg Leu Ser Lys Met
            660                 665                 670

Phe Leu Thr Gly Leu Lys Gly Val His Lys Glu Thr Gly Glu Arg Ala
        675                 680                 685

Ser Ile Leu Asp Phe Met Trp Asn Thr Asn Asp Asn Leu Met Gln Leu
    690                 695                 700

Leu Ser Glu Cys Tyr Thr Phe Ser Asp Glu Ile Thr Lys Leu Gln Glu
705                 710                 715                 720

Ala Tyr Tyr Ala Lys Ala Gln Leu Ser Leu Asn Asp Phe Leu Asp Ser
                725                 730                 735

Met Tyr Ile Ser Asn Ala Val Lys Arg Pro Ile Tyr Arg Thr Leu Ala
            740                 745                 750

Val Val Asn Asp Ile Arg Lys Ala Cys Gly Thr Ala Pro Lys Arg Ile
        755                 760                 765

Phe Ile Glu Met Ala Arg Asp Gly Glu Ser Lys Lys Lys Arg Ser Val
    770                 775                 780

Thr Arg Arg Glu Gln Ile Lys Asn Leu Tyr Arg Ser Ile Arg Lys Asp
785                 790                 795                 800
```

```
Phe Gln Gln Glu Val Asp Phe Leu Glu Lys Ile Leu Glu Asn Lys Ser
                805                 810                 815

Asp Gly Gln Leu Gln Ser Asp Ala Leu Tyr Leu Tyr Phe Ala Gln Leu
            820                 825                 830

Gly Arg Asp Met Tyr Thr Gly Asp Pro Ile Lys Leu Glu His Ile Lys
        835                 840                 845

Asp Gln Ser Phe Tyr Asn Ile Asp His Ile Tyr Pro Gln Ser Met Val
    850                 855                 860

Lys Asp Asp Ser Leu Asp Asn Lys Val Leu Val Gln Ser Glu Ile Asn
865                 870                 875                 880

Gly Glu Lys Ser Ser Arg Tyr Pro Leu Asp Ala Ala Ile Arg Asn Lys
                885                 890                 895

Met Lys Pro Leu Trp Asp Ala Tyr Tyr Asn His Gly Leu Ile Ser Leu
            900                 905                 910

Lys Lys Tyr Gln Arg Leu Thr Arg Ser Thr Pro Phe Thr Asp Asp Glu
        915                 920                 925

Lys Trp Asp Phe Ile Asn Arg Gln Leu Val Glu Thr Arg Gln Ser Thr
    930                 935                 940

Lys Ala Leu Ala Ile Leu Leu Lys Arg Lys Phe Pro Asp Thr Glu Ile
945                 950                 955                 960

Val Tyr Ser Lys Ala Gly Leu Ser Ser Asp Phe Arg His Glu Phe Gly
                965                 970                 975

Leu Val Lys Ser Arg Asn Ile Asn Asp Leu His His Ala Lys Asp Ala
            980                 985                 990

Phe Leu Ala Ile Val Thr Gly Asn  Val Tyr His Glu Arg  Phe Asn Arg
```

```
        995                 1000                1005

Arg Trp  Phe Met Val Asn Gln  Pro Tyr Ser Val Lys  Thr Lys Thr
    1010                1015                1020

Leu Phe  Thr His Ser Ile Lys  Asn Gly Asn Phe Val  Ala Trp Asn
    1025                1030                1035

Gly Glu  Glu Asp Leu Gly Arg  Ile Val Lys Met Leu  Lys Gln Asn
    1040                1045                1050

Lys Asn  Thr Ile His Phe Thr  Arg Phe Ser Phe Asp  Arg Lys Glu
    1055                1060                1065

Gly Leu  Phe Asp Ile Gln Pro  Leu Lys Ala Ser Thr  Gly Leu Val
    1070                1075                1080

Pro Arg  Lys Ala Gly Leu Asp  Val Val Lys Tyr Gly  Gly Tyr Asp
    1085                1090                1095

Lys Ser  Thr Ala Ala Tyr Tyr  Leu Leu Val Arg Phe  Thr Leu Glu
    1100                1105                1110

Asp Lys  Lys Thr Gln His Lys  Leu Met Met Ile Pro  Val Glu Gly
    1115                1120                1125

Leu Tyr  Lys Ala Arg Ile Asp  His Asp Lys Glu Phe  Leu Thr Asp
    1130                1135                1140

Tyr Ala  Gln Thr Thr Ile Ser  Glu Ile Leu Gln Lys  Asp Lys Gln
    1145                1150                1155

Lys Val  Ile Asn Ile Met Phe  Pro Met Gly Thr Arg  His Ile Lys
    1160                1165                1170

Leu Asn  Ser Met Ile Ser Ile  Asp Gly Phe Tyr Leu  Ser Ile Gly
    1175                1180                1185
```

```
Gly Lys  Ser Ser Lys Gly Lys  Ser Val Leu Cys His  Ala Met Val
    1190                 1195                 1200

Pro Leu  Ile Val Pro His Lys  Ile Glu Cys Tyr Ile  Lys Ala Met
    1205                 1210                 1215

Glu Ser  Phe Ala Arg Lys Phe  Lys Glu Asn Asn Lys  Leu Arg Ile
    1220                 1225                 1230

Val Glu  Lys Phe Asp Lys Ile  Thr Val Glu Asp Asn  Leu Asn Leu
    1235                 1240                 1245

Tyr Glu  Leu Phe Leu Gln Lys  Leu Gln His Asn Pro  Tyr Asn Lys
    1250                 1255                 1260

Phe Phe  Ser Thr Gln Phe Asp  Val Leu Thr Asn Gly  Arg Ser Thr
    1265                 1270                 1275

Phe Thr  Lys Leu Ser Pro Glu  Glu Gln Val Gln Thr  Leu Leu Asn
    1280                 1285                 1290

Ile Leu  Ser Ile Phe Lys Thr  Cys Arg Ser Ser Gly  Cys Asp Leu
    1295                 1300                 1305

Lys Ser  Ile Asn Gly Ser Ala  Gln Ala Ala Arg Ile  Met Ile Ser
    1310                 1315                 1320

Ala Asp  Leu Thr Gly Leu Ser  Lys Lys Tyr Ser Asp  Ile Arg Leu
    1325                 1330                 1335

Val Glu  Gln Ser Ala Ser Gly  Leu Phe Val Ser Lys  Ser Gln Asn
    1340                 1345                 1350

Leu Leu  Glu Tyr Leu
    1355
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<210> 100

<211> 653
<212> PRT
<213> Oribacterium sinus

<400> 100

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Met Glu Leu Ile Asn Ser Glu Glu Phe Thr Phe Lys Glu Glu Leu Glu
1               5                  10                  15


Lys His Thr Gln Val Ala Met Lys Gln Leu Ser Glu Phe Thr Tyr Glu
            20                  25                  30


Asp Leu Glu Asp Ser Tyr Phe Ser Val Pro Val Lys Arg Met Ile Trp
        35                  40                  45


Gln Thr Leu Leu Val Val Arg Glu Ile Glu Lys Val Met Gly Tyr Ala
    50                  55                  60


Pro Lys Arg Ile Phe Val Glu Met Thr Arg Thr Glu Glu Glu Lys Gly
65                  70                  75                  80


Asp Lys Gly Arg Lys Glu Ser Arg Gly Asn Gln Leu Leu Glu Leu Tyr
                85                  90                  95


Lys Ser Ile Lys Asn Thr Asp Ser His Asn Trp Lys Glu Glu Ile Ala
            100                 105                 110


Ala Ala Asp Lys Asp Gly Lys Leu Arg Ser Lys Lys Leu Phe Leu Tyr
        115                 120                 125


Tyr Met Gln Met Gly Arg Asp Met Tyr Thr Gly Glu Glu Ile Asp Leu
    130                 135                 140


Gly Arg Leu Tyr Asp Asp Asn Leu Tyr Asp Ile Asp His Ile Tyr Pro
145                 150                 155                 160


Arg His Tyr Val Lys Asp Asp Ser Ile Met Asn Asn Leu Val Leu Val
                165                 170                 175
```

```
Asn Arg Arg Ala Asn Gln Asp Ile Lys Lys Asp Leu Tyr Pro Ile Pro
            180                 185                 190

Glu Gln Ile Lys Ala Asn Pro Asn Val His Met Leu Trp Asp Ala Leu
        195                 200                 205

His Lys Gln Lys Leu Ile Thr Asp Glu Lys Tyr Ala Arg Leu Thr Ser
    210                 215                 220

Asn Thr Ala Phe Ser Glu Lys Gln Leu Gly Asp Phe Ile Ala Arg Gln
225                 230                 235                 240

Leu Val Glu Thr Gly Gln Gly Thr Lys Gly Val Ala Asp Leu Leu Glu
                245                 250                 255

Gln Leu Phe Lys Asp Thr Val Ile Val Tyr Ala Lys Ala Ser Asn Val
            260                 265                 270

Ser Asp Phe Arg Arg Asp Asn Gly Phe Leu Lys Ser Arg Leu Val Asn
        275                 280                 285

Asp Phe His His Ala Gln Asp Ala Tyr Leu Asn Ile Val Val Gly Asn
    290                 295                 300

Val Tyr Tyr Thr Lys Phe Thr Lys Asn Pro Trp Asn Phe Ile Cys Lys
305                 310                 315                 320

Asp Tyr Glu Lys Asp Lys Glu Lys Asn Arg Tyr Asn Leu Ala Arg Met
                325                 330                 335

Phe Asp Trp Asn Val Val Arg Gly Ser Glu Thr Ala Trp Ile Val Glu
            340                 345                 350

Arg Lys Asp Glu Lys Gly Thr Ile Ser Thr Val Arg Lys Met Met Gln
        355                 360                 365

Lys Asn Thr Pro Leu Leu Thr Arg Met Asn Phe Glu Gln His Gly Ser
    370                 375                 380
```

```
Ile Ala Asn Ala Thr Leu Tyr Ser Ala Lys Lys Ala Lys Ser Glu Asn
385                 390                 395                 400

Tyr Leu Pro Leu Lys Thr Ala Asp Glu Lys Met Ser Asp Val Lys Lys
                405                 410                 415

Tyr Gly Gly Tyr Thr Ser Met Ser Ile Ala Tyr Tyr Phe Ile Val His
            420                 425                 430

His Lys Glu Asp Lys Lys Glu Asn Val Thr Ile Glu Ala Leu Pro Leu
        435                 440                 445

Tyr Cys Lys Asp Lys Val Glu Arg Glu Glu Asn Gly Leu Glu Lys Tyr
    450                 455                 460

Cys Glu Glu Val Leu Gly Tyr Gly Glu Val Asn Ile Ile Arg Arg Lys
465                 470                 475                 480

Leu Lys Ile Gln Ser Leu Leu Glu Phe Asn Gly Tyr Gln Val His Leu
                485                 490                 495

Ser Gly Lys Thr Gly Asn Gln Leu Ile Leu Arg Asn Ala Ile Ser Leu
            500                 505                 510

Cys Leu Ser Thr Lys Trp Ile Thr Tyr Ile Lys Lys Leu Glu Lys Ala
        515                 520                 525

Val Asn Ile Gln Ile Val Glu Glu Val Val Thr Pro Glu Glu Asn Ile
    530                 535                 540

Lys Leu Tyr Asn Leu Leu Ala Asp Lys His Ala Asn Thr Val Tyr Ser
545                 550                 555                 560

Lys Arg Pro Asn Ala Tyr Gly Glu Lys Leu Leu Ala Asp Arg Glu Ile
                565                 570                 575
```

```
Phe Val Thr Leu Glu Phe Gly Lys Gln Cys Glu Ala Leu Leu Gln Ile
            580                 585                 590

Leu Ser Leu Thr Lys Ile Gly Ser Thr Glu Ala Asn Leu Leu Leu Ile
        595                 600                 605

Gly Glu Ser Glu His Ser Gly Lys Ile Leu Ile Ser Lys Asn Leu Lys
    610                 615                 620

Ala Ser Asp Arg Pro Ala Val Ile Asn Gln Ser Pro Cys Gly Leu Tyr
625                 630                 635                 640

Glu Lys Lys Glu Trp Ile Phe Asp Lys Ile Val Glu Lys
                645                 650
```

<210> 101
<211> 1436
<212> PRT
<213> Capnocytophaga gingivalis

<400> 101

```
Met Lys Tyr Ile Lys Tyr Ile Leu Gly Leu Asp Ile Gly Ser Asn Ser
1               5                   10                  15

Ile Gly Trp Ala Leu Ile Gln Leu Asp Leu Leu Gln Lys Thr Lys Arg
            20                  25                  30

Ile Ile Ala Ala Gly Ser Arg Ile Ile Pro Met Asp Gln Lys Val Leu
        35                  40                  45

Ser Asp Phe Gly Lys Gly Ile Thr Ile Ser Pro Thr Ala Gln Arg Thr
    50                  55                  60

Ser Tyr Arg Asn Ala Arg His Cys Arg Glu Arg His Leu Leu Arg Arg
65                  70                  75                  80

Glu Arg Leu His Arg Val Leu His Ile Leu Gly Phe Leu Pro Thr His
                85                  90                  95
```

```
Tyr Asp Lys Gln Ile Asp Phe Ser Lys Arg Tyr Gly Lys Phe Val Asp
            100                 105                 110

Asn Thr Glu Pro Lys Ile Ala Tyr Asn Glu Gly Lys Phe Leu Phe Met
        115                 120                 125

Asp Ser Phe Gln Glu Met Leu Ser Asp Phe Lys Ser His Gln Pro Asp
    130                 135                 140

Leu Phe Tyr Thr Lys Lys Asn Gly Glu Glu Ser Lys Ile Pro Tyr Asp
145                 150                 155                 160

Trp Thr Ile Tyr Tyr Leu Arg Lys Lys Ala Leu Ser Gln Lys Ile Ser
                165                 170                 175

Lys Glu Glu Leu Ala Trp Ile Ile Leu Asn Phe Asn Gln Lys Arg Gly
            180                 185                 190

Tyr Tyr Gln Leu Arg Glu Glu Glu Gly Asn Lys Glu Asn Asp Phe Glu
        195                 200                 205

Ile Ile Ser Ser Lys Ile Ile Ser Val Ile Lys Lys Asp Lys Asp Lys
    210                 215                 220

Lys Tyr Asn Lys Tyr Trp Tyr Asp Ile Ile Leu Glu Asn Gly Leu Val
225                 230                 235                 240

Tyr Gln Ala Ala Phe Tyr Asn Asp Phe Val Tyr Asn Trp Ile Asn Gln
                245                 250                 255

Asp Arg Glu Phe Ile Ile Glu Arg Thr Ser Leu Lys Asn Gly Ala Glu
            260                 265                 270

Lys Val Lys Leu Ser Tyr Leu Pro Thr Phe Asp Glu Ile Asp Lys Met
        275                 280                 285

Asp Lys Lys Glu Gln Asp Lys Tyr Tyr Lys Lys Ile Lys Ile Lys Thr
```

```
    290                 295                 300

Glu Asn Ser Ile Gly Asn Lys Thr Val Gly Cys Tyr Ile Tyr Asp His
305                 310                 315                 320

Ile Leu Gln Asn Pro Asn Glu Lys Ile Lys Gly Lys Leu Val Arg Thr
                325                 330                 335

Ile Glu Arg Lys Tyr Tyr Lys Glu Glu Leu Lys Ala Ile Leu Glu Lys
            340                 345                 350

Gln Ile Ala Leu Gln Pro Glu Leu Phe Thr Asp Gln Leu Leu Ala Asp
        355                 360                 365

Cys Ile Arg Glu Leu Tyr Ser Lys Asn Glu Ala Gln Gln Arg Asn Leu
    370                 375                 380

Ala Ala Arg Asp Phe Val His Leu Leu Val Glu Asp Ile Ile Phe Tyr
385                 390                 395                 400

Gln Arg Pro Leu Arg Arg Gln Lys Ser Thr Leu Ala Asn Cys Ser Leu
                405                 410                 415

Glu Ser Arg Ser Tyr Ile Asp Lys Asp Ser His Thr Arg Lys Glu Ala
            420                 425                 430

Pro Leu Lys Val Cys Pro Lys Ser Asn Pro Tyr Tyr Gln Glu Phe Arg
        435                 440                 445

Val Leu Gln Trp Leu Gln Asn Leu Lys Ile Tyr Glu Ile Asp Ser Asp
    450                 455                 460

Gln Glu Val Thr His Gln Phe Ile Lys Thr Leu Glu Asp Lys Gln Gln
465                 470                 475                 480

Leu Phe Glu Phe Leu Met Ala Gln Lys Glu Ile Asp Cys Glu Glu Leu
                485                 490                 495
```

```
Leu Lys Tyr Phe Leu Asn Gln Thr Tyr Pro Asn Ala Lys Glu Lys Ala
            500                 505                 510

Leu Lys Ser Glu Leu Lys Lys Trp Lys Asp Thr Tyr Arg Trp Asn Tyr
        515                 520                 525

Val Tyr Asp Ile Gly Glu Lys Ser Ser Lys Lys Tyr Pro Met Asn Glu
    530                 535                 540

Thr Arg Tyr Glu Leu Lys Arg His Leu Glu Lys Val Ala Asn Leu Pro
545                 550                 555                 560

Asp Asp Phe Leu Ser Ser Glu Val Glu Tyr Leu Leu Trp His Leu Ile
                565                 570                 575

Tyr Ser Val Lys Asp Lys Val Ala Tyr Glu Lys Gly Leu Lys Lys Phe
            580                 585                 590

Ala Gln Lys His His Leu Asp Lys Asp Ser Phe Val Glu Ser Phe Lys
        595                 600                 605

Lys Phe Asn Pro Tyr Pro Ser Glu Tyr Gly Ser Phe Ser Glu Lys Ala
    610                 615                 620

Ile Arg Lys Leu Leu Pro Leu Met Arg Phe Gly Ala His Trp Asp Phe
625                 630                 635                 640

Asn His Ile Asp Lys Asn Thr Gln Lys Arg Ile Glu Asp Leu Ile Thr
                645                 650                 655

Gly Val Glu Asn Glu Glu Ile Arg Thr Ile Leu Arg Glu Lys Ala Glu
            660                 665                 670

Lys Tyr Gln Leu Glu Lys Glu Thr Asp Phe Gln Asp Leu Pro Leu Trp
        675                 680                 685

Leu Ala Gln Tyr Ile Val Tyr Asn Arg His Ala Glu Ala Ser Ser Leu
```

```
    690                 695                 700

Glu Lys Trp Thr Ser Val Asn Asp Leu Glu Thr Tyr Leu Asn Glu Phe
705                 710                 715                 720

Lys Gln His Ser Leu Arg Asn Pro Ile Val Glu Gln Val Val Met Glu
                725                 730                 735

Thr Leu Arg Val Val Arg Asp Ile Trp Gln Gln Tyr Gly Gln Gly Gln
            740                 745                 750

Ala Ser Phe Phe Asn Glu Ile His Ile Glu Leu Gly Arg Glu Leu Lys
        755                 760                 765

Lys Thr Ala Lys Glu Arg Glu Lys Leu Ser Lys Gln Asn Gln Lys Asn
    770                 775                 780

Glu Asp Ile Asn Leu Ser Ile Lys Glu Lys Leu Lys Glu Leu Glu Lys
785                 790                 795                 800

Tyr Asn Thr Arg Ala Tyr Ser Ile Thr His Gln Glu Lys Tyr Lys Leu
                805                 810                 815

Trp Leu Glu Gln Lys His Ile Ser Pro Tyr Thr Gly Gln Ile Ile Ser
            820                 825                 830

Pro Glu Asn Leu Phe Thr Asp Asn Tyr Glu Ile Glu His Ile Ile Pro
        835                 840                 845

Gln Ser Arg Phe Phe Asp Asp Ser Leu Ser Asn Lys Val Val Cys Glu
    850                 855                 860

Ser Ile Val Asn Lys Ala Pro Tyr Lys Asp Arg Gln Leu Gly Leu Glu
865                 870                 875                 880

Phe Ile Lys Asn Gln Gly Gly Arg Ile Val Lys Glu Leu Ser Lys Glu
                885                 890                 895
```

```
Asn Lys Thr Ile Lys Ile Phe Thr Glu Glu Gln Tyr Arg Thr Phe Ile
            900                 905                 910

Lys Glu His Tyr Ser Asn Asn Pro Glu Lys Thr Lys Lys Leu Leu Leu
        915                 920                 925

Glu Glu Ile Pro Glu Lys Met Val Ala Arg Gln Met Asn Asp Thr Cys
    930                 935                 940

Tyr Ile Ser Lys Phe Ile Ser Glu Ile Leu Ser Lys Ile Val Arg Ser
945                 950                 955                 960

Asp Glu Gln Asp Glu Gly Val His Ser Lys Asn Val Ile Leu Cys Thr
                965                 970                 975

Gly Lys Ile Thr Ser Ile Leu Arg Gln Asp Trp Gly Leu Asn Asp Ile
            980                 985                 990

Trp Asp Asn Leu Ile Leu Pro Arg  Phe Glu Arg Met Asn  Asn Leu Leu
        995                 1000                1005

Gln Lys  Glu Lys Phe Thr Ile  Tyr Ser Ile Glu Lys  Gln Lys Lys
    1010                1015                1020

Ile Pro  Val Val Pro Ile Asn  Asp Gln Phe Lys Ser  Phe Gln Lys
    1025                1030                1035

Lys Arg  Ile Asp His Arg His  His Ala Met Asp Ala  Ile Ile Ile
    1040                1045                1050

Ala Cys  Thr Thr Arg Glu His  Ile Asn Tyr Ile Asn  Asn Gln His
    1055                1060                1065

Ala Leu  Glu Lys Glu Lys Asp  Lys Lys Glu Lys Gln  Glu Glu Arg
    1070                1075                1080

Asp Lys  Leu Arg Glu Lys Leu  Cys Ile Lys Lys Tyr  Asn Asn Arg
```

```
    1085                1090                1095

Ser Glu  Gly Asn Tyr Ser Trp  Ile Phe Lys Lys Pro  Trp Asp Thr
    1100                1105                1110

Phe Thr  Gln Glu Val Arg Val  Ala Leu Glu Asp Ile  Val Val Ser
    1115                1120                1125

Phe Lys  Gln Asn Leu Arg Val  Ile Asn Lys Ala Thr  Asn Tyr Tyr
    1130                1135                1140

Glu Arg  Trp Val Glu Glu Asn  Gly Lys Tyr Ile Lys  Lys Met Val
    1145                1150                1155

Lys Gln  Glu Gly Thr Asn Trp  Ala Ile Arg Lys Pro  Leu His Glu
    1160                1165                1170

Glu Thr  Ile Ser Gly Lys Ile  Tyr Leu Asp Arg Glu  Lys Ile Thr
    1175                1180                1185

Lys Asn  Asp Ile Leu Thr Ala  Thr Arg Lys Thr Val  Asp Ser Ser
    1190                1195                1200

Phe Asp  Asp Lys Arg Ile Lys  Lys Ile Thr Asp Thr  Gly Ile Gln
    1205                1210                1215

Lys Ile  Leu Leu Asn Tyr Leu  Lys Tyr Lys Gly Ser  Pro Glu Ile
    1220                1225                1230

Ala Phe  Ser Pro Glu Gly Leu  Glu Glu Leu Asn Lys  Asn Leu Ser
    1235                1240                1245

Ile Tyr  Asn Asp Gly Lys Pro  His Lys Pro Ile Tyr  Lys Val Arg
    1250                1255                1260

Ile Tyr  Glu Lys Gly Ser Gly  Arg Phe Ala Leu Gly  Glu Lys Gly
    1265                1270                1275
```

```
Arg Lys  Tyr Lys Lys Tyr Val  Gln Gly Ala Ser Asn  Leu Tyr Phe
    1280                1285                1290

Gly Ile  Tyr Gln Gly Ala Lys  Arg Ser Phe Ala Thr  Ile Pro Leu
    1295                1300                1305

Asn Glu  Val Ile Glu Arg Gln  Lys Gln Gly Leu Pro  Ser Val Pro
    1310                1315                1320

Glu Tyr  Asn Glu Lys Gly Asp  Leu Leu Leu Phe Ser  Leu Ser Pro
    1325                1330                1335

Asn Asp  Leu Val Tyr Val Pro  Ile Glu Gly Glu Ile  Ile Glu Asn
    1340                1345                1350

Ile Asp  Phe Arg Asn Leu Ser  Lys Glu Gln Lys Glu  Arg Ile Tyr
    1355                1360                1365

Asn Val  Asn Asp Phe Ser Ser  Thr Cys Tyr Phe Thr  Pro Asn Arg
    1370                1375                1380

Ile Ala  Lys Ala Ile Phe Pro  Lys Glu Val Asp Leu  Gln Arg Lys
    1385                1390                1395

Gly Asp  Lys Leu Ser Gly Ser  Tyr Asp Thr Lys Thr  Ala Ser Leu
    1400                1405                1410

Glu Gly  Ile Gln Ile Lys Glu  Val Cys Ile Lys Leu  Lys Val Asp
    1415                1420                1425

Arg Leu  Gly Asn Ile Ser Lys  Ala
    1430                1435
```

<210> 102
<211> 1069
<212> PRT
<213> Bacillus cereus

<400> 102

Met Asn Tyr Asp Ile Gly Leu Arg Ile Gly Ile Thr Ser Cys Gly Trp
1 5 10 15

Ser Ile Ile Asn Lys Asp Leu Glu Arg Ile Glu Asp Leu Gly Val Arg
20 25 30

Val Phe Glu Lys Ala Glu Asn Pro Asp Gly Thr Ala Ser Ala Ala Pro
35 40 45

Arg Arg Glu Ala Arg Lys Ser Arg Arg Lys His Arg Arg Lys Lys His
50 55 60

Arg Ile Glu Arg Ile Lys Arg Leu Ile Val Gln His Asp Leu Leu Ser
65 70 75 80

Lys Lys Glu Leu Asp Ser Leu Tyr Leu Ser Pro Phe Asn Ile Asp Val
85 90 95

Trp Asn Leu Gln Val Glu Ala Leu Glu Arg Lys Leu Asp Asn Arg Glu
100 105 110

Phe Ala Arg Val Leu Ile His Leu Val Gln Arg Arg Gly Phe Gln Thr
115 120 125

Ile Arg Lys Ser Val Glu Ile Gln Glu Glu Gly Lys Leu Leu Glu Asn
130 135 140

Val Ser Glu Asn Glu Arg Ile Met Lys Val Asn Gly Tyr Lys Thr Val
145 150 155 160

Gly Glu Met Phe Ser Lys His Glu Lys Phe Thr His His Lys Arg Asn
165 170 175

Lys Asp Gly Ser Tyr Thr Ser Val Val Thr Arg Ser Leu Leu Leu Lys
180 185 190

```
Glu Ile Lys Thr Ile Phe Asn Ser Gln Arg Ile Leu Gly Asn Val Phe
        195                 200                 205

Ser Thr Gln Lys Leu Glu Ser Asp Tyr Leu Tyr Ile Trp Gly Ser Gln
    210                 215                 220

Arg Pro Thr Leu Thr Tyr Glu Gln Leu Met Ser Met Val Gly Asn Cys
225                 230                 235                 240

Ile Tyr Glu Lys Lys Glu Lys Arg Ala Pro Lys Thr Ser Trp Ala Phe
                245                 250                 255

Gln Tyr Phe Ser Leu Leu Gln Lys Ile Asn Lys Leu Lys Val Ser Asp
            260                 265                 270

Asp Asn Thr Leu Arg Lys Leu Ser Lys Glu Glu Arg Asp Ile Val Ile
        275                 280                 285

Glu Leu Ala Phe Lys Lys Lys Asn Val Ser Phe Val Asp Ile Arg Lys
    290                 295                 300

Ala Leu Lys Leu Asn Asp Asn Thr Lys Phe Asn His Leu Thr Tyr Ser
305                 310                 315                 320

His Val Val Glu Thr Lys Lys Val Glu Lys Ala Thr Phe Ile Glu Leu
                325                 330                 335

Lys Gly Tyr His Leu Ile Lys Lys Gln Leu Lys Asp Arg Asn Val Glu
            340                 345                 350

Leu Thr Gln Glu Leu Gln Pro Lys Asp Tyr Asp Ala Ile Ala Ala Ala
        355                 360                 365

Ser Thr Phe Phe Lys Asn Asp Ile Glu Phe Arg Asp Tyr Leu Arg Asn
    370                 375                 380

Gln Tyr Leu Asp Ser Asn Gly Lys Arg Lys Ser Asn Ile Ala Asn Lys
385                 390                 395                 400
```

```
Val Phe Glu Asp Lys Val Ile Ala Ala Val Phe Glu Leu Asn Phe Ser
                405                 410                 415

Lys Val Cys His Leu Ser Phe Lys Ser Leu Tyr Lys Leu Ile Pro His
            420                 425                 430

Leu Glu Lys Gly Leu Asp Tyr Lys Glu Ala Ile Leu Cys Ala Gly Tyr
        435                 440                 445

Asn Phe Arg Asp Glu Asn Lys Arg Asp Lys Lys Leu Phe Leu Pro Val
    450                 455                 460

Ile Gln Gln Glu Thr Asn Pro Val Val His Arg Ala Leu Thr Gln Ala
465                 470                 475                 480

Arg Lys Val Ile Asn Ala Ile Ile Arg Glu Tyr Gly Ser Pro Asn Thr
                485                 490                 495

Ile Arg Phe Val Val Ala Asn Asp Leu Ala Lys Thr Tyr Lys Gln Arg
            500                 505                 510

Lys Glu Leu Glu Ser Thr Leu Lys Lys Asn Arg Ala Glu Asn Glu Lys
        515                 520                 525

Ile Lys Thr Lys Leu Leu Ser Met Gly Ile Ile Asn Pro Thr Gly Met
    530                 535                 540

Asp Ile Val Lys Tyr Lys Leu Trp Tyr Glu Gln Ser Gly Ile Cys Leu
545                 550                 555                 560

Tyr Thr Gly Arg Gln Met Glu Leu Ser Ser Leu Phe Lys Pro Gly Tyr
                565                 570                 575

Ser Ile Val Asn His Ile Ile Pro Tyr Asn Arg Ser Phe Asp Asp Thr
            580                 585                 590
```

```
Tyr His Asn Arg Val Leu Thr Leu Thr Glu Thr Lys Tyr Glu Lys Gly
        595                 600                 605

Asn Lys Ile Pro Phe Glu Tyr Phe Gly Ala Glu Glu Thr Cys Trp Asn
    610                 615                 620

Glu Tyr Glu Lys Arg Val Ser Thr Ser Lys Lys Ile His Asp Lys Lys
625                 630                 635                 640

Arg Glu Lys Leu Leu Ile Arg Asn Phe Asp Ile Glu Tyr Glu Asn Glu
                645                 650                 655

Met Ile Ser Asn Asn Val Phe Asp Thr His Tyr Ile Gly Ser Tyr Phe
            660                 665                 670

Glu Lys Tyr Ile Asp Glu His Leu Gln Phe Lys Lys Ser Thr Lys Lys
        675                 680                 685

Gln Lys Val Phe Ser Ile His Gly Asn Met Val Ala His Leu His Ser
    690                 695                 700

Arg Trp Gly Phe Asn Lys Asn Ser Arg Glu Ile Tyr Leu Asn His Ala
705                 710                 715                 720

Val Asp Ala Ala Ile Val Ala Val Leu Thr Asp Gln Leu Ile Arg Asn
                725                 730                 735

Ile Ala Asp Tyr Tyr Arg Arg Asp Asn Ile Leu Glu Gln Lys Gly Ser
            740                 745                 750

Leu Lys Phe Pro Glu Pro Trp Lys Ser Phe Ser Ile Glu Leu Glu Ala
        755                 760                 765

Arg Ile Ser Pro Gln Val Arg Asp Leu Ile Lys Lys Leu Asn Leu Asp
    770                 775                 780

Ser Tyr Leu Asp Val Asp Ile Leu His Ile Lys Pro Val Phe Ile Ser
785                 790                 795                 800
```

```
Lys Lys Pro Arg Arg Lys Val Asn Gly Glu Ala His Lys Ser Thr Ile
                805                 810                 815

Arg Ser Leu Ile Gly Ile Asn Glu Ile Gly Lys Thr Val Thr Cys Ile
            820                 825                 830

Lys Thr Arg Leu Glu Asp Ile Pro Phe Asp Glu Asn Gly Asp Phe Pro
        835                 840                 845

Met Tyr Gly Lys Asp Thr Asp Lys Tyr Thr Tyr Thr Ala Ile Lys Glu
    850                 855                 860

Arg Tyr Leu Glu Phe Asn Lys Asp Lys Glu Lys Ala Phe Ser Thr Pro
865                 870                 875                 880

Leu Tyr Lys Leu Lys Arg Asn Gly Glu Pro Gly Asn Gln Ile Lys Ser
                885                 890                 895

Val Lys Ile Ile Asp Thr Arg Asn Ile Val Asn Lys Val Asn Gln Gly
            900                 905                 910

Lys Gly Ile Ala Tyr Asn Ser Asn Ile Ile Arg Val Asp Val Phe Ser
        915                 920                 925

Arg Asp Gln Lys Tyr Tyr Val Val Pro Ile Tyr Leu Arg Asp Phe Ile
    930                 935                 940

Lys Gly Ser Leu Pro Asn Lys Ile Ile Thr Ala Ala Lys Gly Phe Met
945                 950                 955                 960

Gln Trp Pro Glu Thr Asp Asn Ser Tyr Thr Phe Leu Phe Ser Ile Phe
                965                 970                 975

Pro Asn Asp Leu Ile Lys Val Val Pro Lys Glu Gly Lys Phe Ile Lys
            980                 985                 990
```

```
Ala Lys Asn Glu Asn Lys Glu Asn  Ile Asn Leu Thr Glu  Ile Leu Gly
        995                 1000                1005


Tyr Phe  Lys Gly Leu Asp Ser  Ser Thr Gly Ala Phe  Thr Leu Glu
    1010                1015                1020


Ser His  Asp Gly Ser Leu Leu  Ala Arg Gly Ile Gly  Thr Lys Asn
    1025                1030                1035


Leu Leu  Leu Ile Glu Lys Tyr  Gln Val Asp Val Leu  Gly Arg Tyr
    1040                1045                1050


Asn Lys  Val Gly Asn Glu Glu  Arg Gln Asp Ile Lys  Ile Gln Gln
    1055                1060                1065


Asn
```

<210> 103
<211> 1391
<212> PRT
<213> Lactobacillus jensenii

<400> 103

```
Met Lys Glu Ile Lys Asp Tyr Ile Ile Gly Leu Asp Ile Gly Thr Asn
1               5                   10                  15


Ser Cys Gly Tyr Val Val Thr Asp Lys Gln Asn Asn Ile Leu Lys Leu
            20                  25                  30


Lys Gly Lys Thr Ala Ile Gly Ala Arg Leu Phe Lys Glu Gly Glu Ala
        35                  40                  45


Ala Ala Asp Arg Arg Ala Phe Arg Thr Thr Arg Arg Arg Leu Ala Arg
    50                  55                  60


Arg Arg Trp Arg Leu Ser Leu Leu Glu Glu Ile Phe Asp Glu Glu Met
65                  70                  75                  80
```

```
Asn Lys Val Asp Pro Ser Phe Phe Arg Arg Leu Lys Glu Ser Asp Tyr
                85                  90                  95

Ser Pro Lys Asp Arg Arg Lys Gln Phe Asn Ser Ile Val Phe Glu Ser
            100                 105                 110

Ser Glu Ala Asp Lys Ala Phe Tyr Glu Lys Tyr Pro Thr Ile Tyr His
        115                 120                 125

Leu Arg Asn Ala Leu Met His Asp Asn Gln Lys His Asp Leu Arg Glu
    130                 135                 140

Ile Phe Leu Ala Val His His Ile Val Lys Tyr Arg Gly Asn Phe Leu
145                 150                 155                 160

Arg Glu Asp Ser Val Lys Ala Phe Lys Ala Ala Lys Phe Thr Leu Gln
                165                 170                 175

Gly Glu Asp Gly Ile Gly Pro Val Asp Lys Leu Asn Asp Leu Leu Lys
            180                 185                 190

Glu Ile Tyr Ile Glu Ala Ala Pro Glu Leu Ala Thr Asp Asn Leu Ser
        195                 200                 205

Lys Ile Glu Asp Ile Ile Lys Asp Lys Lys Leu Tyr Lys Gln Asp Lys
    210                 215                 220

Leu Lys Gln Ile Ala Asn Leu Leu Pro Lys Ala Val Asp Ser Lys Asp
225                 230                 235                 240

Lys Ala Lys Leu Asn Lys Asp Ile Ala Lys Gln Val Ala Asn Ala Leu
                245                 250                 255

Met Gly Tyr Met Phe Arg Leu Asp Thr Leu Phe Ser Phe Thr Asp Val
            260                 265                 270

Asp Val Lys Asp Tyr Lys Leu Lys Phe Ser Asp Ala Asn Ile Asp Glu
```

```
        275                 280                 285

Ser Leu Asp Ala Leu Thr Ser Leu Leu Thr Asp Ala Gln Ile Glu Phe
    290                 295                 300

Val Leu Glu Leu Gln Ser Ile Tyr Asn Thr Ile Val Leu Asn Glu Ile
305                 310                 315                 320

Val Pro Asp Gly Met Ser Leu Ser Glu Ser Met Val Lys Lys Tyr Asp
                325                 330                 335

Asp His Lys Lys Asp Leu Lys Leu Tyr Lys Glu Tyr Ile Asp Ser Leu
            340                 345                 350

Ser Asp Gln Lys Lys Ala Lys Gln Leu Glu Ala Ala Tyr Ala Leu Tyr
        355                 360                 365

Val Asn Tyr Arg Lys Ala Asp Leu Leu Ala Ala Lys Lys Leu Phe Glu
    370                 375                 380

Lys Lys Lys Ile Gly Asp Lys Lys Phe Val Asp Val Ile Ser Asn Phe
385                 390                 395                 400

Glu Val Phe Gly Lys Phe Val Ser Asp Asn Leu Asp Asp Ser Glu Leu
                405                 410                 415

Ala Asn Lys Ile Lys Ala Arg Leu Asp Leu Gly Glu Phe Leu Pro Lys
            420                 425                 430

Gln Arg Thr Asn Gln Asn Gly Val Ile Pro Tyr Gln Leu His Gln Val
        435                 440                 445

Glu Leu Thr Gln Ile Leu Glu Lys Gln Gly Lys Tyr Tyr Pro Phe Leu
    450                 455                 460

Ile Thr Pro Asn Pro Val Glu Ser His Arg Asn Asn Ala Pro Tyr Glu
465                 470                 475                 480
```

```
Ile Ser Glu Leu Val Ser Phe Arg Val Pro Tyr Tyr Val Gly Pro Leu
                485                 490                 495

Ile Asp Asn Gln Ser Ile Lys Asp Lys Gln Asn Lys Asn Lys Phe Ala
            500                 505                 510

Trp Met Val Arg Gln Lys Gln Gly Gln Ile Thr Pro Trp Asn Phe Glu
        515                 520                 525

Glu Met Val Asp Thr Thr Glu Ser Ala Asn Gln Phe Ile Lys Arg Met
    530                 535                 540

Thr Arg Lys Asp Thr Tyr Leu Leu Ala Glu Asp Val Leu Pro Lys Ser
545                 550                 555                 560

Ser Leu Ile Tyr Gln Lys Phe Met Ile Leu Asp Glu Leu Asn Arg Ile
                565                 570                 575

Lys Ile Asp Gly Lys Lys Leu Thr Ser Lys Leu Lys His Asp Ile Phe
            580                 585                 590

Glu Lys Leu Phe Lys Lys Gln Lys Ser Ile Asn Leu Asp Asn Leu Lys
        595                 600                 605

Asn Tyr Leu Leu Ala Glu Gly Asn Ile Pro Gly Leu Ile Glu Gly Leu
    610                 615                 620

Ser Asp Gly Ile Asn Phe Asn Asn Ser Phe Ser Thr Tyr Ile Asp Tyr
625                 630                 635                 640

Arg Asn Ile Phe Gly Asp Glu Ile Asp Asn Pro Asn Lys Gln Ala Asp
                645                 650                 655

Phe Glu Lys Met Ile Glu Trp Ser Thr Val Phe Glu Asp Arg Lys Ile
            660                 665                 670

Phe Lys Arg Lys Leu Lys Glu Ile Thr Trp Leu Thr Pro Glu Gln Ile
```

```
        675                 680                 685

Lys Gln Val Ser Ser Lys Arg Tyr Ser Gly Trp Gly Arg Leu Ser Lys
    690                 695                 700

Lys Leu Leu Thr Gln Ile Thr Asp Glu Asn Gly Val Asn Ile Leu Gln
705                 710                 715                 720

Arg Leu Trp Asn Glu Pro Glu Thr Leu Thr Glu Val Leu Ala Asn Pro
                725                 730                 735

Val Ile Lys Arg Lys Ile Ser Glu Ala Asn Ser Leu Phe Val Gln Ile
            740                 745                 750

Asn Lys Val Glu Asn Ile Leu Asp Asp Ala Tyr Thr Ser Pro Gln Asn
        755                 760                 765

Lys Lys Ala Ile Arg Gln Val Ile Arg Val Val Asp Asp Ile Ile Ala
    770                 775                 780

Ala Ala His Gly Lys Lys Pro Ser Gln Ile Ala Ile Glu Phe Ala Arg
785                 790                 795                 800

Ser Ser Gln Asn Lys Ala Lys Val Pro Asp Thr Arg Lys Lys Gln Leu
                805                 810                 815

Asp Lys Ile Tyr Asn Lys Ile Ser Ser Glu Ile Leu Asp Ser Ser Ile
            820                 825                 830

Lys Asn Glu Leu Lys Asn Leu Lys Ser Asn Lys Tyr Leu Ser Lys Asp
        835                 840                 845

Lys Leu Phe Leu Tyr Phe Lys Gln Met Gly Arg Asp Ala Tyr Thr Gly
    850                 855                 860

Asp Lys Leu Ser Leu Asp Gln Leu Gln Asn Tyr Asp Ile Asp His Ile
865                 870                 875                 880
```

```
Phe Pro Arg Ser Phe Ile Lys Asp Asp Ser Leu Asp Asn Arg Val Leu
               885                 890                 895

Thr Gln Lys Pro Ile Asn Ala Lys Lys Ser Asp Tyr Gly Ile Pro Ala
            900                 905                 910

Leu Glu Phe Gly Asn Lys Tyr Val Pro Asp Leu Gly Ile Thr Val Lys
        915                 920                 925

Glu Met Trp Lys Leu Trp Gln Glu Asn Gly Leu Ile Ser Lys Ser Lys
    930                 935                 940

Leu Ile Asn Leu Cys Thr Asn Pro Lys Lys Ile Gly Ser Lys Arg Ala
945                 950                 955                 960

Ser Gly Phe Ile Asn Arg Gln Leu Val Glu Thr Ser Gln Val Ile Lys
               965                 970                 975

Leu Val Ala Ile Ile Leu Gln Ala Glu Phe Pro Asp Thr Glu Ile Ile
            980                 985                 990

Glu Val Lys Ala Leu Gln Asn Thr  Thr Leu Arg Glu Ser  Phe His Leu
        995                 1000                1005

Tyr Lys  Asn Arg Ser Val Asn  Asp Tyr His His Ala  Ile Asp Ala
    1010                1015                1020

Tyr Leu  Thr Thr Ile Val Gly  Asn Tyr Leu Tyr Gln  Val Tyr Pro
    1025                1030                1035

Lys Leu  Arg Pro Tyr Phe Val  Tyr Gly Gln Phe Lys  Lys Phe Asn
    1040                1045                1050

Gln Glu  Lys Asn Ile Asp Ile  Leu Lys Arg Leu Lys  Asn Phe Asn
    1055                1060                1065

Phe Leu  Arg Gln Leu Ile Phe  Asn Thr Asp Asp Asn  Ile Tyr Ile
```

```
    1070                1075                1080

Ser Gly  Thr Lys Glu Ile Val  Phe Asn Lys Lys Asp  Ile Ile His
    1085                1090                1095

Lys Leu  Glu Thr Ala Tyr Gly  Tyr Lys Tyr Met Asn  Ile Ser Arg
    1100                1105                1110

Glu Cys  Tyr Gln Glu Thr Ser  Ser Leu Phe Asn Gln  Thr Leu Tyr
    1115                1120                1125

Ala His  Asn Ser Ser Val Lys  Asn Ser Leu Ile Pro  Lys Lys Lys
    1130                1135                1140

Gly Leu  Pro Thr Glu Ile Tyr  Gly Gly Tyr Ser Gly  Asn Lys Asp
    1145                1150                1155

Ser Phe  Phe Val Leu Val Lys  Ile Val Lys Lys Arg  Thr Asn Leu
    1160                1165                1170

Tyr Arg  Ile Val Gly Ile Pro  Thr Arg Glu Leu Ala  Lys Leu Asn
    1175                1180                1185

Ser Ser  Asn Asn Tyr Asn Gln  Ala Leu Asn Lys Ile  Val Glu Ser
    1190                1195                1200

Lys Leu  Cys Leu Lys Glu Thr  Glu Ser Phe Lys Ile  Leu Ile Lys
    1205                1210                1215

Arg Leu  Leu Tyr Gly Thr Leu  Ile Val Asp Asn Gly  Gln Lys Phe
    1220                1225                1230

Arg Ile  Gly Ser Phe Lys Glu  Lys His Asn Val Gln  Gln Leu Val
    1235                1240                1245

Leu Gln  Leu Lys Ser Met Lys  Tyr Ile Lys Phe Tyr  Ile Asp Gly
    1250                1255                1260
```

```
Gly Gln  Asn Tyr Phe Thr Asp  Val Glu Arg Lys Lys  Leu Glu Lys
    1265                1270                1275


Gln Asp  Arg Asp Lys Cys Leu  Leu Tyr Val Phe Asp  Asp Ile Met
    1280                1285                1290


Asn Val  Val Asn Lys Arg Phe  Thr Leu Phe Asp Met  Ser Lys Tyr
    1295                1300                1305


Glu Lys  Asp Gly Asp Ser Leu  Arg Glu Lys Phe Asn  Cys Leu Asp
    1310                1315                1320


Phe Asn  Asp Lys Val Ser Ile  Leu Ser Asp Leu Leu  Lys Ala Phe
    1325                1330                1335


His Ala  Asn Ser Asp Arg Thr  Ser Ile Thr Lys Leu  Lys Ile Thr
    1340                1345                1350


Asn Leu  Gly Arg His Gln Ala  Gly Lys Asn Gly Ile  Thr Leu Thr
    1355                1360                1365


Thr Asn  Ala Gln Ile Ile Tyr  Gln Ser Pro Thr Gly  Leu Phe Glu
    1370                1375                1380


Arg Arg  Ile Lys Ile Lys Asp  Leu
    1385                1390


<210>  104
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<212>  PRT
<213>  Eubacterium rectale

<400>  104

Met Asn Tyr Thr Glu Lys Glu Lys Leu Phe Met Lys Tyr Ile Leu Ala
1               5                   10                  15


Leu Asp Ile Gly Ile Ala Ser Val Gly Trp Ala Ile Leu Asp Lys Glu
            20                  25                  30
```

```
Ser Glu Thr Val Ile Glu Ala Gly Ser Asn Ile Phe Pro Glu Ala Ser
        35                  40                  45

Ala Ala Asp Asn Gln Leu Arg Arg Asp Met Arg Gly Ala Lys Arg Asn
    50                  55                  60

Asn Arg Arg Leu Lys Thr Arg Ile Asn Asp Phe Ile Lys Leu Trp Glu
65                  70                  75                  80

Asn Asn Asn Leu Ser Ile Pro Gln Phe Lys Ser Thr Glu Ile Val Gly
                85                  90                  95

Leu Lys Val Arg Ala Ile Thr Glu Glu Ile Thr Leu Asp Glu Leu Tyr
            100                 105                 110

Leu Ile Leu Tyr Ser Tyr Leu Lys His Arg Gly Ile Ser Tyr Leu Glu
        115                 120                 125

Asp Ala Leu Asp Asp Thr Val Ser Gly Ser Ser Ala Tyr Ala Asn Gly
    130                 135                 140

Leu Lys Leu Asn Ala Lys Glu Leu Glu Thr His Tyr Pro Cys Glu Ile
145                 150                 155                 160

Gln Gln Glu Arg Leu Asn Thr Ile Gly Lys Tyr Arg Gly Gln Ser Gln
                165                 170                 175

Ile Ile Asn Glu Asn Gly Glu Val Leu Asp Leu Ser Asn Val Phe Thr
            180                 185                 190

Ile Gly Ala Tyr Arg Lys Glu Ile Gln Arg Val Phe Glu Ile Gln Lys
        195                 200                 205

Lys Tyr His Pro Glu Leu Thr Asp Glu Phe Cys Asp Gly Tyr Met Leu
    210                 215                 220
```

```
Ile Phe Asn Arg Lys Arg Lys Tyr Tyr Glu Gly Pro Gly Asn Glu Lys
225                 230                 235                 240

Ser Arg Thr Asp Tyr Gly Arg Phe Thr Thr Lys Leu Asp Ala Asn Gly
                245                 250                 255

Asn Tyr Ile Thr Glu Asp Asn Ile Phe Glu Lys Leu Ile Gly Lys Cys
            260                 265                 270

Ser Val Tyr Pro Asp Glu Leu Arg Ala Ala Ala Ala Ser Tyr Thr Ala
        275                 280                 285

Gln Glu Tyr Asn Val Leu Asn Asp Leu Asn Asn Leu Thr Ile Asn Gly
    290                 295                 300

Arg Lys Leu Glu Glu Asn Glu Lys His Glu Ile Val Glu Arg Ile Lys
305                 310                 315                 320

Ser Ser Asn Thr Ile Asn Met Arg Lys Ile Ile Ser Asp Cys Met Gly
                325                 330                 335

Glu Asn Ile Asp Asp Phe Ala Gly Ala Arg Ile Asp Lys Ser Gly Lys
            340                 345                 350

Glu Ile Phe His Lys Phe Glu Val Tyr Asn Lys Met Arg Lys Ala Leu
        355                 360                 365

Leu Glu Ile Gly Ile Asp Ile Ser Asn Tyr Ser Arg Glu Glu Leu Asp
    370                 375                 380

Glu Ile Gly Tyr Ile Met Thr Ile Asn Thr Asp Lys Glu Ala Met Met
385                 390                 395                 400

Glu Ala Phe Gln Lys Ser Trp Ile Asp Leu Ser Asp Asp Val Lys Gln
                405                 410                 415

Cys Leu Ile Asn Met Arg Lys Thr Asn Gly Ala Leu Phe Asn Lys Trp
            420                 425                 430
```

```
Gln Ser Phe Ser Leu Lys Ile Met Asn Glu Leu Ile Pro Glu Met Tyr
        435                 440                 445

Ala Gln Pro Lys Glu Gln Met Thr Leu Leu Thr Glu Met Gly Val Thr
    450                 455                 460

Lys Gly Thr Gln Glu Glu Phe Ala Gly Leu Lys Tyr Ile Pro Val Asp
465                 470                 475                 480

Val Val Ser Glu Asp Ile Phe Asn Pro Val Val Arg Arg Ser Val Arg
                485                 490                 495

Ile Ser Phe Lys Ile Leu Asn Ala Val Leu Lys Lys Tyr Lys Ala Leu
            500                 505                 510

Asp Thr Ile Val Ile Glu Met Pro Arg Asp Arg Asn Ser Glu Glu Gln
        515                 520                 525

Lys Lys Arg Ile Asn Asp Ser Gln Lys Leu Asn Glu Lys Glu Met Glu
    530                 535                 540

Tyr Ile Glu Lys Lys Leu Ala Val Thr Tyr Gly Ile Lys Leu Ser Pro
545                 550                 555                 560

Ser Asp Phe Ser Ser Gln Lys Gln Leu Ser Leu Lys Leu Lys Leu Trp
                565                 570                 575

Asn Glu Gln Asp Gly Ile Cys Leu Tyr Ser Gly Lys Thr Ile Asp Pro
            580                 585                 590

Asn Asp Ile Ile Asn Asn Pro Gln Leu Phe Glu Ile Asp His Ile Ile
        595                 600                 605

Pro Arg Ser Ile Ser Phe Asp Asp Ala Arg Ser Asn Lys Val Leu Val
    610                 615                 620
```

```
Tyr Arg Ser Glu Asn Gln Lys Lys Gly Asn Gln Thr Pro Tyr Tyr Tyr
625                 630                 635                 640


Leu Thr His Ser His Ser Glu Trp Ser Phe Glu Gln Tyr Lys Ala Thr
                645                 650                 655


Val Met Asn Leu Ser Lys Lys Lys Glu Tyr Ala Ile Ser Arg Lys Lys
            660                 665                 670


Ile Gln Asn Leu Leu Tyr Ser Glu Asp Ile Thr Lys Met Asp Val Leu
        675                 680                 685


Lys Gly Phe Ile Asn Arg Asn Ile Asn Asp Thr Ser Tyr Ala Ser Arg
    690                 695                 700


Leu Val Leu Asn Thr Ile Gln Asn Phe Phe Met Ala Asn Glu Ala Asp
705                 710                 715                 720


Thr Lys Val Lys Val Ile Lys Gly Ser Tyr Thr His Gln Met Arg Cys
                725                 730                 735


Asn Leu Lys Leu Asp Lys Asn Arg Asp Glu Ser Tyr Ser His His Ala
            740                 745                 750


Val Asp Ala Met Leu Ile Gly Tyr Ser Glu Leu Gly Tyr Glu Ala Tyr
        755                 760                 765


His Lys Leu Gln Gly Glu Phe Ile Asp Phe Glu Thr Gly Glu Ile Leu
    770                 775                 780


Arg Lys Asp Met Trp Asp Glu Asn Met Ser Asp Glu Val Tyr Ala Asp
785                 790                 795                 800


Tyr Leu Tyr Gly Lys Lys Trp Ala Asn Ile Arg Asn Glu Val Val Lys
                805                 810                 815


Ala Glu Lys Asn Val Lys Tyr Trp His Tyr Val Met Arg Lys Ser Asn
            820                 825                 830
```

```
Arg Gly Leu Cys Asn Gln Thr Ile Arg Gly Thr Arg Glu Tyr Asp Gly
        835                 840                 845

Lys Gln Tyr Lys Ile Asn Lys Leu Asp Ile Arg Thr Lys Glu Gly Ile
    850                 855                 860

Lys Val Phe Ala Lys Leu Ala Phe Ser Lys Lys Asp Ser Asp Arg Glu
865                 870                 875                 880

Arg Leu Leu Val Tyr Leu Asn Asp Arg Arg Thr Phe Asp Asp Leu Cys
                885                 890                 895

Lys Ile Tyr Glu Asp Tyr Ser Asp Ala Ala Asn Pro Phe Val Gln Tyr
            900                 905                 910

Glu Lys Glu Thr Gly Asp Ile Ile Arg Lys Tyr Ser Lys Lys His Asn
        915                 920                 925

Gly Pro Arg Ile Asp Lys Leu Lys Tyr Lys Asp Gly Glu Val Gly Ala
    930                 935                 940

Cys Ile Asp Ile Ser His Lys Tyr Gly Phe Glu Lys Gly Ser Lys Lys
945                 950                 955                 960

Val Ile Leu Glu Ser Leu Val Pro Tyr Arg Met Asp Val Tyr Tyr Lys
                965                 970                 975

Glu Glu Asn His Ser Tyr Tyr Leu Val Gly Val Lys Gln Ser Asp Ile
            980                 985                 990

Lys Phe Glu Lys Gly Arg Asn Val  Ile Asp Glu Glu Ala  Tyr Ala Arg
        995                 1000                1005

Ile Leu  Val Asn Glu Lys Met  Ile Gln Pro Gly Gln  Ser Arg Ala
    1010                1015                1020
```

```
Asp Leu  Glu Asn Leu Gly Phe  Lys Phe Lys Leu Ser  Phe Tyr Lys
    1025                1030                1035


Asn Asp  Ile Ile Glu Tyr Glu  Lys Asp Gly Lys Ile  Tyr Thr Glu
    1040                1045                1050


Arg Leu  Val Ser Arg Thr Met  Pro Lys Gln Arg Asn  Tyr Ile Glu
    1055                1060                1065


Thr Lys  Pro Ile Asp Lys Ala  Lys Phe Glu Lys Gln  Asn Leu Val
    1070                1075                1080


Gly Leu  Gly Lys Thr Lys Phe  Ile Lys Lys Tyr Arg  Tyr Asp Ile
    1085                1090                1095


Leu Gly  Asn Lys Tyr Ser Cys  Ser Glu Glu Lys Phe  Thr Ser Phe
    1100                1105                1110


Cys
```

<210> 105
<211> 1362
<212> PRT
<213> Lactobacillus paracasei

<400> 105

```
Met Thr Lys Leu Gly Lys Pro Tyr Gly Ile Gly Val Asp Ile Gly Ser
1               5                   10                  15


Asn Ser Ile Gly Phe Ala Ala Val Asp Glu Asn Ser His Leu Ile Arg
            20                  25                  30


Leu Lys Gly Lys Thr Val Ile Gly Ala Arg Leu Phe Glu Glu Gly Lys
        35                  40                  45


Ala Ala Ala Lys Arg Arg Ala Gly Arg Thr Thr Arg Arg Arg Leu Ser
    50                  55                  60
```

```
Arg Asn Arg Trp Arg Leu Ser Phe Leu Arg Asp Phe Phe Glu Ser His
65                  70                  75                  80

Ile Thr Pro Thr Asp Pro Asn Phe Phe Met Arg Gln Lys Tyr Ser Glu
                85                  90                  95

Ile Ser Pro Lys Asp Lys Ala Arg Tyr Lys Tyr Glu Lys Arg Leu Phe
            100                 105                 110

Asn Asp Arg Thr Asp Ala Glu Phe Tyr Gln Gln Tyr Ser Thr Met Tyr
        115                 120                 125

His Leu Arg Asn Arg Leu Met Thr Asp Pro Ser Arg Ala Asp Val Arg
    130                 135                 140

Glu Ile Tyr Phe Ala Ile His His Ile Leu Lys Ser Arg Gly His Phe
145                 150                 155                 160

Leu Thr Pro Gly Asp Ala Lys Asp Phe Asn Thr Asn Asp Val Ala Leu
                165                 170                 175

Asp Glu Ile Phe Pro Ala Leu Gln Asp Ala Tyr Ala Gln Val Tyr Pro
            180                 185                 190

Asp Leu Gly Ile Thr Phe Asp Glu Asp Lys Ala Asn Glu Phe Lys Thr
        195                 200                 205

Ile Leu Leu Asn Glu Ile Ala Thr Ser Ile Asp Thr Gln Arg Ala Leu
    210                 215                 220

Val Lys Leu Leu Leu Ala Glu Glu Asp Asp Lys Asp Ile Leu Lys Gln
225                 230                 235                 240

Gln Lys Gln Val Leu Thr Glu Phe Ala Lys Ala Val Val Gly Leu Lys
                245                 250                 255

Thr Lys Leu Asn Leu Ala Leu Gly Thr Glu Val Asp Ser Ser Glu Ala
```

```
            260                 265                 270

Thr Ala Trp Asn Phe Ser Leu Gly Gln Leu Asp Asp Lys Trp Ala Gly
        275                 280                 285

Ile Glu Ser Ala Met Thr Asp Glu Gly Thr Glu Ile Leu Asp Gln Ile
    290                 295                 300

Arg Asp Leu Tyr Arg Ala Arg Leu Leu Asn Gly Ile Val Pro Thr Gly
305                 310                 315                 320

Lys Thr Leu Ser Gln Ala Lys Val Asp Asp Tyr Thr Gln His His Glu
                325                 330                 335

Asp Leu Gln Leu Phe Lys Ala Tyr Leu Lys Gln Leu Glu Asp Asp Gly
            340                 345                 350

Thr Ala Lys Ala Ile Arg Gln Leu Tyr Asp Arg Tyr Ile Asp Gly Asp
        355                 360                 365

Asp Ala Ala Pro Phe Leu Arg Glu Asn Phe Val Lys Ala Leu Thr Lys
    370                 375                 380

Asp Val Thr Ala His Pro Asn Thr Lys Ser Pro Glu Leu Leu Glu Arg
385                 390                 395                 400

Leu Ala Gln Pro Asp Phe Met Leu Lys Gln Arg Asn Lys Ala Asn Gly
                405                 410                 415

Ala Ile Pro Val Gln Met Gln Gln Arg Glu Leu Asp Gln Ile Ile Lys
            420                 425                 430

Asn Gln Ala Val Tyr Tyr Asp Trp Leu Ala Ala Pro Asn Pro Val Glu
        435                 440                 445

Lys His Arg Lys Ser Met Pro Tyr Gln Leu Asp Glu Leu Leu Asn Phe
    450                 455                 460
```

```
Arg Ile Pro Tyr Tyr Val Gly Pro Leu Val Thr Ala Lys Glu Gln Lys
465                 470                 475                 480

Ala Ala Gln Gly Gly Val Phe Ala Trp Met Val Arg Lys Asp Pro Glu
                485                 490                 495

Gly Asn Ile Thr Pro Tyr Asn Phe Asp Glu Lys Val Asp Arg Glu Ala
            500                 505                 510

Ser Ala Asn Thr Phe Ile Gln Arg Met Lys Thr Thr Asp Thr Tyr Leu
        515                 520                 525

Ile Gly Glu Asp Val Leu Pro Lys Gln Ser Leu Leu Tyr Gln Arg Tyr
    530                 535                 540

Glu Val Leu Asn Glu Leu Asn Asn Val Arg Val Asn Asn Glu Lys Leu
545                 550                 555                 560

Ser Ile Glu Gln Lys Gln Gln Val Ile Arg Glu Leu Phe Glu Arg His
                565                 570                 575

Asn Ser Val Thr Ile Lys Gln Phe Ala Glu Asn Leu Arg Ala His Gly
            580                 585                 590

Asp Tyr Ala His Ile Pro Glu Ile Arg Gly Leu Ala Asp Glu Lys Arg
        595                 600                 605

Phe Leu Ser Ser Leu Ser Thr Tyr Arg Gln Leu Lys Ser Leu Leu Pro
    610                 615                 620

Glu Ala Ile Asp Asp Pro Ala Lys Gln Ala Asp Ile Glu Asn Ile Ile
625                 630                 635                 640

Ala Trp Ser Thr Val Phe Glu Asp Ala Ala Ile Phe Lys Thr Lys Leu
                645                 650                 655

Lys Glu Ile Ser Trp Leu Gly Ser Glu Ala Ile Thr Lys Leu Ser Asn
```

```
            660                 665                 670

Ile Arg Tyr Arg Gly Trp Gly Gln Phe Ser Arg Lys Phe Leu Asn Gly
        675                 680                 685

Leu Thr Leu Gly Asn Gly His Thr Ile Ile Gln Glu Leu Leu Leu Ser
    690                 695                 700

Thr Asn Asn Leu Met Gln Ile Leu Thr Asp Glu Thr Leu Gln Lys Lys
705                 710                 715                 720

Met Thr Glu Leu Asn Ala Asp Lys Leu Lys Thr Ala Asn Ile Asn Asp
                725                 730                 735

Ala Ile Asp Asn Ala Tyr Thr Ser Pro Ser Asn Lys Lys Ala Leu Arg
            740                 745                 750

Gln Val Leu Arg Val Val Asp Asp Ile Lys Arg Ala Ala Asp Gly Gln
        755                 760                 765

Asp Pro Ser Trp Leu Tyr Val Glu Thr Ala Asp Gly Gly Gly Thr Pro
    770                 775                 780

Gly Lys Arg Thr Arg Ala Arg Gln His Gln Leu Gln Glu Ile Tyr Ala
785                 790                 795                 800

Asn Ala Ala His Glu Leu Ile Asp Thr Ala Val Arg Gly Glu Leu Glu
                805                 810                 815

Asp Lys Ile Ser Asp Lys Ala Asp Phe Asn Asp Arg Leu Val Leu Tyr
            820                 825                 830

Phe Met Gln Gly Gly Arg Asp Ile Tyr Thr Gly Ala Pro Leu Asn Ile
        835                 840                 845

Asp Gln Leu Ser Ser Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Leu
    850                 855                 860
```

```
Ile Lys Asp Asn Ser Leu Asp Asn Arg Val Leu Val His Ala Ile Ile
865                 870                 875                 880


Asn Arg Glu Lys Asn Ala Thr Phe Ala Ser Thr Ile Tyr Ala Gln Lys
                885                 890                 895


Met Asn Ala Thr Trp Arg Gln Trp His Glu Ala Gly Leu Ile Ser Gly
            900                 905                 910


Arg Lys Leu Arg Asn Leu Gln Met Arg Pro Asp Gln Ile Asp Lys Tyr
        915                 920                 925


Ala Ser Gly Phe Val Ala Arg Gln Leu Val Glu Thr Arg Gln Ile Ile
    930                 935                 940


Lys Leu Thr Glu Gln Ile Val Ala Ala Gln Tyr Pro Asp Thr Lys Ile
945                 950                 955                 960


Ile Ala Val Lys Ala Gly Leu Ser His Gln Leu Arg Glu Glu Leu Glu
                965                 970                 975


Phe Pro Lys Asn Arg Asp Val Asn His Tyr His His Ala Phe Asp Ala
            980                 985                 990


Phe Leu Ala Ala Arg Ile Gly Thr  Tyr Leu Leu Lys Arg  Phe Pro Asn
        995                 1000                1005


Leu Gln  Ala Phe Phe Thr Tyr  Gly Lys Phe Thr Lys  Ala Asp Val
    1010                1015                1020


Lys Lys  Leu Arg Gly Phe Asn  Phe Ile Arg Asp Ile  Thr His Ala
    1025                1030                1035


Glu Asp  Lys Ile Val Ala Lys  Asp Thr Gly Glu Val  Val Trp Asp
    1040                1045                1050


Lys Gln  Arg Asp Val Asp Glu  Leu Asp Arg Ile Tyr  Asn Phe Lys
```

```
    1055                1060                1065

Arg Met  Leu Ile Thr His Glu  Val Arg Phe Glu Thr  Ala Asp Leu
    1070                1075                1080

Phe Lys  Gln Thr Val Tyr Gly  Ala Arg Asp Ser Lys  Glu Ala Gly
    1085                1090                1095

Gly Ser  Lys Gln Leu Ile Pro  Lys Lys Lys Gly Tyr  Pro Val Asp
    1100                1105                1110

Ile Tyr  Gly Gly Tyr Phe Arg  Glu Asn Thr Ala Tyr  Leu Ala Val
    1115                1120                1125

Val Lys  Val Thr Lys Lys Thr  Glu Thr Ile Phe Lys  Val Val Lys
    1130                1135                1140

Ile Ala  Thr Ser Gln Val Ala  Ala Leu Asn Lys Ala  Arg Ser Arg
    1145                1150                1155

Ser Thr  Ala Glu Glu Leu Ser  Val Leu Thr Glu Leu  Leu Lys Pro
    1160                1165                1170

Lys Phe  Ser Lys Val Gly Lys  Asn Gly Lys Ile Thr  Asp Thr Pro
    1175                1180                1185

Phe Glu  Val Val Leu Pro Arg  Val Pro Arg Glu Gln  Leu Phe Tyr
    1190                1195                1200

Asn Ala  Lys Tyr Gly Phe Phe  Met Val Asn Ser Asp  Thr Met Phe
    1205                1210                1215

His Asn  Phe Gln Glu Ile Trp  Val Ser Arg Ser Asp  Gln Lys Ile
    1220                1225                1230

Leu Gln  Gln Ile Arg Lys Ala  Lys Ile Asp Tyr Pro  Asn Val Asp
    1235                1240                1245
```

```
Gln Asp  Leu Asp Asn Leu Phe  His Asn Leu Ala Asp  Gln Ile Val
    1250                1255                1260


Lys Tyr  Phe Asp Leu Tyr Ser  Ile Ala Gly Phe Lys  Glu Lys Ile
    1265                1270                1275


Ser Gln  Ser Gln Asn Thr Phe  Asn Asp Leu Ala Val  Asp Asp Thr
    1280                1285                1290


Asp Gln  Ser Val Gly Lys Ile  Thr Val Ile Asn Glu  Leu Leu Lys
    1295                1300                1305


Gly Ala  Gln Ala Asn Gly Met  Thr Gly Ser Leu Lys  Val Leu Lys
    1310                1315                1320


Ile Ser  Thr Pro Phe Gly Phe  Thr Gln Asp Lys Ser  Gly Val Leu
    1325                1330                1335


Thr Lys  Asp Ser Ser Ile Ile  Tyr Gln Ser Pro Thr  Gly Leu Phe
    1340                1345                1350


Glu Arg  Ser Val Arg Leu Thr  Asp Leu
    1355                1360


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<212>  PRT
<213>  Actinobacillus minor

<400>  106

Met Lys Ala Leu Asn Tyr Ile Leu Gly Leu Asp Leu Gly Ile Ala Ser
1               5                   10                  15


Val Gly Trp Ala Val Val Glu Ile Asp Gln Asn Glu Leu Pro Ile Arg
            20                  25                  30


Leu Ile Asp Leu Gly Val Arg Thr Phe Glu Arg Ala Glu Val Pro Lys
        35                  40                  45
```

```
Thr Gly Asp Ser Leu Ala Leu Ala Arg Arg Leu Ala Arg Ser Ser Arg
    50                  55                  60

Arg Leu Val Arg Arg Arg Ala Val Arg Leu Leu Lys Ala Lys Arg Leu
65                  70                  75                  80

Leu Lys Gln Glu Gly Ile Leu Gln Ala Asp Asp Phe His Ser Ser His
                85                  90                  95

Leu Lys Pro Leu Pro Asn Asn Pro Trp Glu Leu Arg Val Lys Gly Leu
            100                 105                 110

Asn His Leu Leu Asp Arg Lys Glu Trp Ala Ala Val Leu Leu His Leu
        115                 120                 125

Leu Lys His Arg Gly Tyr Leu Ser Gln Arg Lys Asn Glu Ser Lys Thr
    130                 135                 140

Asp Asn Lys Glu Leu Gly Ala Leu Leu Lys Gly Val Ser Glu Asn Arg
145                 150                 155                 160

Gln Leu Leu Gln Ala Gln Ala Phe Ser Thr Pro Ala Glu Ile Ala Ile
                165                 170                 175

Lys Lys Phe Gln Gln Glu Glu Gly His Ile Arg Asn Gln Arg Gly Ala
            180                 185                 190

Tyr Ser His Thr Phe Asp Arg Asn Asp Leu Leu Ala Glu Leu Arg Leu
        195                 200                 205

Leu Phe Gln Lys Gln Arg Glu Phe Asn Asn Pro Tyr Thr Ser Gln Ser
    210                 215                 220

Leu Glu Gln Ala Ile Ala Glu Leu Leu Met Trp Gln Lys Pro Ala Leu
225                 230                 235                 240
```

```
Ser Gly Glu Ala Ile Leu Lys Met Leu Gly Lys Cys Thr Phe Glu Pro
                245                 250                 255

Ser Glu Tyr Lys Ala Pro Lys Asn Ser Tyr Ser Ala Glu Tyr Phe Val
            260                 265                 270

Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile Leu Glu Asn Gly Ala Asp
        275                 280                 285

Arg Gly Leu Thr Ala Glu Glu Arg Gln Leu Leu Ile Asn Gln Pro Phe
    290                 295                 300

Glu Lys Ala Lys Phe Thr Tyr Ala Gln Ala Arg Lys Leu Leu Glu Leu
305                 310                 315                 320

Ser Asp Leu Ala Ile Phe Lys Gly Val Arg Tyr Gly Lys Asp Asn Ala
                325                 330                 335

Glu Ser Ala Thr Leu Met Glu Met Lys Ala Trp His Ala Ile Arg Lys
            340                 345                 350

Ala Leu Glu Ser Asn Gly Leu Lys Thr Glu Trp Asn Gly Leu Lys Thr
        355                 360                 365

Lys Pro Glu Leu Leu Asp Lys Ile Gly Thr Ala Phe Ser Ile Tyr Lys
    370                 375                 380

Thr Asp Glu Asp Ile Ser Gln Tyr Leu Asn Gly Glu Leu Ser Pro Ala
385                 390                 395                 400

Val Leu Asn Ala Leu Leu Glu Asn Leu Ser Phe Asp Lys Phe Ile Arg
                405                 410                 415

Leu Ser Leu Gln Ser Leu Ala Lys Ile Leu Pro Leu Met Glu Gln Gly
            420                 425                 430

Leu Arg Tyr Asp Glu Ala Cys Lys Gln Val Tyr Gly Asp His Tyr Gly
        435                 440                 445
```

```
Lys Lys Glu Gln Leu Glu Leu Arg Phe Leu Pro Lys Ile Pro Val Glu
    450                 455                 460

Asp Ile Arg Asn Pro Val Val Leu Arg Thr Leu Ser Gln Ala Arg Lys
465                 470                 475                 480

Val Ile Asn Gly Val Val Arg Leu Tyr Gly Ser Pro Ala Arg Ile His
                485                 490                 495

Ile Glu Thr Gly Arg Glu Val Gly Lys Ser Phe Ser Glu Arg Arg Asp
            500                 505                 510

Ile Ser Lys Arg Gln Glu Glu Asn Arg Asn Glu Arg Gln Arg Ala Val
        515                 520                 525

Glu Lys Phe Lys Glu Phe Phe Pro His Phe Val Gly Glu Pro Lys Ala
    530                 535                 540

Lys Asp Ile Leu Lys Met Arg Leu Tyr Glu Gln Gln His Gly Lys Cys
545                 550                 555                 560

Leu Tyr Ser Gly Lys Glu Leu Asp Leu Asn Arg Leu Leu Glu Lys Gly
                565                 570                 575

Tyr Val Glu Ile Asp His Ala Leu Pro Phe Ser Arg Thr Trp Asp Asp
            580                 585                 590

Ser Phe Asn Asn Lys Val Leu Val Leu Ala Ser Glu Asn Gln Asn Lys
        595                 600                 605

Gly Asn Gln Thr Pro Tyr Glu Trp Leu Asn Gly Lys Glu Asn Ala Glu
    610                 615                 620

Arg Trp Lys Leu Phe Gln Ala Leu Val Asn Gly Ser Arg Phe Pro Tyr
625                 630                 635                 640
```

```
Ser Lys Lys Gln Arg Ile Leu Thr Lys Tyr Leu Asp Glu Asp Gly Phe
                645                 650                 655

Arg Glu Arg Asn Leu Asn Asp Thr Arg Tyr Val Ala Arg Phe Leu Cys
            660                 665                 670

Asn Phe Ile Glu Asp Asn Met Gln Leu Val Gly Gln Gly Lys Lys Arg
        675                 680                 685

Val Phe Ala Ser Asn Gly Gln Ile Thr Ala Leu Leu Arg Arg Ser Trp
    690                 695                 700

Gly Ile Gln Lys Val Arg Glu Asp Asn Asp Arg His His Ala Val Asp
705                 710                 715                 720

Ala Val Val Val Ala Cys Ser Thr Arg Ala Leu Gln Lys Lys Ile Thr
                725                 730                 735

Asp Tyr Val Arg Tyr Lys Glu Met Asn Val Phe Thr Gly Glu Lys Ile
            740                 745                 750

Asp Gln Glu Thr Gly Glu Ile Ile Lys Phe His Phe Pro Glu Pro Trp
        755                 760                 765

Lys Phe Phe Arg Gln Glu Val Glu Ile Arg Val Phe Ser Glu Thr Pro
    770                 775                 780

Ala Glu Asp Val Val Ile Ala Leu Pro Asp Arg Pro Gln Ala Asn His
785                 790                 795                 800

Glu Phe Ile Gln Pro Leu Phe Val Ser Arg Ala Pro Thr Arg Lys Met
                805                 810                 815

Thr Gly Gln Gly His Met Glu Thr Ile Lys Ser Ala Lys Arg Leu Ala
            820                 825                 830

Glu Gly Leu Ser Val Ser Arg Val Pro Leu Thr Gln Leu Lys Leu Lys
        835                 840                 845
```

```
Asp Leu Glu Asn Met Val Asn Arg Glu Arg Glu Lys Ala Leu Tyr Glu
    850                 855                 860

Ala Leu Lys Val Arg Leu Glu Lys Phe Asn Asn Asp Pro Ala Lys Ala
865                 870                 875                 880

Phe Ala Asp Pro Phe Tyr Lys Lys Gly Gly Gln Gln Val Lys Ala Val
                885                 890                 895

Arg Val Glu Gln Val Gln Lys Ser Gly Val Leu Val Arg Gln Glu Asn
            900                 905                 910

Gly Val Ala Asp Asn Ala Ser Met Val Arg Val Asp Val Phe Ile Lys
        915                 920                 925

Gly Gly Lys Tyr Phe Leu Val Pro Ile Tyr Thr Trp Gln Val Ala Lys
    930                 935                 940

Gly Ile Leu Pro Asn Arg Ala Ala Thr Gln Gly Lys Glu Glu Glu Tyr
945                 950                 955                 960

Trp Asp Ile Met Asp Glu Thr Ala Ile Phe Gln Phe Ser Leu Tyr Gln
                965                 970                 975

Asn Asp Leu Ile Lys Leu Val Thr Lys Lys Lys Thr Ile Phe Gly Tyr
            980                 985                 990

Phe Asn Gly Leu Asn Arg Ala Thr  Ser Asn Ile Asn Ile  Lys Glu His
        995                 1000                1005

Asp Leu  Asp Lys Ser Lys Gly  Lys Asp Gly Ile Tyr  Leu Glu Val
    1010                1015                1020

Gly Val  Lys Leu Ala Leu Ser  Leu Glu Lys Tyr Gln  Val Asp Glu
    1025                1030                1035
```

Leu Gly Lys Asn Ile Gln Pro Cys Arg Ser Met Lys Lys Arg Pro
    1040   1045   1050

Pro Val Arg
    1055

<210> 107
<211> 1081
<212> PRT
<213> Neisseria flavescens

<400> 107

Met Thr Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
1   5   10   15

Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Glu
            20   25   30

Glu Asn Pro Ile Arg Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
        35   40   45

Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Ala Ala Arg Arg Leu
    50   55   60

Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65   70   75   80

Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
                85   90   95

Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100   105   110

Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
        115   120   125

Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130   135   140

```
Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160

Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Val Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Val Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Ile Ser Asp Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Ala Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

Tyr Cys Thr Phe Glu Pro Thr Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Ile Asp Met Pro Tyr Lys Asn Lys Leu Thr Tyr Ala Lys Ala Arg
305                 310                 315                 320

Glu Leu Leu Gly Leu Asp Asp Thr Ala Phe Phe Lys Gly Leu Arg Tyr
                325                 330                 335

Gly Lys Asp Asn Ala Glu Ser Ala Thr Leu Met Glu Met Lys Ala Tyr
```

```
            340                 345                 350

His Ala Ile Arg Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys Lys
        355                 360                 365

Ser Pro Leu Ser Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr Ala
    370                 375                 380

Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys Gly
385                 390                 395                 400

Cys Leu Gln Pro Glu Ile Leu Asp Ala Leu Leu Lys His Ile Asn Phe
                405                 410                 415

Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val Pro
            420                 425                 430

Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Thr Tyr
        435                 440                 445

Gly Asp His Tyr Gly Glu Lys Asn Ser Glu Glu Met Leu Tyr Leu Pro
    450                 455                 460

Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala Leu
465                 470                 475                 480

Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly Ser
                485                 490                 495

Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser Phe
            500                 505                 510

Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys Asp
        515                 520                 525

Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe Val
    530                 535                 540
```

```
Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu Gln
545                 550                 555                 560

Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Ala Ile Asp Ile Arg Arg
                565                 570                 575

Leu Asn Gly Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe Ser
            580                 585                 590

Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly Ser
        595                 600                 605

Glu Asn Gln Asn Lys Gly Asn Arg Thr Pro Tyr Glu Tyr Leu Asn Gly
    610                 615                 620

Lys Asp Asn Ser Arg Glu Trp Leu Glu Phe Lys Ala Arg Val Glu Thr
625                 630                 635                 640

Ser Arg Phe Pro His Ser Lys Lys Gln Arg Val Leu Leu Gln Lys Phe
                645                 650                 655

Asp Glu Lys Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr Val
            660                 665                 670

Asn Arg Phe Leu Cys Gln Phe Val Ala Asp His Met Gln Leu Thr Gly
        675                 680                 685

Lys Gly Lys Arg Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn Leu
    690                 695                 700

Leu Arg Gly Phe Trp Gly Leu His Lys Val Arg Ala Glu Asn Asp Arg
705                 710                 715                 720

His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala Met
                725                 730                 735

Gln Gln Lys Ile Thr Cys Phe Val Arg Tyr Lys Glu Met Asn Ala Phe
```

```
            740                 745                 750

Asp Gly Lys Thr Val Asp Lys Glu Thr Gly Glu Val Leu His Gln Lys
        755                 760                 765

Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met Ile
    770                 775                 780

Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala Asp
785                 790                 795                 800

Thr Pro Glu Lys Leu Arg Ala Leu Leu Ala Glu Lys Leu Ser Ser Arg
                805                 810                 815

Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg Ala
            820                 825                 830

Pro Asn Arg Lys Met Ser Gly Ala His Lys Asp Thr Leu Arg Ser Ala
        835                 840                 845

Lys Arg Phe Val Lys His Asn Glu Lys Ile Ser Val Lys Arg Val Trp
    850                 855                 860

Leu Thr Glu Ile Lys Leu Ala Asp Leu Glu Asn Met Val Asn Tyr Lys
865                 870                 875                 880

Asn Gly Arg Glu Ile Glu Leu Tyr Glu Ala Leu Lys Ala Arg Leu Gly
                885                 890                 895

Ala Tyr Gly Gly Asn Ala Lys Gln Ala Phe Asp Pro Lys Asp Asn Pro
            900                 905                 910

Phe Tyr Lys Lys Gly Gly Gln Leu Val Lys Ala Val Arg Val Glu Lys
        915                 920                 925

Thr Gln Glu Ser Gly Val Leu Leu Asn Lys Lys Asn Ala Tyr Thr Ile
    930                 935                 940
```

```
Ala Asp Asn Gly Asp Met Val Arg Val Asp Val Phe Cys Lys Val Asp
945                 950                 955                 960


Lys Lys Gly Lys Asn Gln Tyr Phe Ile Val Pro Ile Tyr Ala Trp Gln
                965                 970                 975


Val Ala Glu Asn Ile Leu Pro Asp Ile Asp Cys Lys Gly Tyr Arg Ile
            980                 985                 990


Asp Asp Ser Tyr Thr Phe Cys Phe  Ser Leu His Lys Tyr  Asp Leu Ile
        995                 1000                1005


Ala Phe  Gln Lys Asp Glu Lys  Ser Lys Val Glu Phe  Ala Tyr Tyr
    1010                1015                1020


Ile Asn  Cys Asp Ser Ser Asn  Gly Arg Phe Tyr Leu  Ala Trp His
    1025                1030                1035


Asp Lys  Gly Ser Lys Glu Gln  Gln Phe Arg Ile Ser  Thr Gln Asn
    1040                1045                1050


Leu Val  Leu Met Gln Lys Tyr  Gln Ile Asp Glu Leu  Gly Lys Glu
    1055                1060                1065


Ile Arg  Pro Cys Arg Leu Lys  Lys Arg Pro Pro Val  Arg
    1070                1075                1080


<210>  108
<211>  1392
<212>  PRT
<213>  Gemella haemolysans

<400>  108

Met Ala Asn Lys Thr Trp Tyr Leu Gly Leu Asp Ile Gly Ser Ala Ser
1               5                   10                  15


Val Gly Trp Ala Ala Thr Asp Thr Gly Tyr Lys Ile Ile Arg Lys Asn
            20                  25                  30
```

```
Lys Lys Arg Leu Trp Gly Val Arg Leu Phe Glu Glu Ala Lys Thr Ala
        35                  40                  45

Glu Asp Arg Arg Gly Tyr Arg Ser Ser Arg Arg Arg Leu Ala Arg Arg
    50                  55                  60

Lys Trp Arg Leu Asn Leu Leu Glu Glu Leu Phe Thr Ser Glu Val Lys
65                  70                  75                  80

Lys Val Asp Glu Asn Phe Phe Leu Arg Leu Lys Glu Ser Gln Tyr His
                85                  90                  95

Tyr Glu Asp Lys Thr His Lys Val Pro Tyr Ala Ile Phe Asn Asp Lys
            100                 105                 110

Asp Tyr Thr Asp Lys Asp Tyr Tyr Lys Asp Tyr Pro Thr Ile Tyr His
        115                 120                 125

Leu Arg Ser Lys Leu Met Thr Glu Glu Asn Pro Asp Ile Arg Lys Val
    130                 135                 140

Phe Leu Ala Ile His His Ile Ile Lys Asn Arg Gly His Phe Leu Leu
145                 150                 155                 160

Gln Gly Gln Ser Phe Lys Asp Gly Asn Leu Asn Asn Leu Ile Lys Glu
                165                 170                 175

Leu Leu Glu Leu Asp Ile Leu His Val Gly Phe Glu Val Thr Glu Glu
            180                 185                 190

Val Val Asp Lys Ile Ala Asp Ile Ser Leu Glu Lys Lys Thr Ser Lys
        195                 200                 205

Asp Lys Leu Asn Asp Ile Lys Glu Leu Tyr Pro Lys Glu Lys Gln Leu
    210                 215                 220
```

```
Leu Glu Val Phe Arg Leu Ile Phe Gly Gly Lys Thr Ser Leu Asp Lys
225                 230                 235                 240

Leu Phe Ala Ile Asp Glu Tyr Lys Glu Leu Asp Ala Ala Ile Lys Ser
                245                 250                 255

Val Ser Phe Lys Glu Lys Ile Tyr Glu Glu Val Arg His Asp Tyr Glu
            260                 265                 270

Gln Val Leu Ser Asn Tyr Ile Glu Leu Leu Asp Leu Ala Lys Leu Val
        275                 280                 285

Tyr Asp Ser Ile Ile Leu Ser Asp Ile Lys Lys Glu Gly Lys Thr Leu
    290                 295                 300

Ser Glu Ser Lys Val Glu Leu Phe Glu Lys His Arg Asp Asp Leu Leu
305                 310                 315                 320

Lys Leu Lys Asn Leu Val Lys Asn Asp Ser Lys Leu Ser Glu Asp Lys
                325                 330                 335

Lys Val Glu Leu Tyr Ala Leu Ile Phe Lys Glu Asp Lys Asp Lys Gly
            340                 345                 350

Thr Asn Tyr Val Asn Tyr Ile Arg Lys Ser Glu Glu Gly Lys Gly Cys
        355                 360                 365

Asn Tyr Glu Asp Phe Lys Lys Phe Leu Val Lys Glu Leu Ala Lys Leu
    370                 375                 380

Glu Glu Ser Ser Val Lys Thr Glu Ile Ile Lys Asp Leu Glu Leu Glu
385                 390                 395                 400

Gln Phe Leu Pro Leu Gln Arg Thr Lys Asp Asn Ser Val Val Pro Tyr
                405                 410                 415

Gln Ile His Lys Glu Glu Leu Val Lys Ile Leu Asp Asn Ala Ala Arg
            420                 425                 430
```

```
Tyr His Ser Phe Leu Asn Glu Lys Asp Glu Ser Gly Tyr Asn Val Arg
        435                 440                 445

Glu Lys Val Ile Gln Leu Leu Glu Phe Arg Ile Pro Tyr Tyr Val Gly
    450                 455                 460

Pro Leu Asn Ser Ser Lys Lys Ala Lys Glu Gly Gly Phe Ala Trp Ser
465                 470                 475                 480

Val Arg Asn Thr Gly Tyr Glu Asn Thr Pro Val Thr Pro Trp Asn Tyr
                485                 490                 495

Ser Lys Val Ile Asp Glu Ser Ala Ser Ala Glu Lys Phe Ile Thr Asn
            500                 505                 510

Leu Thr Asn Lys Cys Thr Tyr Leu Lys Gly Glu Asp Val Leu Pro Lys
        515                 520                 525

Ser Ser Leu Leu Tyr Ser Glu Phe Ala Leu Leu Asn Glu Leu Asn Ala
    530                 535                 540

Leu Lys Tyr Asp Gly Asn Arg Ile Ser Leu Glu Ala Arg Asn Thr Ile
545                 550                 555                 560

Ile Glu Lys Leu Phe Lys Gln Gln Gly Lys Lys Val Thr Lys Thr Ser
                565                 570                 575

Ile Lys Asn Leu Leu Lys Ala Glu Gly Tyr Ile Asp Gly Lys Gly Glu
            580                 585                 590

Ile Thr Gly Ile Asp Ile Thr Val Lys Asn Asp Leu Lys Ser Tyr Arg
        595                 600                 605

Asp Phe Lys Lys Ile Leu Gly Asn Lys Phe Asn Ser Glu His Val Glu
    610                 615                 620
```

```
Asn Ile Ile Leu Trp Ile Thr Leu Tyr Gly Glu Ser Arg Lys Leu Ile
625                 630                 635                 640

Lys Ala Lys Ile Glu Ser Val Tyr Gly Glu Val Tyr Ser Lys Asp Glu
                645                 650                 655

Ile Thr Lys Met Ser Arg Leu Val Tyr Lys Asp Trp Gly Arg Phe Ser
            660                 665                 670

Arg Lys Leu Leu Thr Glu Leu Val Ser Lys Lys Leu Tyr Asn Glu Glu
        675                 680                 685

Thr Gly Glu Cys Leu Asn Ile Ile Gly Ala Met Arg Gln Asn Asn Ile
    690                 695                 700

Leu Phe Met Glu Leu Leu Ala Asp Arg Phe Asp Tyr Ser Lys Gln Ile
705                 710                 715                 720

Val Glu Phe Asn Lys Glu Leu Gln Glu Asp Val Thr Glu Ile Ala Pro
                725                 730                 735

Glu Ile Leu Asp Asp Leu Tyr Val Ser Pro Ala Val Lys Arg Ser Ile
            740                 745                 750

Trp Gln Thr Val Arg Ile Val Glu Glu Leu Lys Lys Ile Ile Gly Cys
        755                 760                 765

Ala Pro Ala Lys Ile Phe Val Glu Thr Thr Arg Ser Asn Gln Glu Lys
    770                 775                 780

Lys Lys Pro Thr Asp Ser Arg Lys Lys Gln Leu Glu Leu Ala Tyr Lys
785                 790                 795                 800

Ala Val Lys Lys Asp Val Lys Glu Leu Glu Lys Glu Ile Gly Thr Ile
                805                 810                 815

Asn Phe Asp Val Leu Asn Asp Arg Leu Ser Ser Val Glu Pro Ser Lys
            820                 825                 830
```

```
Leu Lys Ala Lys Lys Leu Tyr Leu Tyr Tyr Thr Gln Leu Gly Arg Cys
        835                 840                 845

Met Tyr Ser Glu Glu Pro Ile Asn Ile Ser Glu Leu Phe Asp Asn Asn
    850                 855                 860

Lys Tyr Asp Ile Asp His Ile Tyr Pro Gln Ser Lys Ile Lys Asp Asp
865                 870                 875                 880

Ser Phe Thr Asn Thr Val Leu Val Lys Arg Glu Ser Asn Ala Ala Lys
                885                 890                 895

Thr Asp Arg Tyr Pro Leu Gly Ser Asp Ile Gln Thr Pro Ser Asn Arg
            900                 905                 910

Arg Phe Trp Lys Phe Leu Lys Glu Lys Gly Leu Ile Ser Asp Glu Lys
        915                 920                 925

Tyr Asn Arg Leu Val Arg Thr Glu Glu Phe Ser Asp Glu Glu Leu Ser
    930                 935                 940

Gly Phe Ile Ala Arg Gln Leu Val Glu Thr Ser Gln Ser Val Lys Ala
945                 950                 955                 960

Val Ala Ser Ile Leu Gly Glu Leu Asn Pro Glu Thr Ser Ile Cys Tyr
                965                 970                 975

Ser Lys Ala Glu Asn Val Ser Ser Phe Arg Gln Asn Phe Gly Lys Ile
            980                 985                 990

Lys Lys Gly Asp Arg Asp Ser Lys  Asn Asn Asp Gln Leu  Ile Lys Val
        995                 1000                1005

Arg Glu  Ile Asn Asp Tyr His  His Ala Lys Asp Ala  Tyr Leu Asn
    1010                1015                1020
```

```
Val Val  Val Gly Asn Val Tyr  Asp Thr Lys Phe Thr  Arg Asn Val
    1025                1030                1035

Phe Asn  Phe Ile Lys Asp Lys  Lys Asp Gly Arg Lys  Tyr Ser Leu
    1040                1045                1050

Asn Lys  Val Phe Tyr Glu Asn  Val Ser Asp Ser Lys  Thr Val Ala
    1055                1060                1065

Trp Glu  Met Asp Lys Thr Ile  His Gln Val Glu Lys  Val Met Asn
    1070                1075                1080

Asn Asn  Asn Ile Met Val Thr  Arg Arg Thr Ser Glu  Gln Lys Gly
    1085                1090                1095

Gly Leu  Phe Asp Ala Thr Val  Tyr Lys Ala Lys Val  Ala Ala Lys
    1100                1105                1110

Ala Lys  Asp Gly Val Tyr Tyr  Pro Leu Lys Thr Ser  Asn Ser Val
    1115                1120                1125

Val Lys  Asp Val Ala Lys Tyr  Gly Gly Tyr Thr Ser  Ile Gly Ile
    1130                1135                1140

Ala Tyr  Tyr Ser Ile Phe Glu  Tyr Thr Ile Val Asn  Lys Lys Gly
    1145                1150                1155

Glu Glu  Lys Ile Thr Arg Ile  Ile Pro Ile Pro Ile  Tyr Ile Ser
    1160                1165                1170

Gln Asn  Ile Lys Asp Ser Thr  Ala Leu Ile Glu Phe  Gly Lys Ser
    1175                1180                1185

Gln Ile  Phe Cys Arg Ala Tyr  Glu Lys Ile Lys Asp  Phe Lys Leu
    1190                1195                1200

Leu Tyr  Arg Lys Leu Cys Ile  Gly Ser Lys Ile Asn  Ile Asn Asn
    1205                1210                1215
```

```
Tyr Gln  Tyr Tyr Ile Gly Gly  Lys Ser Asp Glu Arg  Phe Tyr Tyr
    1220                1225                1230

Asp Ser  Ala Ile Gln Val Thr  Leu Asp Lys Lys Ser  Glu Lys Tyr
    1235                1240                1245

Leu Lys  Ile Leu Ser Lys Tyr  Gln Asn Trp Lys Lys  Glu Asn Lys
    1250                1255                1260

Asp Gly  Glu Leu Trp Glu Asn  Ile Thr Lys Glu Asn  Asn Ile Glu
    1265                1270                1275

Leu Tyr  Asn Lys Leu Val Glu  Lys Met Asn Ser Glu  Ile Phe Thr
    1280                1285                1290

Lys Lys  Lys Ser Asn Lys Tyr  Asn Glu Leu Asn Ser  Glu Glu Ile
    1295                1300                1305

Arg Asn  Asn Phe Ile Lys Ile  Ser Val Glu Glu Gln  Ala Lys Val
    1310                1315                1320

Leu Leu  Glu Ile Leu Asn Leu  Leu Thr Asn Lys Lys  Ser Ile Phe
    1325                1330                1335

Asp Leu  Lys Ser Ile Asp Ile  Lys Ala Ala Arg Gly  Lys Ile Ser
    1340                1345                1350

Phe Asn  Leu Thr Ser Leu Ile  Gln Phe Ser Ile Ile  Glu Gln Ser
    1355                1360                1365

Ile Thr  Gly Phe Tyr Glu Lys  Glu Ile Thr Ile Ile  Gly Asp Lys
    1370                1375                1380

Gly Asn  Asp Met Glu Asn Asn  Asn Ser
    1385                1390
```

<210> 109
<211> 702
<212> PRT
<213> Helicobacter pullorum

<400> 109

```
Met Arg Lys Ile Leu Lys Ile Asp Glu Arg Ile Gln Phe Lys Glu Val
1               5                  10                  15


Asp Tyr Thr Ala Lys Asn Pro Glu Asn Lys Lys Phe Val Glu Phe Lys
            20                  25                  30


Asn Leu Lys Lys Phe Cys Glu Ile Leu Gly Ala Ile Val Gly Asp Arg
        35                  40                  45


Ala Leu Ala Asp Ser Ile Ala Arg Asp Met Thr Leu Ile Lys Asp Glu
    50                  55                  60


Glu Glu Leu Ala Gln Lys Leu Arg Gly Tyr Gly Lys Phe Ser Gln Glu
65                  70                  75                  80


Gln Ile Thr Gln Leu Ser Ala Leu His Phe Ser His His Ile Ser Leu
                85                  90                  95


Ser Leu Lys Ala Leu Ser Glu Ile Leu Pro Phe Met Arg Glu Gly Met
            100                 105                 110


Arg Tyr Asp Glu Ala Cys Gln Glu Ala Lys Leu Gln Ala Lys His Asn
        115                 120                 125


Asp Lys Lys Ser Lys Phe Leu Pro Pro Phe Cys Glu Ser Ile Tyr Ala
    130                 135                 140


Asp Glu Leu Thr Asn Pro Val Val His Arg Ala Ile Ala Glu Tyr Arg
145                 150                 155                 160


Lys Ile Leu Asn Ala Leu Ile Ala Lys Tyr Gly Ser Val His Lys Ile
                165                 170                 175
```

```
His Ile Glu Leu Thr Arg Asp Val Gly Lys Asn Phe Gln Glu Arg Glu
            180                 185                 190

Lys Tyr Lys Lys Glu Ile Glu Ser Asn Tyr Lys Ala Arg Val Gln Ala
        195                 200                 205

Met Gln Glu Cys Glu Lys Leu Gly Leu Thr Leu Ser Glu Gly Asn Ile
    210                 215                 220

Leu Lys Leu Arg Leu Phe Arg Glu Gln Asn Glu Ile Cys Val Tyr Ser
225                 230                 235                 240

Gly Arg Lys Ile Thr Leu Ala Asn Leu Lys Glu Gln Gly Ala Leu Glu
                245                 250                 255

Ile Asp His Ile Leu Pro Tyr Ser Arg Ser Ser Asp Asp Ser Tyr Met
            260                 265                 270

Asn Lys Val Leu Val Phe Thr Asn Glu Asn Gln Asn Lys Gly Asn Lys
        275                 280                 285

Thr Pro Tyr Glu Ala Phe Gly Gly Asp Ser Gln Lys Trp Gly Glu Ile
    290                 295                 300

Glu Ser Leu Ala Leu Arg Ser Gly Tyr Pro Lys Lys Lys Ala Lys Arg
305                 310                 315                 320

Ile Leu Asp Lys Gly Phe Gly Asp Arg Glu Ala Gly Phe Lys Ser Arg
                325                 330                 335

Asn Ile Val Asp Ser Gly Tyr Ile Ala Arg Leu Ile Ala Asn Tyr Thr
            340                 345                 350

Lys Glu Tyr Leu Lys Phe Leu Pro Leu Asp Ser His Glu Asn Thr Ala
        355                 360                 365

Leu Ile Ala Gly Glu Lys Asp Ser Lys Ile His Val Glu Ala Val Lys
```

```
    370                 375                 380

Gly Met Leu Thr Ala Thr Met Arg His Phe Trp Gly Leu Gly Ser Lys
385                 390                 395                 400

Asn Arg Tyr Glu His Thr His His Ala Val Asp Ala Ile Ile Ile Ala
                405                 410                 415

Tyr Ile Asn Ala Ala Met Ile Gln Arg Phe Ser Gln Phe Arg Gln Asn
            420                 425                 430

Gln Glu Ser Leu Lys Ala Arg Phe Tyr Ala Lys Glu Leu Ala Lys Glu
        435                 440                 445

Glu Phe Lys Thr Gln Arg Ala Phe Phe Glu Pro Phe Ser Gly Phe Arg
    450                 455                 460

Glu Gln Val Leu Ala Lys Val Gly Gln Ile Phe Val Ser Arg Pro Pro
465                 470                 475                 480

Arg Lys Arg Ala Arg Gly Ala Leu His Glu Glu Thr Phe Tyr Ser Ile
                485                 490                 495

Asp Asp Lys Lys Leu Ser Glu Thr Tyr Gly Gly Lys Lys Gly Val Gln
            500                 505                 510

Arg Ala Leu Ser Leu Gly Lys Ile Arg Gln Ile Gly Thr Lys Ile Val
        515                 520                 525

Ala Asn Gly Pro Met Val Arg Val Asp Ile Phe Lys His Thr Gln Ser
    530                 535                 540

Gly Arg Phe Tyr Ala Val Pro Ile Tyr Thr Met Asp Phe Ala Leu Gly
545                 550                 555                 560

Ile Leu Pro Asn Lys Ala Val Val Ser Gly Lys Asp Lys Asp Arg Ile
                565                 570                 575
```

```
Ile Lys Asp Trp Leu Glu Met Asp Ser Cys Tyr Glu Phe Cys Phe Ser
            580                 585                 590


Leu Phe Lys Asp Asp Val Ile Glu Val Gln Lys Arg Asp Met Glu Lys
        595                 600                 605


Pro Glu Leu Ala Tyr Phe Val Ser Leu Asp Ala Ser Asp Gly Arg Ile
    610                 615                 620


Lys Val Arg His His Cys Asn Asp Ile Thr Lys Ile Asn Glu Asn Gln
625                 630                 635                 640


Lys Lys Leu Phe Ser Glu Ala Ile Glu Lys Glu Val Val Gly Arg Gly
                645                 650                 655


Ser Ile Gln Asn Leu Lys Val Phe Lys Lys Tyr Lys Val Ser Pro Leu
            660                 665                 670


Gly Glu Ile Lys Glu Ala Lys Tyr Glu Pro Arg Gln Pro Ile Ala Leu
        675                 680                 685


Lys Thr Ser Pro Lys Lys His Arg Lys Gln Asn Asn Ala Gln
    690                 695                 700


<210>  110
<211>  1371
<212>  PRT
<213>  Streptococcus dysgalactiae

<400>  110

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45
```

```
Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Arg
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Ser Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Met Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Arg Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Arg Asn Gly Leu Phe Gly Asn
225                 230                 235                 240
```

```
Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445
```

```
Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Glu Phe Leu Ser Gly Lys Gln
    530                 535                 540

Lys Glu Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Lys Glu Met Ile Glu Glu Arg Leu Lys Lys Tyr Ala
625                 630                 635                 640
```

```
Asn Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg His Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Ala Ile Gln Lys Ala Gln Val Ser Gly Gln Gly His Ser Leu
705                 710                 715                 720

His Glu Gln Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Ser Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
        755                 760                 765

Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu
    770                 775                 780

Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val
785                 790                 795                 800

Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln
                805                 810                 815

Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu
            820                 825                 830

Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp
        835                 840                 845
```

```
Asp Ser Ile Asp Asn Lys Ile Leu Thr Arg Ser Asp Lys Asn Arg Gly
    850                 855                 860

Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn
865                 870                 875                 880

Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe
                885                 890                 895

Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys
            900                 905                 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925

His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu
    930                 935                 940

Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys
945                 950                 955                 960

Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu
                965                 970                 975

Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val
            980                 985                 990

Gly Thr Ala Leu Ile Lys Lys Tyr  Thr Lys Leu Glu Ser  Glu Phe Val
        995                 1000                1005

Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg Lys Met  Ile Ala Lys
    1010                1015                1020

Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala Lys Arg  Phe Phe Tyr
    1025                1030                1035
```

```
Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu Ile Thr  Leu Ala Asn
    1040                1045                1050

Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu Thr Asn  Glu Glu Thr
    1055                1060                1065

Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp Phe Ala  Thr Val Arg
    1070                1075                1080

Lys Val  Leu Ser Met Pro Gln  Val Asn Ile Val Lys  Lys Thr Glu
    1085                1090                1095

Val Gln  Thr Gly Ala Leu Thr  Asn Glu Ser Ile Tyr  Ala Arg Gly
    1100                1105                1110

Ser Phe  Asp Lys Leu Ile Ser  Arg Lys His Arg Phe  Glu Ser Ser
    1115                1120                1125

Lys Tyr  Gly Gly Phe Gly Ser  Pro Thr Val Thr Tyr  Ser Val Leu
    1130                1135                1140

Val Val  Ala Lys Ser Lys Val  Gln Asp Gly Lys Val  Lys Lys Ile
    1145                1150                1155

Lys Thr  Gly Lys Glu Leu Ile  Gly Met Thr Leu Leu  Asp Lys Leu
    1160                1165                1170

Val Phe  Glu Lys Asn Pro Leu  Lys Phe Ile Glu Asp  Lys Gly Tyr
    1175                1180                1185

Gly Asn  Val Gln Ile Asp Lys  Cys Ile Lys Leu Pro  Lys Tyr Ser
    1190                1195                1200

Leu Phe  Glu Phe Glu Asn Gly  Thr Arg Arg Met Leu  Ala Ser Val
    1205                1210                1215

Met Ala  Asn Asn Asn Ser Arg  Gly Asp Leu Gln Lys  Ala Asn Glu
    1220                1225                1230
```

```
Met Phe  Leu Pro Ala Lys Leu  Val Thr Leu Leu Tyr  His Ala His
    1235                1240                1245


Lys Ile  Glu Ser Ser Lys Glu  Leu Glu His Glu Ala  Tyr Ile Leu
    1250                1255                1260


Asp His  Tyr Asn Asp Leu Tyr  Gln Leu Leu Ser Tyr  Ile Glu Arg
    1265                1270                1275


Phe Ala  Ser Leu Tyr Val Asp  Val Glu Lys Asn Ile  Ser Lys Val
    1280                1285                1290


Lys Glu  Leu Phe Ser Asn Ile  Glu Ser Tyr Ser Ile  Ser Glu Ile
    1295                1300                1305


Cys Ser  Ser Val Ile Asn Leu  Leu Thr Leu Thr Ala  Ser Gly Ala
    1310                1315                1320


Pro Ala  Asp Phe Lys Phe Leu  Gly Thr Thr Ile Pro  Arg Lys Arg
    1325                1330                1335


Tyr Gly  Ser Pro Gln Ser Ile  Leu Ser Ser Thr Leu  Ile His Gln
    1340                1345                1350


Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile Asp Leu  Ser Gln Leu
    1355                1360                1365


Gly Gly  Asp
    1370


<210>  111
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<212>  PRT
<213>  Helicobacter canadensis

<400>  111

Met Lys Val Leu Gly Phe Asp Ile Gly Ile Asn Ser Ile Gly Trp Ala
```

```
1               5                   10                  15

Phe Val Glu Asn Asn Glu Leu Lys Asp Cys Gly Val Arg Leu Phe Thr
            20                  25                  30

Lys Ala Glu Asn Pro Lys Thr Lys Glu Ser Leu Ala Leu Pro Arg Arg
        35                  40                  45

Asn Ala Arg Ser Ser Arg Val Arg Leu Arg Arg Arg Arg Ser Arg Leu
    50                  55                  60

Leu Ser Leu Lys His Ile Ile Ser Lys Glu Phe Gly Leu His Tyr Glu
65                  70                  75                  80

Asp Tyr Ile Ala Leu Asp Gly Asn Leu Pro Lys Ala Tyr Thr Gly Lys
                85                  90                  95

Ile Glu Ser Ile Tyr Lys Leu Arg Tyr Glu Ala Leu Ser Gln Ala Ile
            100                 105                 110

Ser Lys Glu Asp Leu Ala Arg Val Ile Leu His Ile Ala Lys His Arg
        115                 120                 125

Gly Tyr Met Asn Lys Asn Gln Lys Thr Ser Gln Asp Ser Glu Lys Gly
    130                 135                 140

Ala Ile Leu Ser Ala Ile Lys Glu Asn Ser Asn Lys Ile Lys His Tyr
145                 150                 155                 160

Gln Thr Ala Gly Glu Tyr Phe Tyr Lys Glu Leu Phe Glu Asn Leu Arg
                165                 170                 175

Asp Gly Thr Lys Glu Phe Lys Asn Ile Arg Asn Lys Ala Met Lys Asn
            180                 185                 190

Glu Lys Thr Gly Asn Met Glu Ser Thr Tyr Tyr Asn Thr Ile Leu Ala
        195                 200                 205
```

```
Ser Asp Leu Glu Lys Glu Leu Lys Leu Ile Leu Glu Lys Gln Gln Ala
    210                 215                 220

Tyr His Asn Tyr Ser Asp Thr Phe Ile Lys Glu Val Leu Glu Ile Ala
225                 230                 235                 240

Phe Tyr Gln Arg Pro Leu Lys Asp Phe Ser His Leu Val Gly Ser Cys
                245                 250                 255

Thr Phe Tyr Glu Asn Glu Lys Arg Ala Cys Lys Asn Ser Tyr Ser Ala
            260                 265                 270

Trp Glu Phe Ile Ala Leu Gly Lys Ile Ile Asn Thr Leu Glu Ser Ile
        275                 280                 285

Lys Lys Asp Thr Gly Glu Ile Phe Ser Asn Glu Ile Ile Thr Gln Ile
    290                 295                 300

Leu Lys Glu Val Leu Asp Lys Gly Ser Leu Ser Tyr Thr Lys Leu Arg
305                 310                 315                 320

Lys Met Ile Asn Leu Asp Glu Lys Val Lys Phe Lys Gly Leu Lys Tyr
                325                 330                 335

Asp Lys Glu Gly Val Glu Lys Thr Asn Leu Ile Glu Phe Lys Lys Leu
            340                 345                 350

Lys Glu Phe Lys Lys Ala Leu Gly Glu His Asn Leu Glu Arg Lys Thr
        355                 360                 365

Leu Asp Glu Ile Ala Thr His Ile Thr Leu Thr Lys Asp Glu Asn Gln
    370                 375                 380

Leu Lys Lys Gln Leu Glu Gln Tyr Ala Leu Ser Gln Asn Gln Ile Asp
385                 390                 395                 400

Ala Leu Ala Glu Leu Asp Phe Asn Asp His Ile Asn Leu Ser Phe Lys
```

```
                405                 410                 415

Ala Leu Tyr Glu Ile Leu Pro Leu Met Glu Lys Gly Lys Arg Tyr Asp
            420                 425                 430

Glu Ala Cys Asn Glu Leu Gly Leu Lys Ala Lys Thr Ser Asn Gln Lys
        435                 440                 445

Ser Glu Phe Leu Pro Ala Phe Cys Asp Ser Ile Phe Ala Gln Glu Leu
    450                 455                 460

Thr Asn Pro Ile Val Asn Arg Ala Ile Ser Glu Tyr Arg Lys Val Leu
465                 470                 475                 480

Asn Arg Leu Leu Lys Lys Tyr Gly Lys Met His Lys Ile His Ile Glu
                485                 490                 495

Leu Ala Arg Asp Ala Gly Leu Ser Lys Glu Ala Arg Asn Lys Ile Glu
            500                 505                 510

Lys Glu Gln Lys Glu Asn Lys Asp Ile Asn Asp Lys Ala Glu Lys Thr
        515                 520                 525

Cys Lys Glu Phe Gly Leu Lys Pro Asn Ala Lys Asn Ile Leu Lys Ile
    530                 535                 540

Lys Leu Trp Arg Glu Gln Gly Glu Ile Cys Ala Tyr Ser Gly Lys Lys
545                 550                 555                 560

Ile Thr Ile Asp Asp Leu Lys Glu Asp Lys Ala Leu Glu Val Asp His
                565                 570                 575

Ile Tyr Pro Tyr Ser Arg Ser Tyr Asp Asp Ser Tyr Asn Asn Lys Val
            580                 585                 590

Leu Val Phe Ile Lys Glu Asn Gln Leu Lys Leu Asn Gln Thr Pro Tyr
        595                 600                 605
```

```
Glu Ala Phe Gly Ser Asn Gln Glu Lys Trp Ser Lys Ile Gln Val Leu
    610                 615                 620

Ala Gln Lys Leu Pro Tyr Lys Lys Lys Asn Arg Ile Leu Asp Glu Asn
625                 630                 635                 640

Phe Lys Asn Lys Asp Gln Ile Glu Phe Ile Ser Arg Asn Leu Asn Asp
                645                 650                 655

Thr Arg Tyr Ala Thr Ser Leu Ile Ala Lys Tyr Thr Lys Glu Tyr Leu
            660                 665                 670

Glu Phe Leu Pro Leu Ser Asp Asp Glu Asp Ile Ser Leu Lys Ser Gly
        675                 680                 685

Glu Lys Gly Ser Lys Thr His Val Gln Thr Met Asn Gly Met Leu Thr
    690                 695                 700

Ser Val Leu Arg His Ala Trp Gly Phe Ser Gln Lys Asp Arg Asn Asn
705                 710                 715                 720

His Leu His His Ala Leu Asp Ala Ile Ile Ile Ala Tyr Ser Thr Asn
                725                 730                 735

Ser Ile Ile Lys Ala Phe Ser Asp Phe Lys Lys Asn Gln Glu Ile Leu
            740                 745                 750

Lys Ala Lys Leu Tyr Ala Lys Lys Leu Thr Ser Glu Glu Tyr Lys Asn
        755                 760                 765

Gln Ser Lys Phe Thr Gly Phe Glu Lys Tyr Arg Ser Lys Ile Leu Glu
    770                 775                 780

Lys Leu Asp Ser Ile Phe Val Ser Lys Pro Pro Asn Lys Asn Thr Lys
785                 790                 795                 800

Gly Ala Leu His Glu Gln Thr Phe Tyr Ser Tyr Gln Asp Ile Leu Glu
```

```
                805                 810                 815

Glu Tyr Lys Thr Gln Glu Gly Leu Lys Arg Ala Leu Glu Cys Gly Lys
            820                 825                 830

Val Arg Lys Ile Gly Thr Lys Tyr Val Val Asn Asp Arg Met Val Arg
        835                 840                 845

Leu Asp Ile Phe Lys Lys Asp Asn Lys Phe Tyr Gly Ile Pro Ile Tyr
    850                 855                 860

Thr Met Asp Phe Ala Leu Gly Val Leu Pro Asn Lys Val Val Thr Ile
865                 870                 875                 880

Gly Thr Asp Lys Asp Lys Ile Lys Lys Glu Trp Lys Thr Ile Asp Glu
                885                 890                 895

Thr Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Gly Asp Leu Val Leu Ile
            900                 905                 910

Gln Lys Lys Glu Met Gln Glu Ser Glu Phe Ala Tyr Tyr Asn Gly Phe
        915                 920                 925

Asp Ile Ser Ser Ala Ser Ile Ser Leu Glu Lys His Asp Asn Lys Phe
    930                 935                 940

Glu Asn Leu Thr Glu Asn Gln Lys Leu Leu Phe Pro Lys Ala Lys Glu
945                 950                 955                 960

Gly Asp Val Glu Val Arg Gly Ile Gly Ile Gln Gly Leu Lys Val Phe
                965                 970                 975

Lys Lys Tyr Met Val Thr Pro Leu Gly Glu Ile Gln Glu Thr Arg Thr
            980                 985                 990

Glu Ala Arg Gln Asn Ile Gln Pro  Arg Lys Lys His Gly  Leu Arg
        995                 1000                1005
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<212> PRT
<213> gamma proteobacterium

<400> 112

Met Thr Lys Asn Tyr Ile Ser Pro Ile Ala Ile Asp Leu Gly Ala Lys
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Phe Thr Gly Val Ala Leu Tyr Gln Tyr Leu Glu Gly Ala Asp Cys Thr
20 25 30

Gln Glu Val Ala Lys Gly Leu Leu Val Asp Asp Arg Gly Asn Val Thr
35 40 45

Trp Ser Gln Glu Gly Arg Arg Gly Lys Arg His Gln Val Arg Gly Tyr
50 55 60

Lys Arg Arg Lys Met Ala Lys Arg Leu Leu Trp Leu Ile Leu Asp Ser
65 70 75 80

Glu Tyr Gly Ile Lys Arg Glu Glu Val Thr Glu Pro Leu Leu Lys Phe
85 90 95

Ile Asn Gly Leu Leu Asn Arg Arg Gly Tyr Thr Tyr Ile Ser Glu Glu
100 105 110

Val Asp Glu Glu Ser Met Asn Val Ser Pro Leu Pro Phe Ser Glu Met
115 120 125

Met Pro Asp Tyr Phe Asn Ser Ser Ala Pro Leu Leu Glu Gln Leu Ala
130 135 140

Lys Leu Leu Ser Asp Lys Asn Lys Leu Val Arg Phe Arg Ala Glu Gly
145 150 155 160

Lys Ile Pro Ser Asn Lys Asn Glu Phe Lys Lys Leu Leu Asp Thr Ala
165 170 175

```
Leu Asp Gly Lys Tyr Lys Asp Glu Lys Lys Glu Leu Ser Glu Ala Trp
            180                 185                 190

Gly Asn Ile Leu Ile Ala Ser Glu Asn Val Leu Lys Ser Thr Val Asp
        195                 200                 205

Gly His Lys Ser Arg Ser Glu Tyr Leu Ala Asn Ile Lys Glu Asp Ile
    210                 215                 220

Lys Ser Asn Glu Glu Leu Glu Lys Gln Ile Ser Ser Lys Glu Ile Asp
225                 230                 235                 240

Gly Phe Tyr Asn Leu Val Gly His Leu Ser Asn Phe Gln Leu Arg Leu
                245                 250                 255

Leu Arg Lys Tyr Phe Asn Asp Pro Asn Met Ser Gly Val Ser Tyr Trp
            260                 265                 270

Asp Glu Lys Arg Leu Glu Lys Tyr Phe Tyr Gln Trp Val Gln Gly Trp
        275                 280                 285

His Thr Lys Gly Gly Thr Asp Glu Ala Glu Lys Lys Asn Ile Ile Leu
    290                 295                 300

Lys Thr Lys Gly Ala Pro Leu Leu Lys Thr Leu Lys Ser Leu Ser Ala
305                 310                 315                 320

Asp Leu Thr Ile Pro Pro Tyr Glu Asp Gln Asn Asn Arg Arg Pro Pro
                325                 330                 335

Lys Cys Gln Ser Val Leu Leu Ser Asp Glu Lys Leu Thr Met His Tyr
            340                 345                 350

Pro Lys Trp Lys Glu Trp Val Gly Gln Leu Val Lys Gln Asn Asp Asn
        355                 360                 365
```

```
Ala Tyr Leu Asn Glu Asn Val Thr Leu Ala Asn Ala Leu His Arg Ile
    370                 375                 380

Val Glu Arg Ser Arg Ser Ile Asp Pro Tyr Gln Leu Arg Leu Leu Ile
385                 390                 395                 400

Ser Ile Thr Asp Ala Glu Lys Arg Asn Asp Leu Ala Gly Tyr Lys Arg
                405                 410                 415

Leu Lys Leu Ser Leu Gly Ser Glu Val Asp Glu Phe Leu Leu Leu Val
            420                 425                 430

Lys Asn Ile Val Asp Glu Thr Lys Glu Ala Arg Glu Gly Leu Trp Phe
        435                 440                 445

Glu Thr Glu Asn Lys Leu Phe Phe Lys Cys Gly Lys Thr Pro Pro Arg
    450                 455                 460

Lys Glu Lys Leu Lys Ser Thr Leu Leu Ser Ala Val Leu Gly Lys Asn
465                 470                 475                 480

Leu Ser Asp Asp Glu Gln Ser Ser Phe Ile Glu Glu Phe Trp Lys Ser
                485                 490                 495

Gly Thr Pro Lys Ile Glu Arg Arg Asn Val Arg Gly Trp Cys Arg Leu
            500                 505                 510

Ala Ser Gln Val Gln Lys Thr Tyr Gly Val Tyr Leu Lys Glu Tyr Gly
        515                 520                 525

Leu Gln Gln Leu His Lys Leu Glu Ala Gly Lys Lys Leu Asp Asp Lys
    530                 535                 540

Pro Leu Ala Leu Leu Tyr Lys Asn Ser Gly Leu Ile Ala Ser Lys Ile
545                 550                 555                 560

Gly Glu Ala Leu Asn Ile Glu Pro Asp Glu Val Ser Arg Phe Ala Ser
                565                 570                 575
```

```
Pro His Ser Leu Ala Gln Ile Phe Asn Ile Ile Glu Gly Asp Val Ala
            580                 585                 590

Gly Phe Asn Lys Thr Cys Arg Ala Cys Thr Tyr Glu Asn Ile Trp Arg
        595                 600                 605

Met Gln Glu Glu Lys Val Glu Ser Leu Leu Thr Asn Gln Leu Leu Ser
    610                 615                 620

Glu Ile His Gly Glu Arg Lys Val Pro Leu Lys Ser Ala Met Cys Thr
625                 630                 635                 640

Arg Leu Ser Ala Asp Ser Thr Arg Pro Phe Asp Gly Gln Met Ala Ser
                645                 650                 655

Ile Ile Glu His Ile Ala Arg Lys Ile Ala Gln His Lys Ile Ala Gln
            660                 665                 670

Ile Asn Asp Val Pro Lys Glu Phe Ser Ile Asp Ile Pro Ile Ile Ile
        675                 680                 685

Glu Ser Asn Gln Phe Ser Phe Thr Ala Glu Leu Glu Glu Ile Lys Arg
    690                 695                 700

Gly Arg Gly Ser Ala Lys Ala Lys Lys Ala Lys Glu Leu Gly Glu Lys
705                 710                 715                 720

Ser Lys Ala Gly Trp Val Ser Lys Thr Glu Arg Ile Lys Thr Ser Ser
                725                 730                 735

Glu Gly Ile Cys Pro Tyr Thr Gly Ala Pro Leu Gly Gly Ser Gly Glu
            740                 745                 750

Ile Asp His Ile Ile Pro Arg Ser Leu Thr Gly Arg Thr Lys Lys Thr
        755                 760                 765
```

```
Val Phe Asn Ser Glu Ala Asn Leu Ile Tyr Cys Ser Ser Lys Gly Asn
    770                 775                 780

His Asp Lys Gly Asn Arg Val Tyr Val Ile Glu Gln Leu Asn Asp Lys
785                 790                 795                 800

Tyr Leu Lys Lys Gln Phe Ser Thr Ser Asp Val Asn Leu Ile Lys Lys
                805                 810                 815

Lys Ile Lys Thr Thr Ile Gln Arg Phe Thr Glu Gly Gly Glu Lys Leu
            820                 825                 830

Arg Ser Phe Ser Glu Leu Ser Arg Glu Asp Gln Lys Ala Phe Arg His
        835                 840                 845

Ala Leu Phe Val Pro Glu Leu Lys Ser Glu Val Thr Ser Leu Leu Ala
    850                 855                 860

Val Lys Asn Ile Thr Arg Val Asn Gly Thr Gln Ala Trp Leu Ala Lys
865                 870                 875                 880

Lys Ile Ala Ser Leu Leu Ala Glu His Leu Asp Lys Gln Gly Arg Asp
                885                 890                 895

Tyr Thr Leu Ser Ala His Gln Ile Asp Pro Trp Ser Val Ser Lys Gln
            900                 905                 910

Arg Lys Met Leu Ala Ser Ala Glu Pro Ile Trp Ala Lys Lys Asp Pro
        915                 920                 925

Gln Pro Ala Ala Ser His Val Val Asp Ala Val Cys Thr Phe Leu Glu
    930                 935                 940

Ala Leu Glu Gln Pro His Thr Ala Ser Arg Leu Lys Thr Ile Ser Ser
945                 950                 955                 960

Thr Ser Phe Glu Lys Thr Gly Trp Arg Ser Ala Leu Ile Pro Asp Leu
                965                 970                 975
```

```
Ile Lys Val Asp Ala Leu Asp Arg Arg Pro Lys Tyr Arg Arg Tyr Asn
            980                 985                 990


Ile Gly Ser Thr Ser Leu Phe Lys  Asp Gly Ile Tyr Ala  Glu Arg Phe
        995                 1000                1005


Leu Pro  Ile Leu Ile Asp Glu  Asn Gly Leu Met Ala  Gly Tyr Asp
    1010                1015                1020


Ile Asp  Asn Ser Leu Lys Ala  Lys Gly Ala Asp Val  Val Phe Glu
    1025                1030                1035


Ser Leu  Ser Pro Phe Leu Leu  Phe Lys Gly Glu Glu  Val Gly Ala
    1040                1045                1050


Gln Ser  Leu Ser Asp Trp Gln  Glu Arg Ile Asp Gly  Arg Tyr Leu
    1055                1060                1065


Tyr Met  Ser Ile Asp Lys Val  Lys Ala Phe Asp Tyr  Leu Gln Glu
    1070                1075                1080


Lys Val  Gly Glu Lys Asp Ile  Ala Ala Glu Leu Leu  Asn Ser Ile
    1085                1090                1095


His Phe  Thr Gln Arg Lys Thr  Glu Leu Arg Ala Lys  Phe Ser Asp
    1100                1105                1110


Asp Ser  Gly Lys Lys Met Lys  Thr Leu Asp Ala Ile  Arg Lys Ser
    1115                1120                1125


Leu Lys  Leu Thr Val Thr Val  Asn Glu Ile Gly Lys  Arg Lys Glu
    1130                1135                1140


Lys Cys  Gly Phe Ser Gly Thr  Ile Gly Ile Pro Ala  Lys Ser Ala
    1145                1150                1155
```

```
Trp Glu  Asn Leu Leu Asp Glu  Pro Leu Leu Glu Thr  Tyr Trp Gly
    1160                1165                1170

Thr Lys  Met Pro Pro Gln Glu  Ile Trp Glu Lys Val  Tyr Arg Lys
    1175                1180                1185

His Phe  Pro Arg Asn Ile Pro  Asn Gln Ala His Arg  Lys Val Arg
    1190                1195                1200

Lys Asp  Phe Ser Leu Pro Val  Val Asp Ser Val Ser  Gly Gly Phe
    1205                1210                1215

Arg Val  Lys Arg Lys Thr Pro  Asn Gly Tyr Asn Tyr  Gln Leu Leu
    1220                1225                1230

Ala Ile  Asp Gly Tyr Ser Ala  Val Gly Phe Lys Lys  Glu Gly Asp
    1235                1240                1245

Asn Val  Asp Phe Lys Ser Pro  Ala Leu Val Pro Gln  Ile Ala Glu
    1250                1255                1260

Ser Lys  Ser Val Thr Pro Ile  Ser Ser Glu Leu Val  His Leu Asp
    1265                1270                1275

Lys Asn  Glu Ile Val Tyr Phe  Asp Glu Trp Arg Lys  Ile Asp Ile
    1280                1285                1290

Ser Asp  Ser Asp Leu Lys Gln  Phe Val Ser Ser Leu  Glu Leu Ala
    1295                1300                1305

Pro Gly  Ser Gln Asn Arg Phe  Tyr Ile Arg Phe Thr  Val Asp Glu
    1310                1315                1320

Asp Gln  Phe Glu Arg His Phe  Lys Ser Ala Leu Arg  Val Asn Gly
    1325                1330                1335

Ile Gln  Asp Leu Asp Thr Val  Asn Lys Thr Phe Asp  Trp Asn Arg
    1340                1345                1350
```

Glu Ile Pro Ser Leu Leu Ile Pro Pro Arg Ser Asn Leu Phe Leu
    1355   1360   1365

Leu Glu Thr Gly Gln Lys Ile Thr Phe Glu Tyr Ile Ala Asn Gly
    1370   1375   1380

Ala Asn Ala Glu Val Lys Lys Ala Tyr Ser Leu Arg Arg Ala
    1385   1390   1395

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<212> PRT
<213> Neisseria meningitidis

<400> 113

Met Ala Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
1   5   10   15

Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Glu
            20   25   30

Glu Asn Pro Ile Arg Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
        35   40   45

Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Met Val Arg Arg Leu
    50   55   60

Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65   70   75   80

Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
                85   90   95

Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100   105   110

Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser

```
        115                 120                 125

Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160

Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Ile Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Ile Ser Gly Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320
```

```
Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
               325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Ile Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
               405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
               485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
```

```
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Gly
                565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655

Phe Asp Glu Asp Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp Arg Met Arg Leu Thr
        675                 680                 685

Gly Lys Gly Lys Lys Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700

Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala Glu Asn Asp
705                 710                 715                 720
```

```
Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
               725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765

Lys Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
               805                 810                 815

Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
        835                 840                 845

Ser Ala Lys Arg Leu Asp Glu Gly Val Ser Val Leu Arg Val Pro Leu
    850                 855                 860

Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Glu Arg
865                 870                 875                 880

Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
               885                 890                 895

Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910

Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Val Glu Gln Val
```

```
        915                 920                 925

Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940

Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Gly Asp Lys Tyr Tyr
945                 950                 955                 960

Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
                965                 970                 975

Arg Ala Val Val Gln Gly Lys Asp Glu Glu Asp Trp Gln Leu Ile Asp
            980                 985                 990

Asp Ser Phe Asn Phe Lys Phe Ser  Leu His Pro Asn Asp  Leu Val Glu
        995                 1000                1005

Val Ile  Thr Lys Lys Ala Arg  Met Phe Gly Tyr Phe  Ala Ser Cys
    1010                1015                1020

His Arg  Gly Thr Gly Asn Ile  Asn Ile Arg Ile His  Asp Leu Asp
    1025                1030                1035

His Lys  Ile Gly Lys Asn Gly  Ile Leu Glu Gly Ile  Gly Val Lys
    1040                1045                1050

Thr Ala  Leu Ser Phe Gln Lys  Tyr Gln Ile Asp Glu  Leu Gly Lys
    1055                1060                1065

Glu Ile  Arg Pro Cys Arg Leu  Lys Lys Arg Pro Pro  Val Arg
    1070                1075                1080
```

<210> 114
<211> 1334
<212> PRT
<213> Listeria monocytogenes

<400> 114

```
Met Lys Lys Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Leu Thr Asp Gln Tyr Asp Leu Val Lys Arg Lys Met
            20                  25                  30

Lys Ile Ser Gly Asp Ser Glu Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Glu Lys Gly Glu Thr Ala Ala Lys Arg Arg Met
    50                  55                  60

Ser Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Ile Gln Met Asn Glu Val Asp Asp Asn
                85                  90                  95

Phe Phe Asn Arg Leu Lys Glu Ser Phe Tyr Ala Glu Ser Asp Lys Lys
            100                 105                 110

Tyr Asn Arg His Pro Phe Phe Gly Thr Val Glu Glu Glu Val Ala Tyr
        115                 120                 125

Tyr Lys Asp Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ile Asp
    130                 135                 140

Ser Gln Lys Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175

Lys Asn Thr Ser Ile Asp Glu Met Phe Lys Gln Phe Leu Gln Ile Tyr
            180                 185                 190

Asn Gln Val Phe Ala Asn Asp Ile Glu Glu Ala Ser Leu Lys Lys Thr
        195                 200                 205
```

```
Glu Lys Asn Gln Glu Val Ala Gln Ile Leu Ala Glu Lys Phe Thr Arg
    210                 215                 220

Lys Asp Lys Leu Asp Lys Ile Leu Ser Leu Tyr Pro Gly Glu Lys Thr
225                 230                 235                 240

Thr Gly Val Phe Ala Gln Phe Val Asn Ile Ile Val Gly Ser Thr Gly
                245                 250                 255

Lys Phe Lys Lys His Phe Asn Leu His Glu Lys Lys Asp Ile Asn Cys
            260                 265                 270

Ala Glu Asp Thr Tyr Asp Thr Asp Leu Glu Ser Leu Leu Ala Ile Ile
        275                 280                 285

Gly Asp Glu Phe Ala Glu Val Phe Val Ala Ala Lys Asn Ala Tyr Asn
    290                 295                 300

Ala Val Val Leu Ser Asn Ile Ile Thr Val Thr Asp Ser Thr Thr Arg
305                 310                 315                 320

Ala Lys Leu Ser Ala Ser Leu Ile Glu Arg Phe Glu Asn His Lys Glu
                325                 330                 335

Asp Leu Lys Lys Met Lys Arg Phe Val Arg Thr Tyr Leu Pro Glu Lys
            340                 345                 350

Tyr Asp Glu Ile Phe Asp Asp Thr Glu Lys His Gly Tyr Ala Gly Tyr
        355                 360                 365

Ile Ser Gly Lys Thr Lys Gln Ala Asp Phe Tyr Lys Tyr Met Lys Ala
    370                 375                 380

Thr Leu Glu Lys Ile Glu Gly Ala Asp Tyr Phe Ile Ala Lys Ile Glu
385                 390                 395                 400
```

```
Glu Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile
                405                 410                 415

Pro His Gln Leu His Leu Glu Glu Leu Glu Ala Ile Leu His Gln Gln
            420                 425                 430

Ala Lys Tyr Tyr Pro Phe Leu Arg Glu Asp Tyr Glu Lys Ile Lys Ser
        435                 440                 445

Leu Val Thr Phe Arg Ile Pro Tyr Phe Val Gly Pro Leu Ala Lys Gly
    450                 455                 460

Gln Ser Glu Phe Ala Trp Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg
465                 470                 475                 480

Pro Trp Asn Ile Glu Glu Lys Val Asp Phe Gly Lys Ser Ala Val Asp
                485                 490                 495

Phe Ile Glu Lys Met Thr Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn
            500                 505                 510

Val Leu Pro Lys His Ser Leu Cys Tyr Gln Lys Tyr Met Val Tyr Asn
        515                 520                 525

Glu Leu Thr Lys Val Arg Tyr Ile Asp Asp Gln Gly Lys Thr Asn Tyr
    530                 535                 540

Phe Ser Gly Gln Glu Lys Gln Gln Ile Phe Asn Asp Leu Phe Lys Gln
545                 550                 555                 560

Lys Arg Lys Val Lys Lys Lys Asp Leu Glu Leu Phe Leu Arg Asn Ile
                565                 570                 575

Asn Gln Ile Glu Ser Pro Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn
            580                 585                 590

Ala Ser Tyr Ala Thr Tyr His Asp Leu Leu Lys Val Gly Met Lys Gln
        595                 600                 605
```

```
Glu Ile Leu Asp Asn Pro Leu Asn Thr Glu Met Leu Glu Asp Ile Val
    610                 615                 620

Lys Ile Leu Thr Val Phe Glu Asp Lys Arg Met Ile Lys Glu Gln Leu
625                 630                 635                 640

Gln Gln Phe Ser Asp Val Leu Asp Gly Thr Val Leu Lys Lys Leu Glu
                645                 650                 655

Arg Arg His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu Val
            660                 665                 670

Gly Ile Arg Asp Lys Gln Ser His Leu Thr Ile Leu Asp Tyr Leu Met
        675                 680                 685

Asn Asp Asp Gly Leu Asn Arg Asn Leu Met Gln Leu Ile Asn Asp Ser
    690                 695                 700

Asn Leu Ser Phe Lys Ser Ile Ile Glu Lys Glu Gln Val Ser Thr Thr
705                 710                 715                 720

Asp Lys Asp Leu Gln Ser Ile Val Ala Glu Leu Ala Gly Ser Pro Ala
                725                 730                 735

Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val
            740                 745                 750

Ser Val Met Gly Tyr Pro Pro Gln Thr Ile Val Val Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Asn Lys Gly Lys Asn Asn Ser Lys Pro Arg Tyr
    770                 775                 780

Lys Ser Leu Glu Lys Ala Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys
785                 790                 795                 800
```

```
Glu His Pro Thr Asp Asn Gln Glu Leu Lys Asn Asn Arg Leu Tyr Leu
                805                 810                 815

Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Gln Glu Leu Asp
            820                 825                 830

Ile His Asn Leu Ser Asn Tyr Asp Ile Asp His Ile Val Pro Gln Ser
        835                 840                 845

Phe Ile Thr Asp Asn Ser Val Asp Asn Leu Val Leu Thr Ser Ser Ala
    850                 855                 860

Gly Asn Arg Glu Lys Gly Asp Asn Val Pro Pro Leu Glu Ile Val Gln
865                 870                 875                 880

Lys Arg Lys Ile Phe Trp Glu Lys Leu Tyr Gln Gly Asn Leu Met Ser
                885                 890                 895

Lys Arg Lys Phe Asp Tyr Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr
            900                 905                 910

Glu Ala Asp Lys Ala Arg Phe Ile His Arg Gln Leu Val Glu Thr Arg
        915                 920                 925

Gln Ile Thr Lys Asn Val Ala Asn Ile Leu His Gln Arg Phe Asn Tyr
    930                 935                 940

Lys Thr Asp Gly Asn Lys Asp Thr Met Glu Thr Val Arg Ile Val Thr
945                 950                 955                 960

Leu Lys Ser Ala Leu Val Ser Gln Phe Arg Lys Gln Phe Gln Phe Tyr
                965                 970                 975

Lys Val Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala Tyr Leu
            980                 985                 990

Asn Gly Val Val Ala Asn Thr Leu  Leu Lys Val Tyr Pro  Gln Leu Glu
        995                 1000                1005
```

```
Pro Glu  Phe Val Tyr Gly Glu  Tyr His Gln Phe Gly  Trp Phe Lys
    1010                1015                1020

Ala Asn  Lys Ala Thr Ala Lys  Lys Gln Phe Tyr Thr  Asn Ile Met
    1025                1030                1035

Leu Phe  Phe Ala Gln Lys Asp  Arg Ile Ile Asp Glu  Asn Gly Glu
    1040                1045                1050

Ile Leu  Trp Asp Lys Arg Tyr  Leu Glu Thr Val Lys  Lys Val Leu
    1055                1060                1065

Gly Tyr  Arg Gln Met Asn Ile  Val Lys Lys Thr Glu  Ile Gln Lys
    1070                1075                1080

Gly Glu  Phe Ser Asn Val Thr  Pro Asn Pro Lys Gly  Lys Ser Asn
    1085                1090                1095

Lys Leu  Ile Pro Arg Lys Lys  Asp Trp Asp Pro Ile  Lys Tyr Gly
    1100                1105                1110

Gly Phe  Asp Gly Ser Lys Met  Ala Tyr Ala Ile Ile  Ile Glu Tyr
    1115                1120                1125

Glu Lys  Gln Lys Arg Lys Val  Arg Ile Glu Lys Lys  Leu Ile Gln
    1130                1135                1140

Ile Asn  Ile Met Glu Arg Glu  Ala Phe Glu Lys Asp  Glu Lys Thr
    1145                1150                1155

Phe Leu  Glu Glu Lys Gly Tyr  His Gln Pro Lys Val  Leu Ile Lys
    1160                1165                1170

Val Pro  Lys Tyr Thr Leu Tyr  Glu Cys Lys Asn Gly  Arg Arg Arg
    1175                1180                1185
```

```
Met Leu  Gly Ser Ala Asn Glu  Ala His Lys Gly Asn  Gln Met Leu
    1190                1195                1200


Leu Pro  Asn His Leu Met Ala  Leu Leu Tyr His Ala  Glu Lys Tyr
    1205                1210                1215


Glu Ala  Ile Asp Gly Glu Ser  Leu Ala Tyr Ile Glu  Val His Arg
    1220                1225                1230


Ala Leu  Phe Asp Glu Leu Leu  Ala Tyr Ile Ser Glu  Phe Ala Arg
    1235                1240                1245


Lys Tyr  Thr Leu Ser Asn Asp  Arg Leu Asp Glu Ile  Asn Met Leu
    1250                1255                1260


Tyr Glu  Arg Asn Lys Asp Gly  Asp Val Lys Ser Ile  Ala Glu Ser
    1265                1270                1275


Phe Val  Ser Leu Lys Lys Phe  Asn Ala Phe Gly Val  His Gln Asp
    1280                1285                1290


Phe Ser  Phe Phe Gly Thr Lys  Ile Glu Arg Lys Arg  Asp Arg Lys
    1295                1300                1305


Leu Asn  Glu Leu Leu Asn Ser  Thr Ile Ile Tyr Gln  Ser Ile Thr
    1310                1315                1320


Gly Leu  Tyr Glu Ser Arg Lys  Arg Leu Asp Asn
    1325                1330


<210>  115
<211>  1337
<212>  PRT
<213>  Enterococcus faecalis

<400>  115

Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15
```

```
Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
            20                  25                  30

Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Ala Leu Asp Glu Asn
                85                  90                  95

Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
            100                 105                 110

Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175

Glu Asn Ile Ser Val Lys Glu Gln Phe Gln Gln Phe Met Ile Ile Tyr
            180                 185                 190

Asn Gln Thr Phe Val Asn Gly Glu Ser Arg Leu Val Ser Ala Pro Leu
        195                 200                 205

Pro Glu Ser Val Leu Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg
```

```
    210                 215                 220

Thr Lys Lys Ser Glu Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala
225                 230                 235                 240

Asn Gly Leu Phe Gly Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala
                245                 250                 255

Asp Phe Lys Lys Val Phe Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr
            260                 265                 270

Ala Ser Glu Ser Tyr Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val
        275                 280                 285

Gly Asp Glu Tyr Ser Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp
    290                 295                 300

Ala Val Glu Leu Ser Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser His
305                 310                 315                 320

Ala Lys Leu Ser Ser Ser Met Ile Val Arg Phe Thr Glu His Gln Glu
                325                 330                 335

Asp Leu Lys Lys Phe Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu
            340                 345                 350

Tyr Asp Asn Leu Phe Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr
        355                 360                 365

Ile Ala His Ala Gly Lys Val Ser Gln Leu Lys Phe Tyr Gln Tyr Val
    370                 375                 380

Lys Lys Ile Ile Gln Asp Ile Ala Gly Ala Glu Tyr Phe Leu Glu Lys
385                 390                 395                 400

Ile Ala Gln Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly
                405                 410                 415
```

```
Val Ile Pro His Gln Ile His Leu Ala Glu Leu Gln Ala Ile Ile His
            420                 425                 430

Arg Gln Ala Ala Tyr Tyr Pro Phe Leu Lys Glu Asn Gln Glu Lys Ile
        435                 440                 445

Glu Gln Leu Val Thr Phe Arg Ile Pro Tyr Tyr Ile Gly Pro Leu Ser
    450                 455                 460

Lys Gly Asp Ala Ser Thr Phe Ala Trp Leu Lys Arg Gln Ser Glu Glu
465                 470                 475                 480

Pro Ile Arg Pro Trp Asn Leu Gln Glu Thr Val Asp Leu Asp Gln Ser
                485                 490                 495

Ala Thr Ala Phe Ile Glu Arg Met Thr Asn Phe Asp Thr Tyr Leu Ser
            500                 505                 510

Ser Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Lys Phe Met
        515                 520                 525

Val Phe Asn Glu Leu Thr Lys Ile Ser Tyr Thr Asp Asp Arg Gly Ile
    530                 535                 540

Lys Ala Asn Phe Ser Gly Lys Glu Lys Glu Lys Ile Phe Asp Tyr Leu
545                 550                 555                 560

Phe Lys Thr Arg Arg Lys Val Lys Lys Lys Asp Ile Ile Gln Phe Tyr
                565                 570                 575

Arg Asn Glu Tyr Asn Thr Glu Ile Val Thr Leu Ser Gly Leu Glu Glu
            580                 585                 590

Asp Gln Phe Asn Ala Ser Phe Ser Thr Tyr Gln Asp Leu Leu Lys Cys
        595                 600                 605

Gly Leu Thr Arg Ala Glu Leu Asp His Pro Asp Asn Ala Glu Lys Leu
```

```
    610                 615                 620

Glu Asp Ile Ile Lys Ile Leu Thr Ile Phe Glu Asp Arg Gln Arg Ile
625                 630                 635                 640

Arg Thr Gln Leu Ser Thr Phe Lys Gly Gln Phe Ser Ala Glu Val Leu
                645                 650                 655

Lys Lys Leu Glu Arg Lys His Tyr Thr Gly Trp Gly Arg Leu Ser Lys
            660                 665                 670

Lys Leu Ile Asn Gly Ile Tyr Asp Lys Glu Ser Gly Lys Thr Ile Leu
        675                 680                 685

Gly Tyr Leu Ile Lys Asp Asp Gly Val Ser Lys His Tyr Asn Arg Asn
    690                 695                 700

Phe Met Gln Leu Ile Asn Asp Ser Gln Leu Ser Phe Lys Asn Ala Ile
705                 710                 715                 720

Gln Lys Ala Gln Ser Ser Glu His Glu Glu Thr Leu Ser Glu Thr Val
                725                 730                 735

Asn Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Tyr Gln Ser
            740                 745                 750

Leu Lys Ile Val Asp Glu Leu Val Ala Ile Met Gly Tyr Ala Pro Lys
        755                 760                 765

Arg Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Ser Thr Gly
    770                 775                 780

Lys Arg Arg Ser Ile Gln Arg Leu Lys Ile Val Glu Lys Ala Met Ala
785                 790                 795                 800

Glu Ile Gly Ser Asn Leu Leu Lys Glu Gln Pro Thr Thr Asn Glu Gln
                805                 810                 815
```

```
Leu Arg Asp Thr Arg Leu Phe Leu Tyr Tyr Met Gln Asn Gly Lys Asp
            820                 825                 830

Met Tyr Thr Gly Asp Glu Leu Ser Leu His Arg Leu Ser His Tyr Asp
        835                 840                 845

Ile Asp His Ile Ile Pro Gln Ser Phe Met Lys Asp Asp Ser Leu Asp
    850                 855                 860

Asn Leu Val Leu Val Gly Ser Thr Glu Asn Arg Gly Lys Ser Asp Asp
865                 870                 875                 880

Val Pro Ser Lys Glu Val Val Lys Asp Met Lys Ala Tyr Trp Glu Lys
                885                 890                 895

Leu Tyr Ala Ala Gly Leu Ile Ser Gln Arg Lys Phe Gln Arg Leu Thr
            900                 905                 910

Lys Gly Glu Gln Gly Gly Leu Thr Leu Glu Asp Lys Ala His Phe Ile
        915                 920                 925

Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala Gly
    930                 935                 940

Ile Leu Asp Gln Arg Tyr Asn Ala Asn Ser Lys Glu Lys Lys Val Gln
945                 950                 955                 960

Ile Ile Thr Leu Lys Ala Ser Leu Thr Ser Gln Phe Arg Ser Ile Phe
                965                 970                 975

Gly Leu Tyr Lys Val Arg Glu Val Asn Asp Tyr His His Gly Gln Asp
            980                 985                 990

Ala Tyr Leu Asn Cys Val Val Ala  Thr Thr Leu Leu Lys  Val Tyr Pro
        995                 1000                1005

Asn Leu  Ala Pro Glu Phe Val  Tyr Gly Glu Tyr Pro  Lys Phe Gln
```

```
    1010                1015                1020

Ala Phe  Lys Glu Asn Lys Ala  Thr Ala Lys Ala Ile  Ile Tyr Thr
    1025                1030                1035

Asn Leu  Leu Arg Phe Phe Thr  Glu Asp Glu Pro Arg  Phe Thr Lys
    1040                1045                1050

Asp Gly  Glu Ile Leu Trp Ser  Asn Ser Tyr Leu Lys  Thr Ile Lys
    1055                1060                1065

Lys Glu  Leu Asn Tyr His Gln  Met Asn Ile Val Lys  Lys Val Glu
    1070                1075                1080

Val Gln  Lys Gly Gly Phe Ser  Lys Glu Ser Ile Lys  Pro Lys Gly
    1085                1090                1095

Pro Ser  Asn Lys Leu Ile Pro  Val Lys Asn Gly Leu  Asp Pro Gln
    1100                1105                1110

Lys Tyr  Gly Gly Phe Asp Ser  Pro Val Val Ala Tyr  Thr Val Leu
    1115                1120                1125

Phe Thr  His Glu Lys Gly Lys  Lys Pro Leu Ile Lys  Gln Glu Ile
    1130                1135                1140

Leu Gly  Ile Thr Ile Met Glu  Lys Thr Arg Phe Glu  Gln Asn Pro
    1145                1150                1155

Ile Leu  Phe Leu Glu Glu Lys  Gly Phe Leu Arg Pro  Arg Val Leu
    1160                1165                1170

Met Lys  Leu Pro Lys Tyr Thr  Leu Tyr Glu Phe Pro  Glu Gly Arg
    1175                1180                1185

Arg Arg  Leu Leu Ala Ser Ala  Lys Glu Ala Gln Lys  Gly Asn Gln
    1190                1195                1200
```

```
Met Val  Leu Pro Glu His Leu  Leu Thr Leu Leu Tyr  His Ala Lys
    1205                1210                1215


Gln Cys  Leu Leu Pro Asn Gln  Ser Glu Ser Leu Ala  Tyr Val Glu
    1220                1225                1230


Gln His  Gln Pro Glu Phe Gln  Glu Ile Leu Glu Arg  Val Val Asp
    1235                1240                1245


Phe Ala  Glu Val His Thr Leu  Ala Lys Ser Lys Val  Gln Gln Ile
    1250                1255                1260


Val Lys  Leu Phe Glu Ala Asn  Gln Thr Ala Asp Val  Lys Glu Ile
    1265                1270                1275


Ala Ala  Ser Phe Ile Gln Leu  Met Gln Phe Asn Ala  Met Gly Ala
    1280                1285                1290


Pro Ser  Thr Phe Lys Phe Phe  Gln Lys Asp Ile Glu  Arg Ala Arg
    1295                1300                1305


Tyr Thr  Ser Ile Lys Glu Ile  Phe Asp Ala Thr Ile  Ile Tyr Gln
    1310                1315                1320


Ser Thr  Thr Gly Leu Tyr Glu  Thr Arg Arg Lys Val  Val Asp
    1325                1330                1335


<210>  116
<211>  1426
<212>  PRT
<213>  Capnocytophaga ochracea

<400>  116

Met Lys Asn Ile Leu Gly Leu Asp Leu Gly Thr Thr Ser Ile Gly Phe
1               5                  10                  15


Ala His Ile Val Glu Asp Glu Asn Lys Glu Lys Ser Glu Ile Lys Glu
            20                  25                  30
```

```
Leu Gly Val Arg Ile Val Ser Leu Thr Thr Asp Glu Gln Ser Asp Phe
        35                  40                  45

Glu Lys Gly Lys Ser Ile Thr Thr Asn Ala Asn Arg Thr Leu Lys His
    50                  55                  60

Gly Ala Arg Leu Asn Leu Asp Arg Tyr Gln Gln Arg Arg Lys Tyr Leu
65                  70                  75                  80

Ile Asp Leu Leu Gln Lys Ala Asn Leu Ile Thr Pro Ser Ser Ile Leu
                85                  90                  95

Ala Glu Asn Gly Lys Asn Thr Thr His Ser Thr Trp Gln Leu Arg Ala
            100                 105                 110

Lys Ala Val Thr Glu Arg Ile Glu Lys Glu Glu Phe Ala Arg Ile Leu
        115                 120                 125

Leu Ala Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Ala Lys
    130                 135                 140

Thr Glu Asp Glu Gly Gln Ala Ile Asp Gly Met Ala Ile Ala Lys Arg
145                 150                 155                 160

Leu Tyr Asp Glu Asn Leu Thr Pro Gly Gln Leu Ser Leu Gln Leu Leu
                165                 170                 175

Gln Gln Asn Lys Lys Leu Leu Pro Asp Phe Tyr Arg Ser Asp Leu Gln
            180                 185                 190

Lys Glu Phe Asp Leu Val Trp Asn Phe Gln Lys Gln Phe Tyr Pro Asp
        195                 200                 205

Ile Leu Thr Asp Ile Phe Tyr Lys Glu Leu Gln Gly Lys Gly Lys Asp
    210                 215                 220
```

```
Ala Thr Ser Lys Ala Phe Ser Lys Arg Tyr His Phe Asp Thr Thr Glu
225                 230                 235                 240


Asn Lys Gly Ser Lys Glu Ser Val Arg Leu Gln Ala Tyr Gln Trp Arg
                245                 250                 255


Ala Glu Ala Ile Ser Lys Gln Leu Ser Lys Glu Glu Val Ala Tyr Val
            260                 265                 270


Leu Thr Glu Ile Asn Asn Asn Leu Asn Asn Ala Ser Gly Tyr Leu Gly
        275                 280                 285


Ala Ile Ser Asp Arg Ser Lys Glu Leu Tyr Phe Asn Arg Gln Thr Val
    290                 295                 300


Gly Gln Tyr Leu Tyr Ala Lys Leu Gln Glu Asn Arg His Asn Ser Leu
305                 310                 315                 320


Lys Asn Lys Val Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe Glu Arg
                325                 330                 335


Ile Trp Glu Thr Gln Ala Ser Phe His Lys Glu Leu Thr Asp Glu Leu
            340                 345                 350


Lys Lys Gln Ile Arg Asp Val Val Ile Phe Tyr Gln Arg Lys Pro Lys
        355                 360                 365


Ser Gln Lys Gly Leu Ile Ser Phe Cys Glu Phe Glu Ser Lys Glu Ile
    370                 375                 380


Glu Ile Glu Lys Asp Gly Lys Thr Ile Thr Lys Asn Ile Gly Ala Arg
385                 390                 395                 400


Val Val Pro Lys Ser Ser Pro Leu Phe Gln Glu Phe Lys Ile Trp Gln
                405                 410                 415


Ile Leu Asn Asn Val Ile Cys Lys Arg Lys Gly Ile Arg Lys Lys Lys
            420                 425                 430
```

```
Ile Ser Ala Lys Thr Thr Gln Leu Asp Leu Leu Asn Glu Ser Ser Gln
        435                 440                 445

Thr Ile Phe Ser Leu Asp Met Glu Cys Lys Gln Leu Leu Phe Asp Glu
    450                 455                 460

Leu Asn Leu Lys Gly Asp Leu Lys Ser Asp Lys Val Leu Lys Leu Leu
465                 470                 475                 480

Gly Tyr Ser Pro Gln Glu Trp Glu Ile Asn Tyr Asn Gln Leu Glu Gly
                485                 490                 495

Asn Arg Thr Gln Lys Ala Leu Tyr Glu Ala Tyr Leu Lys Ile Val Glu
            500                 505                 510

Met Glu Ala His Asp Val Lys Asp Ile Leu Gln Ile Lys Ser Ala Lys
        515                 520                 525

Asp Asp Trp Ser Leu Asp Glu Ser Pro Leu Ser Ala Ser Glu Ile Arg
    530                 535                 540

Glu Lys Val Lys Ala Ile Phe Gln Thr Leu Gly Ile Cys Thr Lys Ile
545                 550                 555                 560

Leu Tyr Phe Asp Pro Leu Leu Pro Val Lys Glu Phe Glu Glu Gln Asp
                565                 570                 575

Ser Tyr Gln Leu Trp His Leu Leu Tyr Ser Tyr Glu Ser Asp Asp Ser
            580                 585                 590

Thr Ser Gly Asn Glu Thr Leu Tyr Arg Ile Leu Glu Lys Lys Tyr Ala
        595                 600                 605

Phe Lys Arg Glu His Ala Arg Ile Leu Ala Asn Val Ala Leu Gln Asp
    610                 615                 620
```

```
Asp Tyr Gly Ser Leu Ser Thr Lys Ala Ile Arg Lys Ile Tyr Pro Asn
625                 630                 635                 640

Ile Lys Glu Asn Gln Tyr Ser Thr Ala Cys Glu Lys Ala Gly Tyr Lys
                645                 650                 655

His Ser Lys Leu Ser Leu Thr Thr Glu Glu Leu Glu Ala Arg Glu Leu
            660                 665                 670

Lys Asn Ile Ile Pro Leu Leu Lys Lys Asn Ala Leu Arg Asn Pro Val
        675                 680                 685

Val Glu Lys Ile Leu Asn Gln Met Ile Asn Val Val Asn Ala Leu Ile
    690                 695                 700

Glu Lys Asn Ser Glu Arg Asp Ala Glu Gly Lys Ile Thr Lys Tyr Phe
705                 710                 715                 720

His Phe Asp Glu Ile Arg Ile Glu Leu Ala Arg Glu Leu Lys Lys Asn
                725                 730                 735

Ala Gln Lys Arg Tyr Glu Met Thr Gln Asn Ile Asn Lys Ala Lys Leu
            740                 745                 750

Glu His Gln Lys Ile Ser Glu Ile Leu Gln Lys Glu Phe Gly Ile Lys
        755                 760                 765

Asn Pro Thr Lys Ser Asp Ile Ile Arg Tyr Arg Leu Tyr Gln Glu Leu
    770                 775                 780

Glu His Asn Gly Tyr Lys Glu Leu Tyr Thr Asn Ala Pro Ile Ala Arg
785                 790                 795                 800

Asp Met Leu Phe Ser Lys Asn Ile Glu Ile Glu His Ile Val Pro Lys
                805                 810                 815

Ala Arg Val Phe Asp Asp Ser Phe Ser Asn Lys Thr Leu Thr Phe His
            820                 825                 830
```

```
Arg Ile Asn Ser Asp Lys Gly Glu Tyr Thr Ala Phe Asp Tyr Ile Thr
        835                 840                 845

Ser Leu Asn Ser Glu Glu Glu Leu Asn Gln Tyr Leu Thr Arg Val Glu
    850                 855                 860

Asn Ala Tyr Lys Thr Lys Ser Ile Ser Pro Thr Lys Tyr Lys Asn Leu
865                 870                 875                 880

Leu Lys Lys Ala Ser Glu Ile Gly Asp Asp Phe Ile Asn Arg Asp Leu
                885                 890                 895

Arg Asp Thr Gln Tyr Ile Ala Lys Lys Ala Lys Glu Ile Leu Phe Gln
            900                 905                 910

Val Thr Lys Asn Val Leu Ser Thr Ser Gly Ser Ile Thr Asp Arg Leu
        915                 920                 925

Arg Glu Asp Trp Gly Leu Val Asp Val Met Lys Glu Leu Asn Met Pro
    930                 935                 940

Lys Tyr Gln Ser Leu Gly Leu Thr Glu Val Glu Glu Arg Lys Asp Gly
945                 950                 955                 960

Asn Lys Val Thr Val Ile Lys Asn Trp Thr Lys Arg Asn Asp His Arg
                965                 970                 975

His His Ala Met Asp Ala Leu Thr Val Ala Phe Thr Lys Pro Ser Tyr
            980                 985                 990

Ile Gln Tyr Leu Asn His Leu Asn  Ala Arg Lys Asp Glu  Asn Asn Lys
        995                 1000                1005

Asn Tyr  Ser Val Ile Leu Ala  Ile Glu Glu Lys Glu  Thr Ile Lys
    1010                1015                1020
```

```
Val Pro  Thr Asn Asn Gly Lys  Asn Lys Arg Val Phe  Ile Glu Pro
    1025                1030                1035

Ile Pro  Asn Phe Arg Gln Val  Ala Lys Lys His Leu  Glu Glu Ile
    1040                1045                1050

Phe Ile  Ser His Lys Ala Lys  Asn Lys Val Val Thr  Lys Asn Thr
    1055                1060                1065

Asn Lys  Pro Ala Gly Thr Asp  Lys Gln Gln Ile Thr  Leu Thr Pro
    1070                1075                1080

Arg Gly  Gln Leu His Lys Glu  Thr Ile Tyr Gly Lys  Tyr Gln Tyr
    1085                1090                1095

Tyr Ile  Asn Lys Glu Glu Lys  Ile Gly Val Lys Phe  Asp Glu Arg
    1100                1105                1110

Thr Ile  Ala Lys Val Ser Asn  Pro Val Tyr Arg Glu  Ala Leu Leu
    1115                1120                1125

Lys Arg  Leu Gln Ala Asn Asp  Asn Asp Pro Lys Lys  Ala Phe Ala
    1130                1135                1140

Gly Lys  Asn Ala Leu Ser Lys  Asn Pro Ile Tyr Leu  Asp Glu Ser
    1145                1150                1155

Lys Thr  Lys Thr Leu Pro Glu  Lys Val Asn Leu Thr  Tyr Leu Glu
    1160                1165                1170

Glu Asp  Phe Ser Ile Arg Lys  Asp Ile Ser Pro Asp  Asn Phe Lys
    1175                1180                1185

Asp Leu  Lys Ser Ile Glu Lys  Val Ile Asp Gln Gly  Val Lys Arg
    1190                1195                1200

Ile Leu  Ile Lys Arg Leu Gln  Ala Tyr Asp Asn Asp  Pro Lys Lys
    1205                1210                1215
```

```
Ala Phe  Val Asp Leu Glu Lys  Asn Pro Ile Trp Leu  Asn Lys Glu
    1220                1225                1230

Lys Gly  Ile Ala Ile Lys Arg  Val Thr Ile Ser Gly  Val Asn Asn
    1235                1240                1245

Ala Gln  Pro Leu His Ile Gly  Lys Asp His Leu Gly  Lys Thr Thr
    1250                1255                1260

Leu Asn  Lys Glu Gly Lys Glu  Ile Pro Val Asp Tyr  Val Ser Thr
    1265                1270                1275

Gly Asn  Asn His His Val Ala  Ile Tyr Arg Asp Lys  Glu Gly Asn
    1280                1285                1290

Leu Gln  Glu Gln Ile Val Ser  Phe Phe Asp Ala Val  Val Arg Ala
    1295                1300                1305

Gln Gln  Gly Ile Pro Ile Ile  Asp Lys Thr Tyr Lys  Gln Ala Glu
    1310                1315                1320

Gly Trp  Gln Phe Leu Phe Thr  Met Lys Gln Asn Glu  Met Phe Val
    1325                1330                1335

Phe Pro  Asn Ala Thr Thr Gly  Phe Asn Pro Ala Glu  Ile Asp Leu
    1340                1345                1350

Leu Asp  Pro Lys Asn Lys Lys  Leu Ile Ser Pro Asn  Leu Phe Arg
    1355                1360                1365

Val Gln  Lys Ile Ala Thr Lys  Asp Tyr Phe Phe Arg  His His Leu
    1370                1375                1380

Glu Thr  Asn Val Glu Thr Asp  Asn Ile Leu Lys Asn  Val Thr Trp
    1385                1390                1395
```

```
Lys Arg  Glu Gly Leu Ser Gly  Leu Lys Asp Ile Val  Lys Val Arg
    1400                1405                1410


Ile Asn  His Leu Gly Asp Ile  Val Ser Ile Gly Glu  Tyr
    1415                1420                1425


<210>  117
<211>  1424
<212>  PRT
<213>  Parabacteroides sp.

<400>  117

Met Lys Arg Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Leu Val Asn Glu Ala Glu Thr Asp Glu Glu Val Ser Ser Ile Ile
            20                  25                  30


Arg Leu Gly Val Arg Val Asn Pro Leu Thr Val Asp Glu Thr Gln Asn
        35                  40                  45


Phe Glu Lys Gly Lys Ser Ile Thr Thr Asn Ala Glu Arg Thr Leu Lys
    50                  55                  60


Arg Ser Met Arg Arg Asn Leu Gln Arg Tyr Lys Leu Arg Arg Asp Ala
65                  70                  75                  80


Leu Val Glu Phe Leu Lys Glu Leu Gly Phe Ile Thr Asp Glu Thr Ile
                85                  90                  95


Leu Ser Glu Gln Gly Asn Arg Thr Thr Phe Glu Thr Cys Arg Leu Arg
            100                 105                 110


Ala Lys Ala Ala Glu Glu Glu Ile Ser Leu Glu Glu Leu Ser Arg Val
        115                 120                 125


Leu Leu Met Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Val
    130                 135                 140
```

```
Lys Lys Glu Glu Asp Gly Val Leu Ile Asp Gly Met Glu Ile Ala Lys
145                 150                 155                 160


Lys Leu Tyr Glu Glu Asp Leu Thr Pro Gly Gln Leu Cys Ser Gln Leu
                165                 170                 175


Leu Glu Ser Gly Lys Lys Val Leu Pro Asp Phe Tyr Arg Ser Asp Leu
            180                 185                 190


Gln Glu Glu Leu Asp Arg Ile Trp Ser Val Gln Lys Gln Phe His Pro
        195                 200                 205


Asp Val Phe Cys Asp Ala Ala Lys Glu Glu Ile Lys Gly Lys Asn Arg
    210                 215                 220


Ser Gln Thr Trp Ala Ile Leu Ala Asn Tyr Phe Val Trp Lys Glu Glu
225                 230                 235                 240


Val Val Gly Trp Asn Asp Arg Glu Ala Lys Asn Glu Thr Ile Glu Lys
                245                 250                 255


Glu Cys Lys Leu Val Gly Leu Lys Arg Thr Thr Lys Gly Tyr Glu Leu
            260                 265                 270


Lys Lys Glu Asn Tyr Arg Trp Arg Ala Gln Ala Leu Thr Glu Gln Leu
        275                 280                 285


Gly Leu Glu Glu Ile Ala Val Val Leu Gln Glu Ile Asn Gly Gln Ile
    290                 295                 300


Asn Ala Ser Ser Gly Tyr Leu Gly Ala Ile Ser Asp Arg Ser Lys Val
305                 310                 315                 320


Leu Tyr Phe Asn His Gln Thr Val Gly Gln Tyr Gln Met Ala Glu Leu
                325                 330                 335


Asp Lys Asn Pro His Ala Ser Leu Arg Asn Met Val Phe Tyr Arg Gln
```

```
            340                 345                 350

Asp Tyr Leu Asp Glu Phe Asp Arg Ile Trp Glu Lys Gln Ala Glu Phe
        355                 360                 365

His Lys Glu Leu Thr Ala Glu Leu Lys Lys Glu Ile Arg Asp Met Ile
    370                 375                 380

Ile Phe Tyr Gln Arg Arg Leu Lys Ser Gln Lys Gly Leu Ile Ser Phe
385                 390                 395                 400

Cys Glu Phe Glu Arg Leu Glu Ile Val Val Glu Lys Asp Gly Lys Lys
                405                 410                 415

Gln Thr Lys Val Ile Gly Cys Lys Val Ile Pro Arg Ser His Pro Leu
            420                 425                 430

Phe Gln Glu Phe Lys Val Trp Gln Thr Leu Asn Asp Ile Lys Val Leu
        435                 440                 445

Gly Arg Glu Lys Lys Arg Asn Ala Leu Ser Ala Ser Glu Ser Arg Ala
    450                 455                 460

Leu Tyr Pro Glu Glu Lys Glu Ile Leu Ala Arg Glu Leu Ala Ile Lys
465                 470                 475                 480

Glu Asn Met Lys Lys Ala Asp Val Leu Lys Leu Leu Phe Glu Asn Pro
                485                 490                 495

Gln Glu Leu Asp Leu Asn Phe Lys Gln Ile Asp Gly Asn Arg Thr Gly
            500                 505                 510

Phe Ser Leu Phe Ser Ala Tyr Ser Lys Met Ile Glu Lys Tyr Gly Tyr
        515                 520                 525

Glu Pro Leu Asp Phe Lys Lys Pro Ala Asp Glu Ile Ile Gly Gln Leu
    530                 535                 540
```

```
Arg Thr Ile Phe Thr Asp Leu Gly Trp Asn Thr Asn Leu Phe Thr Ile
545                 550                 555                 560

Asp Leu Thr Lys Glu Gly Lys Glu Leu Glu Met Gln Pro Tyr Phe Arg
                565                 570                 575

Leu Trp His Leu Leu Tyr Ser Phe Glu Gly Asp Asn Thr Ser Thr Gly
            580                 585                 590

Asn Gly Lys Leu Ile Glu Lys Ile Met Gln Leu Cys Gly Val Glu Lys
        595                 600                 605

Glu Tyr Ala Val Glu Leu Ala Ser Leu Ser Phe Gln Asp Asp Tyr Gly
    610                 615                 620

Ser Leu Ser Ala Lys Ala Ile Lys Arg Ile Leu Pro Tyr Leu Lys Glu
625                 630                 635                 640

Gly Asn Leu Tyr Asp Val Ala Cys Glu Tyr Ala Gly Tyr Arg His Ser
                645                 650                 655

Lys Ser Ser Leu Thr Lys Glu Glu Ile Glu Asn Lys Val Leu Lys Gly
            660                 665                 670

Lys Leu Glu Val Leu Pro Lys Asn Ser Leu Arg Asn Pro Val Val Glu
        675                 680                 685

Lys Ile Leu Ser Gln Met Val Asn Val Ile Asn Thr Ile Ile Asp Thr
    690                 695                 700

Tyr Gly Lys Pro Asp Glu Ile Arg Val Glu Leu Ala Arg Glu Leu Lys
705                 710                 715                 720

Lys Ser Ala Lys Glu Arg Glu Glu Leu Thr Lys Ala Ile Ala Lys Ser
                725                 730                 735

Thr Arg Glu His Glu Glu Ile Arg Lys Leu Leu Gln Asp Glu Phe Gly
```

```
            740                 745                 750

Met Met Asn Val Ser Arg Asn Asp Ile Ile Arg Tyr Lys Leu Tyr Glu
        755                 760                 765

Glu Leu Lys Asp Asn Gly Tyr Lys Thr Leu Tyr Ser Asn Gln Tyr Ile
    770                 775                 780

Pro Lys Glu Lys Ile Phe Ser Lys Glu Ile Asp Ile Glu His Ile Ile
785                 790                 795                 800

Pro Gln Ser Arg Leu Phe Asp Asp Ser Leu Ser Asn Lys Thr Leu Glu
                805                 810                 815

Tyr Lys Ala Ile Asn Ile Glu Lys Gly Asn Lys Thr Ala Tyr Asp Phe
            820                 825                 830

Val Lys Glu Lys Tyr Gly Glu Glu Gly Leu Gln Gln Tyr Ile Asn Arg
        835                 840                 845

Cys Glu Ser Leu Phe Asn Asp Lys Lys Ala Lys Leu Arg Lys Leu Lys
    850                 855                 860

Met Glu Gln Lys Asp Ile Pro Asp Gly Phe Ile Asp Arg Asp Leu Arg
865                 870                 875                 880

Asn Thr Gln Tyr Ile Ala Lys Lys Ala Leu Ala Met Leu Asn Glu Ile
                885                 890                 895

Cys Arg Arg Val Val Ala Thr Thr Gly Ser Ile Thr Asp Gln Leu Arg
            900                 905                 910

Glu Asp Trp Gln Leu Val Asp Val Met Lys Glu Leu Asn Leu Pro Lys
        915                 920                 925

Tyr Glu Ala Leu Gly Phe Val Glu Thr Tyr Glu Asp Lys Asp Gly Arg
    930                 935                 940
```

```
Lys Ile Lys Arg Ile Lys Asp Trp Thr Lys Arg Asn Asp His Arg His
945                 950                 955                 960


His Ala Met Asp Ala Leu Thr Val Ala Phe Thr Lys Asp Ala Phe Ile
                965                 970                 975


Gln Tyr Phe Asn Asn Lys Asn Ala Ala Gln Asp Ser Gly Asn Arg Asn
            980                 985                 990


His Thr Asn Ile Ile Gly Ile Lys  Thr Arg Tyr Phe Asp  Lys Gly Arg
        995                 1000                1005


Ala Leu  Pro Pro Ile Pro Leu  Glu Gln Phe Arg Ile  Glu Ala Lys
    1010                1015                1020


Gln His  Leu Glu Lys Leu Leu  Val Ser Ile Lys Ala  Lys Asn Lys
    1025                1030                1035


Val Val  Thr Val Asn Val Asn  Arg Thr Lys Lys Arg  Lys Gly Glu
    1040                1045                1050


Asn Thr  Lys Ile Gln Gln Thr  Pro Arg Gly Gln Leu  His Leu Glu
    1055                1060                1065


Thr Val  Tyr Gly Ser His Lys  Gln Tyr Val Thr Lys  Ile Glu Lys
    1070                1075                1080


Val Asn  Ala Ser Phe Asp Ala  Ala Lys Ile Ala Thr  Val Ser Lys
    1085                1090                1095


Arg Ala  Tyr Arg Asn Ala Leu  Leu Lys Arg Leu Glu  Thr Phe Gly
    1100                1105                1110


Asn Asp  Pro Lys Lys Ala Phe  Thr Gly Lys Asn Ala  Leu Glu Lys
    1115                1120                1125


Asn Pro  Leu Tyr Ala Asp Lys  Tyr Gln Thr Ile Arg  Val Pro Glu
```

```
    1130                1135                1140

Lys Val  Gln Thr Val Glu Phe  Glu Thr Ile Tyr Thr  Ile Arg Lys
    1145                1150                1155

Pro Val  Asp Pro Ala Leu Asn  Val Asp Lys Val Val  Asp Val Lys
    1160                1165                1170

Val Arg  Ala Ile Leu Glu Arg  Arg Leu Lys Glu Tyr  Gly Gly Asp
    1175                1180                1185

Pro Lys  Lys Ala Phe Val Asn  Phe Trp Glu Asn Pro  Ile Trp Leu
    1190                1195                1200

Asn Lys  Glu Lys Gly Ile Ser  Ile Lys Arg Val Ser  Ile Arg Gly
    1205                1210                1215

Ile Asn  Asn Ala Gln Ser Ile  His Val Lys Lys Asp  Lys Asn Gly
    1220                1225                1230

Asn Pro  Ile Trp Asp Glu Asn  Gly Lys Gln Ile Pro  Val Asp Phe
    1235                1240                1245

Val Asn  Thr Gly Asn Asn His  His Val Ala Ile Tyr  Arg Lys Pro
    1250                1255                1260

Val Leu  Asp Lys Lys Gly Gln  Val Thr Phe Asp Glu  Asp Gly Asn
    1265                1270                1275

Leu Met  Tyr Glu Leu Asp Glu  Val Val Val Pro Phe  Phe Glu Ala
    1280                1285                1290

Val Thr  Arg Ala Asn Leu Gly  Leu Pro Ile Ile Asp  Lys Asp Tyr
    1295                1300                1305

Arg Lys  Ser Glu Gly Trp Gln  Phe Leu Phe Ser Met  Lys Gln Asn
    1310                1315                1320
```

```
Glu Tyr  Phe Val Phe Pro Asn  Glu Lys Thr Gly Phe  Asn Pro Lys
    1325                1330                1335


Glu Val  Asp Leu Leu Asn Pro  Asp Asn Tyr Ala Met  Ile Ser Pro
    1340                1345                1350


Asn Leu  Phe Arg Val Gln Thr  Met Ser Lys Val Met  Tyr Gly Asn
    1355                1360                1365


Asn Val  Val Arg Asp Tyr Lys  Phe Arg His His Leu  Glu Thr Thr
    1370                1375                1380


Val Lys  Asp Met Lys Glu Leu  Lys Asp Ile Ala Tyr  Lys Gln Tyr
    1385                1390                1395


Lys Thr  Leu Ser Phe Gly Asn  Ser Val Val Lys Ile  Arg Ile Asn
    1400                1405                1410


His Ile  Gly Gln Ile Val Ser  Val Gly Glu Tyr
    1415                1420
```

<210> 118
<211> 1395
<212> PRT
<213> Lactobacillus jensenii

<400> 118

```
Met Lys Glu Ile Lys Asp Tyr Ile Ile Gly Leu Asp Ile Gly Thr Asn
1               5                   10                  15


Ser Cys Gly Tyr Val Val Thr Asp Lys Gln Asn Asn Ile Leu Lys Leu
            20                  25                  30


Lys Gly Lys Thr Ala Ile Gly Ala Arg Leu Phe Lys Glu Gly Gln Ala
        35                  40                  45


Ala Ala Asp Arg Arg Ser Phe Arg Thr Thr Arg Arg Arg Leu Ala Arg
    50                  55                  60
```

```
Arg His Trp Arg Leu Gly Leu Leu Glu Glu Ile Phe Asp Pro Glu Met
65                  70                  75                  80

Glu Lys Ile Asp Pro Asn Phe Phe Arg Arg Leu Lys Glu Ser Asp Tyr
                85                  90                  95

Ser Pro Lys Asp Ser Arg Lys Gln Phe Asn Ala Ile Val Phe Lys Ser
            100                 105                 110

Ile Lys Ala Asp Lys Arg Phe Tyr Lys Lys Tyr Pro Thr Ile Tyr His
        115                 120                 125

Leu Arg Asn Ala Leu Met His Asp Asn Gln Lys His Asp Leu Arg Glu
    130                 135                 140

Ile Phe Met Ala Val His His Ile Val Lys Tyr Arg Gly Asn Phe Leu
145                 150                 155                 160

Arg Glu Asp Ser Val Asn Ala Phe Lys Ala Ala Lys Phe Ser Leu Arg
                165                 170                 175

Gly Glu Asp Gly Ile Gly Pro Val Asp Lys Leu Asn Asp Leu Leu Lys
            180                 185                 190

Glu Ile Tyr Ser Glu Tyr Ser Pro Glu Leu Ala Thr Asn Asn Leu Ser
        195                 200                 205

Lys Ile Glu Asp Ile Ile Lys Asp Lys Asn Leu Tyr Lys Gln Asp Lys
    210                 215                 220

Leu Lys Gln Val Ala Thr Leu Leu Ile Lys Glu Ala Asp Ser Lys Asp
225                 230                 235                 240

Lys Ala Lys Leu Asn Lys Asp Ile Ala Lys Gln Val Ala Asn Ser Phe
                245                 250                 255
```

```
Met Gly Tyr Met Phe Arg Leu Asp Thr Leu Phe Ser Leu Thr Asp Val
            260                 265                 270

Asp Val Lys Asp Tyr Lys Leu Lys Phe Ser Asp Ala Asn Ile Asp Glu
        275                 280                 285

Ser Leu Asp Asp Leu Thr Ser Leu Leu Thr Asp Ala Gln Ile Glu Phe
    290                 295                 300

Val Leu Glu Leu Gln Ser Ile Tyr Asn Thr Ile Val Leu Asn Glu Ile
305                 310                 315                 320

Val Pro Asp Gly Met Ser Leu Ser Glu Ser Met Ile Lys Lys Tyr Asp
                325                 330                 335

Asp His Lys Glu Asp Leu Lys Ile Phe Lys Glu Tyr Ile Asp Ser Leu
            340                 345                 350

Ser Asp Gln Lys Lys Ala Lys Lys Leu Leu Ser Ala Tyr Asn Leu Tyr
        355                 360                 365

Val Asn Tyr Arg Lys Ser Asp Leu Val Glu Ala Lys Asn Leu Phe Lys
    370                 375                 380

Asn Lys Lys Val Gly Asp Lys Asn Phe Ala Asp Val Ile Ser Asn Phe
385                 390                 395                 400

Glu Val Phe Gly Lys Phe Val Ser Asp Asn Leu Asp Asp Ser Glu Leu
                405                 410                 415

Ala Asn Lys Ile Lys Ala Arg Leu Asp Leu Gly Glu Phe Leu Pro Lys
            420                 425                 430

Gln Arg Thr Asn Gln Asn Gly Val Ile Pro Tyr Gln Leu His Gln Val
        435                 440                 445

Glu Leu Thr Gln Ile Leu Glu Lys Gln Gly Lys Tyr Tyr Pro Phe Leu
    450                 455                 460
```

```
Ile Thr Pro Asn Pro Val Glu Ser His Arg Asn Asn Ala Pro Tyr Glu
465                 470                 475                 480

Ile Ser Glu Leu Val Ser Phe Arg Val Pro Tyr Tyr Val Gly Pro Leu
                485                 490                 495

Ile Asp Asn Gln Ser Ile Lys Asp Lys Gln Asn Lys Asn Lys Phe Ala
            500                 505                 510

Trp Met Val Arg Gln Lys Gln Gly Gln Ile Thr Pro Trp Asn Leu Glu
        515                 520                 525

Glu Met Val Asp Thr Thr Glu Ser Ala Asn Gln Phe Ile Lys Arg Met
    530                 535                 540

Thr Arg Lys Asp Thr Tyr Leu Leu Ala Glu Asp Val Leu Pro Lys Ser
545                 550                 555                 560

Ser Leu Val Tyr Gln Lys Phe Met Ile Leu Asp Glu Leu Asn Arg Ile
                565                 570                 575

Lys Ile Asp Gly Lys Lys Leu Thr Ser Glu Leu Lys His Asp Ile Phe
            580                 585                 590

Glu Lys Leu Phe Lys Lys Gln Lys Ser Ile Asn Leu Asp Asn Leu Lys
        595                 600                 605

Asn Tyr Leu Leu Val Glu Gly Asn Ile Pro Gly Leu Ile Glu Gly Leu
    610                 615                 620

Ser Asp Gly Ile Asn Phe Asn Asn Ser Phe Ser Thr Tyr Ile Asp Tyr
625                 630                 635                 640

Arg Asn Ile Phe Gly Asp Glu Ile Asp Asn Pro Asn Lys Gln Ala Asp
                645                 650                 655
```

```
Phe Glu Lys Met Ile Glu Trp Ser Thr Val Phe Glu Asp Arg Lys Ile
            660                 665                 670

Phe Lys Arg Lys Leu Lys Glu Ile Thr Trp Leu Thr Ser Glu Gln Ile
        675                 680                 685

Lys Gln Val Ser Ser Lys Arg Tyr Ser Gly Trp Gly Arg Leu Ser Lys
    690                 695                 700

Lys Leu Leu Thr Gln Ile Thr Asp Glu Asn Gly Val Asn Ile Leu Gln
705                 710                 715                 720

Arg Leu Trp Asn Glu Pro Glu Thr Leu Thr Glu Val Leu Ala Asn Pro
                725                 730                 735

Val Ile Lys Arg Lys Ile Val Glu Ala Asn Ser Ser Phe Thr Lys Ala
            740                 745                 750

Lys Asp Met Lys Asp Ile Leu Val Glu Ala Tyr Thr Ser Pro Gln Asn
        755                 760                 765

Lys Lys Ala Ile Arg Gln Val Met Arg Val Val Asp Asp Ile Ile Ala
    770                 775                 780

Ala Ala His Gly Lys Lys Pro Ser Gln Ile Ala Ile Glu Phe Ala Arg
785                 790                 795                 800

Glu Asp Gln Asp Asn Pro Gln Met Thr Lys Ser Arg Lys Ala Gln Leu
                805                 810                 815

Asp Gln Ile Tyr Ala Lys Ile Ser Asp Glu Phe Leu Asp Asp Ala Val
            820                 825                 830

Lys Asn Glu Leu Lys Asn Met Lys Asp Asn Lys Pro Leu Ala Lys Asp
        835                 840                 845

Lys Val Phe Leu Tyr Phe Lys Gln Met Gly Arg Asp Ala Tyr Ser Gly
    850                 855                 860
```

```
Glu Lys Leu Ser Leu Asp Asn Leu Gln Asp Tyr Asp Ile Asp His Ile
865                 870                 875                 880


Tyr Pro Gln Ser Phe Ile Lys Asp Asp Ser Phe Asp Asn Arg Val Leu
                885                 890                 895


Val Gln Arg Ala Tyr Asn Asn Gly Lys Ser Asp Asn Val Pro Val Leu
            900                 905                 910


Leu Phe Gly Asn Lys Ile Ala Ala Gly Leu Gly Ile Thr Ile Arg Gln
        915                 920                 925


Met Trp Lys Lys Trp Leu Glu Leu Gly Leu Ile Ser Lys Arg Lys Phe
    930                 935                 940


Asn Asn Leu Ile Thr Asp Pro Glu Lys Ile Ser Arg Asn Met Ala Ser
945                 950                 955                 960


Gly Phe Val Asn Arg Gln Leu Val Glu Thr Ser Gln Val Ile Lys Leu
                965                 970                 975


Val Ala Asn Ile Leu Gln Ala Lys Leu Pro Asp Thr Glu Ile Ile Glu
            980                 985                 990


Val Lys Ala Ser Tyr Asn Ser Ile  Leu Arg Lys Glu Phe  Asn Leu Tyr
        995                 1000                1005


Lys Ser  Arg Glu Val Asn Asp  Tyr His His Ala Ile  Asp Ala Tyr
    1010                1015                1020


Leu Thr  Thr Ile Val Gly Asn  Tyr Leu Tyr Gln Val  Tyr Pro Lys
    1025                1030                1035


Leu Arg  Pro Tyr Phe Val Tyr  Gly Gln Phe Lys Lys  Phe Gly Lys
    1040                1045                1050
```

```
Ala Glu  Asn Gln Glu Asp Asp  Pro Val Lys Lys Ile  Lys Lys Phe
    1055                1060                1065

Asn Phe  Ile Tyr Gln Leu Ile  Trp Gly Lys Asp Asp  Ala Ile Cys
    1070                1075                1080

Ile Ser  His Thr Asn Gln Gln  Val Phe Ser Lys Lys  Asp Ile Ile
    1085                1090                1095

Asp Lys  Leu Thr Thr Ala Tyr  Asn Phe Lys Tyr Met  Asn Ile Ser
    1100                1105                1110

His Ala  Val Tyr Thr Arg Asn  Asn Asn Met Phe Lys  Gln Thr Leu
    1115                1120                1125

Phe Pro  Ile Ile Glu Arg Thr  Thr Ala Lys Thr Lys  Ser Leu Ile
    1130                1135                1140

Pro Lys  Lys Leu Asp Arg Pro  Thr Asp Ile Tyr Gly  Gly Tyr Ser
    1145                1150                1155

Asn Asn  Asn Asp Ala Tyr Leu  Ala Leu Val Lys Val  Asp Lys Lys
    1160                1165                1170

Arg Gly  Ser Glu Tyr Arg Val  Val Gly Ile Pro Met  Arg Ala Ala
    1175                1180                1185

Ala Met  Leu Lys Ala Ser Lys  Asn Tyr Asp Glu Asp  Leu Arg Lys
    1190                1195                1200

Val Ile  Glu Pro Met Val Met  Phe Asp Lys Asn Gly  Lys Ala Lys
    1205                1210                1215

Arg Gly  Ile Glu Gly Phe Arg  Val Leu Val Gly Lys  Met Pro Phe
    1220                1225                1230

Lys Gln  Ala Val Leu Asp Gly  Asn Lys Lys Phe Met  Leu Thr Gly
    1235                1240                1245
```

```
Thr Val  Asp Thr Pro Asn Leu  Lys Gln Leu Val Leu  Ser Gln Gln
    1250                1255                1260


Asn Met  Lys Tyr Ile Leu Asp  Tyr Ile Glu Asp Val  Asp Cys Arg
    1265                1270                1275


Lys His  Lys Phe Gly Asp Lys  Val Gln Asn Pro Asp  Lys Cys Leu
    1280                1285                1290


Leu Glu  Val Phe Asp Glu Ile  Ile Glu Ile Val Asp  Lys Tyr Phe
    1295                1300                1305


Glu Leu  Phe Asp Ser Arg Asp  Phe Arg Glu Lys Leu  Arg Asn Ser
    1310                1315                1320


Arg Asn  Lys Phe Ile Lys Leu  Glu Ala Ser Lys Lys  Ala Asp Thr
    1325                1330                1335


Ile Leu  Ala Ile Leu Lys Gly  Leu Gln Ala Lys Ser  Thr Arg Ala
    1340                1345                1350


Thr Ile  Lys Glu Leu Asn Ile  Ser Asp Phe Gly Arg  Ile Ile Thr
    1355                1360                1365


Ser Ser  Ile Ser Pro Glu Ala  Gln Leu Ile Tyr Gln  Ser Pro Thr
    1370                1375                1380


Gly Leu  Phe Glu Arg Arg Val  Lys Val Lys Asp Leu
    1385                1390                1395


<210>  119
<211>  1140
<212>  PRT
<213>  Roseburia intestinalis

<400>  119

Met Arg Glu Asn Gly Ser Asp Glu Arg Arg Arg Asn Met Asp Glu Lys
```

```
1               5                   10                  15

Met Asp Tyr Arg Ile Gly Leu Asp Ile Gly Ile Ala Ser Val Gly Trp
            20                  25                  30

Ala Val Leu Gln Asn Asn Ser Asp Asp Glu Pro Val Arg Ile Val Asp
        35                  40                  45

Leu Gly Val Arg Ile Phe Asp Thr Ala Glu Ile Pro Lys Thr Gly Glu
    50                  55                  60

Ser Leu Ala Gly Pro Arg Arg Ala Ala Arg Thr Thr Arg Arg Arg Leu
65                  70                  75                  80

Arg Arg Arg Lys His Arg Leu Asp Arg Ile Lys Trp Leu Phe Glu Asn
                85                  90                  95

Gln Gly Leu Ile Asn Ile Asp Asp Phe Leu Lys Arg Tyr Asn Met Ala
            100                 105                 110

Gly Leu Pro Asp Val Tyr Gln Leu Arg Tyr Glu Ala Leu Asp Arg Lys
        115                 120                 125

Leu Thr Asp Glu Glu Leu Ala Gln Val Leu Leu His Ile Ala Lys His
    130                 135                 140

Arg Gly Phe Arg Ser Thr Arg Lys Ala Glu Thr Ala Ala Lys Glu Asn
145                 150                 155                 160

Gly Ala Val Leu Lys Ala Thr Asp Glu Asn Gln Lys Arg Met Gln Glu
                165                 170                 175

Lys Gly Tyr Arg Thr Val Gly Glu Met Ile Tyr Leu Asp Glu Ala Phe
            180                 185                 190

Arg Thr Gly Cys Ser Trp Ser Glu Lys Gly Tyr Ile Leu Thr Pro Arg
        195                 200                 205
```

```
Asn Lys Ala Glu Asn Tyr Gln His Thr Met Leu Arg Ala Met Leu Val
    210                 215                 220

Glu Glu Val Lys Glu Ile Phe Ser Ser Gln Arg Arg Leu Gly Asn Glu
225                 230                 235                 240

Lys Ala Thr Glu Glu Leu Glu Glu Lys Tyr Leu Glu Ile Met Thr Ser
                245                 250                 255

Gln Arg Ser Phe Asp Leu Gly Pro Gly Met Gln Pro Asp Gly Lys Pro
            260                 265                 270

Ser Pro Tyr Ala Met Glu Gly Phe Ser Asp Arg Val Gly Lys Cys Thr
        275                 280                 285

Phe Leu Gly Asp Gln Gly Glu Leu Arg Gly Ala Lys Gly Thr Tyr Thr
    290                 295                 300

Ala Glu Tyr Phe Val Ala Leu Gln Lys Ile Asn His Thr Lys Leu Val
305                 310                 315                 320

Asn Gln Asp Gly Glu Thr Arg Asn Phe Thr Glu Glu Glu Arg Arg Ala
                325                 330                 335

Leu Thr Leu Leu Leu Phe Thr Gln Lys Glu Val Lys Tyr Ala Ala Val
            340                 345                 350

Arg Lys Lys Leu Gly Leu Pro Glu Asp Ile Leu Phe Tyr Asn Leu Asn
        355                 360                 365

Tyr Lys Lys Ala Ala Thr Lys Glu Glu Gln Gln Lys Glu Asn Gln Asn
    370                 375                 380

Thr Glu Lys Ala Lys Phe Ile Gly Met Pro Tyr Tyr His Asp Tyr Lys
385                 390                 395                 400

Lys Cys Leu Glu Glu Arg Val Lys Tyr Leu Thr Glu Asn Glu Val Arg
```

```
                405                 410                 415

Asp Leu Phe Asp Glu Ile Gly Met Ile Leu Thr Cys Tyr Lys Asn Asp
            420                 425                 430

Asp Ser Arg Thr Glu Arg Leu Ala Lys Leu Gly Leu Val Pro Ile Glu
        435                 440                 445

Met Glu Gly Leu Leu Ala Tyr Thr Pro Thr Lys Phe Gln His Leu Ser
    450                 455                 460

Met Lys Ala Met Arg Asn Ile Ile Pro Phe Leu Glu Lys Gly Met Thr
465                 470                 475                 480

Tyr Asp Lys Ala Cys Glu Glu Ala Gly Tyr Asp Phe Lys Ala Asp Ser
                485                 490                 495

Lys Gly Thr Lys Gln Lys Leu Leu Thr Gly Glu Asn Val Asn Gln Thr
            500                 505                 510

Ile Asn Glu Ile Thr Asn Pro Val Val Lys Arg Ser Val Ser Gln Thr
        515                 520                 525

Val Lys Val Ile Asn Ala Ile Ile Arg Thr Tyr Gly Ser Pro Gln Ala
    530                 535                 540

Ile Asn Ile Glu Leu Ala Arg Glu Met Ser Lys Thr Phe Glu Glu Arg
545                 550                 555                 560

Arg Lys Ile Lys Gly Asp Met Glu Lys Arg Gln Lys Asn Asn Glu Asp
                565                 570                 575

Val Lys Lys Gln Ile Gln Glu Leu Gly Lys Leu Ser Pro Thr Gly Gln
            580                 585                 590

Asp Ile Leu Lys Tyr Arg Leu Trp Gln Glu Gln Gln Gly Ile Cys Met
        595                 600                 605
```

```
Tyr Ser Gly Lys Thr Ile Pro Leu Glu Glu Leu Phe Lys Pro Gly Tyr
    610                 615                 620

Asp Ile Asp His Ile Leu Pro Tyr Ser Ile Thr Phe Asp Asp Ser Phe
625                 630                 635                 640

Arg Asn Lys Val Leu Val Thr Ser Gln Glu Asn Arg Gln Lys Gly Asn
                645                 650                 655

Arg Thr Pro Tyr Glu Tyr Met Gly Asn Asp Glu Gln Arg Trp Asn Glu
            660                 665                 670

Phe Glu Thr Arg Val Lys Thr Thr Ile Arg Asp Tyr Lys Lys Gln Gln
        675                 680                 685

Lys Leu Leu Lys Lys His Phe Ser Glu Glu Glu Arg Ser Glu Phe Lys
    690                 695                 700

Glu Arg Asn Leu Thr Asp Thr Lys Tyr Ile Thr Thr Val Ile Tyr Asn
705                 710                 715                 720

Met Ile Arg Gln Asn Leu Glu Met Ala Pro Leu Asn Arg Pro Glu Lys
                725                 730                 735

Lys Lys Gln Val Arg Ala Val Asn Gly Ala Ile Thr Ala Tyr Leu Arg
            740                 745                 750

Lys Arg Trp Gly Leu Pro Gln Lys Asn Arg Glu Thr Asp Thr His His
        755                 760                 765

Ala Met Asp Ala Val Val Ile Ala Cys Cys Thr Asp Gly Met Ile Gln
    770                 775                 780

Lys Ile Ser Arg Tyr Thr Lys Val Arg Glu Arg Cys Tyr Ser Lys Gly
785                 790                 795                 800

Thr Glu Phe Val Asp Ala Glu Thr Gly Glu Ile Phe Arg Pro Glu Asp
```

```
                805                 810                 815

Tyr Ser Arg Ala Glu Trp Asp Glu Ile Phe Gly Val His Ile Pro Lys
            820                 825                 830

Pro Trp Glu Thr Phe Arg Ala Glu Leu Asp Val Arg Met Gly Asp Asp
        835                 840                 845

Pro Lys Gly Phe Leu Asp Thr His Ser Asp Val Ala Leu Glu Leu Asp
    850                 855                 860

Tyr Pro Glu Tyr Ile Tyr Glu Asn Leu Arg Pro Ile Phe Val Ser Arg
865                 870                 875                 880

Met Pro Asn His Lys Val Thr Gly Ala Ala His Ala Asp Thr Ile Arg
                885                 890                 895

Ser Pro Arg His Phe Lys Asp Glu Gly Ile Val Leu Thr Lys Thr Ala
            900                 905                 910

Leu Thr Asp Leu Lys Leu Asp Lys Asp Gly Glu Ile Asp Gly Tyr Tyr
        915                 920                 925

Asn Pro Gln Ser Asp Leu Leu Leu Tyr Glu Ala Leu Lys Lys Gln Leu
    930                 935                 940

Leu Leu Tyr Gly Asn Asp Ala Lys Lys Ala Phe Ala Gln Asp Phe His
945                 950                 955                 960

Lys Pro Lys Ala Asp Gly Thr Glu Gly Pro Val Val Arg Lys Val Lys
                965                 970                 975

Ile Gln Lys Lys Gln Thr Met Gly Val Phe Val Asp Ser Gly Asn Gly
            980                 985                 990

Ile Ala Glu Asn Gly Gly Met Val  Arg Ile Asp Val Phe  Arg Val Asn
        995                 1000                1005
```

```
Gly Lys  Tyr Tyr Phe Val Pro  Val Tyr Thr Ala Asp  Val Val Lys
    1010                1015                1020


Lys Val  Leu Pro Asn Arg Ala  Ser Thr Ala His Lys  Pro Tyr Gly
    1025                1030                1035


Glu Trp  Lys Val Met Glu Asp  Lys Asp Phe Leu Phe  Ser Leu Tyr
    1040                1045                1050


Ser Arg  Asp Leu Ile His Ile  Lys Ser Lys Lys Asp  Ile Pro Ile
    1055                1060                1065


Lys Met  Val Asn Gly Gly Met  Glu Gly Ile Lys Glu  Thr Tyr Ala
    1070                1075                1080


Tyr Tyr  Ile Gly Ala Asp Ile  Ser Ala Ala Asn Ile  Gln Gly Ile
    1085                1090                1095


Ala His  Asp Ser Arg Tyr Lys  Phe Arg Gly Leu Gly  Ile Gln Ser
    1100                1105                1110


Leu Asp  Val Leu Glu Lys Cys  Gln Ile Asp Val Leu  Gly His Val
    1115                1120                1125


Ser Val  Val Arg Ser Glu Lys  Arg Met Gly Phe Ser
    1130                1135                1140


<210>  120
<211>  992
<212>  PRT
<213>  Treponema vincentii

<400>  120

Met Gln Lys Asn Ser Gly Glu Asp Glu Asn Cys Gly Phe Glu Phe Leu
1               5                   10                  15


Thr Glu Glu Glu Lys Glu Leu Ile Lys Pro Leu Phe Phe Arg Ile Ser
            20                  25                  30
```

```
Lys Pro Ser Phe Gln Phe Ala Asp Ile Glu Lys Lys Leu Lys Gly Lys
        35                  40                  45

Asn Gly Phe Trp Lys Phe Asn Tyr Arg Lys Asp Thr Asn Val Ser Gly
    50                  55                  60

Cys Pro Val Ser Ala Gly Leu Lys Asn Ile Phe Gly Asp Glu Ala Ser
65                  70                  75                  80

Ala Glu Ser Trp Lys Asp Lys Lys Val Gly Gln Tyr Asp Met Cys Asp
                85                  90                  95

Ile Trp His Val Leu Phe Asp Phe Asp Asp Glu Glu Lys Leu Leu Glu
            100                 105                 110

Phe Ala Lys Arg Lys Leu Phe Leu Ser Asp Glu Ala Ala Lys Lys Phe
        115                 120                 125

Cys Ala Ile Arg Ile Gln Gln Gly Tyr Ala Asn Leu Ser Leu Lys Ala
    130                 135                 140

Ile Arg Lys Ile Thr Pro Phe Leu Arg Lys Gly Tyr Ile Tyr Ser Thr
145                 150                 155                 160

Ala Val Phe Leu Ala Asn Ile Pro Phe Met Ile Gly Arg Asp Ile Phe
                165                 170                 175

Leu Gln Asn Glu Lys Glu Ile Glu Asp Ser Val Lys Asn Ile Ile Gly
            180                 185                 190

Thr Leu Arg Asp Lys Asn Asn Ile Ile Val Leu Ala Asn Arg Cys Ile
        195                 200                 205

Glu Ser Ala Phe Lys Asp Lys Asp Asn Asp Phe Arg Phe Glu Glu Trp
    210                 215                 220
```

```
Asp Lys Ala Leu Val Glu Asn Ser Ala Trp Asp Leu Phe Gly Lys Lys
225                 230                 235                 240

Lys Trp Asn Glu Tyr Asp Glu Glu Lys Arg Lys Thr Ile Ile Ser Gln
                245                 250                 255

Val Ser Glu Lys Val Glu Asp Asn Leu Lys Ile Ala Val Gly Lys Asn
            260                 265                 270

Pro Asn Asp Tyr Lys Tyr Pro Leu Leu Arg Thr Asp Asp Leu Ile Met
        275                 280                 285

Asp Tyr Leu Asn Gln Lys Gly Phe Val Val Lys Gly Glu Leu Tyr His
    290                 295                 300

Pro Ser Asp Thr Asp Tyr Asn Phe Glu Thr Pro Val Pro Ala Glu Asp
305                 310                 315                 320

Gly Lys Ile Tyr Leu Ala Ser Pro Arg Ser Pro Ser Val Lys Asn Pro
                325                 330                 335

Val Val Met Arg Ala Leu His Gln Leu Arg Lys Leu Val Asn Tyr Leu
            340                 345                 350

Ile Lys Thr Gly Lys Ile Asp Ser Thr Thr Lys Ile Asn Val Glu Leu
        355                 360                 365

Ala Asn Asp Val Asn Asp Lys Asn Gln Arg Lys Ala Ile Glu Glu Leu
    370                 375                 380

Ala Lys Thr Asn Glu Lys Asn Asn Ala Asp Ala Arg Lys Lys Ile Glu
385                 390                 395                 400

Glu Leu Cys Asn Glu Ala Gly Phe Lys Val Val Pro Thr Glu Ser Asp
                405                 410                 415

Ile Lys Lys Phe Arg Leu Trp Lys Glu Gln Asn Glu Thr Cys Pro Tyr
            420                 425                 430
```

```
Thr Gly Lys His Ile Ser Phe Thr Asp Leu Phe Gly Pro Ile Pro Lys
        435                 440                 445

Phe Asp Phe Glu His Thr Ile Pro Arg Ser Leu Ser Tyr Asp Asp Ser
    450                 455                 460

Leu Glu Asn Leu Thr Leu Cys Asp Ser Glu Phe Asn Arg Asn Ile Lys
465                 470                 475                 480

Lys Gln Arg Leu Pro Ser Glu Leu Pro Asp Phe Glu Glu Ile Asn Lys
                485                 490                 495

Arg Phe Leu Lys Phe Tyr Glu Asp Lys Ile Asp Asn Cys Leu Arg Ile
            500                 505                 510

Ile Glu Leu Asn Ser Lys Ser Gly Gly Ser Tyr Glu Glu Pro Ala Val
        515                 520                 525

Lys Asp Leu Arg Ile Val Lys Lys His Lys Ala Gln Tyr Glu Leu Asn
    530                 535                 540

Tyr Tyr Lys Glu Lys Leu Arg Arg Phe Ser Ser Thr Glu Ile Thr Ser
545                 550                 555                 560

Gly Phe Lys His Ser Gln Leu Asn Asp Thr Arg Ile Ile Thr Lys Phe
                565                 570                 575

Ser Leu Ser Tyr Leu Lys Gly Val Phe Asp His Val Gln Pro Val Lys
            580                 585                 590

Gly Ser Met Thr Asp Thr Phe Lys Arg Gln Trp Gly Leu Met Glu Arg
        595                 600                 605

Asn Glu Ile Lys Asp Arg Ser Asn His Thr His His Thr Val Asp Ala
    610                 615                 620
```

```
Leu Thr Val Ala Cys Ile Asn Arg Gly Lys Phe Asn Leu Leu Ser Glu
625                 630                 635                 640

Ala Ile Lys Asn Ser Ser Asp Gly Lys His Leu Lys Phe Pro Lys Pro
                645                 650                 655

Trp Glu Thr Phe Asp Thr Asp Val Leu Asn Ala Val Arg Tyr Ile Ile
            660                 665                 670

Pro Lys Tyr Phe Ser Asp Glu Ser Ser Leu Arg Gln Ser Lys Lys Ile
        675                 680                 685

Leu Arg Gly Arg Asp Gly Lys Pro Val Leu Lys Asn Gly Lys Ala Val
    690                 695                 700

Phe Ile Gln Gly Ala Thr Ala Arg Gly Ser Leu His Lys Asp Thr Phe
705                 710                 715                 720

Tyr Gly Cys Ile Lys Thr Val Pro Glu Lys Gly Gly Lys Ser Glu Met
                725                 730                 735

Ile Phe Val Gln Arg Ile Pro Val Ser Thr Leu Asp Glu Lys Val Ala
            740                 745                 750

Glu Lys Ile Ile Asp Lys Arg Ile Arg Lys Thr Phe Glu Lys Asn Leu
        755                 760                 765

Ser Thr Gly Ile Gln Thr Leu Gln Glu Ile Gln Thr Asp Gly Ile Leu
    770                 775                 780

Leu Pro Phe Lys Lys Glu Gly Arg Asp Val Phe Val Lys Arg Val Arg
785                 790                 795                 800

Ile Lys Ala His Pro Thr Ser Pro Ile Ile Leu Lys Lys His His Asn
                805                 810                 815

Val Ile Asn Lys Asn Pro Lys Asp Tyr Lys Gln Asn Tyr Tyr Val Glu
            820                 825                 830
```

```
Asn Glu Glu Asn Tyr Leu Leu Ala Ile Tyr Arg Gly Lys Asp Ala Lys
        835                 840                 845

Gly Lys Asp Val Ser Asp His Lys Leu Cys Asn Leu Leu Asn Ala Val
    850                 855                 860

Lys Ser Arg Gln Asn Lys Thr Gly Phe Tyr Pro Asp Phe Lys Glu Lys
865                 870                 875                 880

Lys Gly Ile Asn Leu Gln Leu Tyr Lys Val Leu Lys Ile Gly Lys Ile
                885                 890                 895

Val Ile Leu Gln Asn Asp Ile Gln Glu Asp Val Phe Ala Leu Pro Lys
            900                 905                 910

Glu Lys Leu Trp Lys Arg Met Tyr Arg Ile Ala Gly Leu Ala Thr Ser
        915                 920                 925

Arg Asn Asp Ile Gln Ile Lys Leu Val His Ile Ile Arg Glu Thr Pro
    930                 935                 940

Trp Gly Tyr Met Lys Gly Glu Lys Asp Leu Asn Ala Gly Lys Glu Cys
945                 950                 955                 960

Leu Leu Tyr Gly Thr Ala Asn Phe Lys Gly Leu Val Glu Gly Gln Asp
                965                 970                 975

Phe Thr Val Ser Pro Ala Gly Glu Ile Ile Gln Lys Ala Arg Val Cys
            980                 985                 990
```

<210> 121
<211> 1340
<212> PRT
<213> Enterococcus faecium

<400> 121

```
Met Lys Lys Glu Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
```

```
1               5                   10                  15

Gly Trp Ser Val Leu Thr Asp Asp Tyr Arg Leu Val Ser Lys Lys Met
            20                  25                  30

Lys Val Ala Gly Asn Thr Glu Lys Ser Ser Thr Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Ala Arg Arg Ser
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Leu Ala Arg Arg Arg Gln Arg Ile Leu
65                  70                  75                  80

Glu Leu Gln Lys Ile Phe Ala Pro Glu Ile Leu Lys Ile Asp Glu His
                85                  90                  95

Phe Phe Ala Arg Leu Asn Glu Ser Phe Leu Val Pro Asp Glu Lys Lys
            100                 105                 110

Gln Ser Arg His Pro Val Phe Ala Thr Ile Lys Gln Glu Lys Ser Tyr
        115                 120                 125

His Gln Thr Tyr Pro Thr Ile Tyr His Leu Arg Gln Ala Leu Ala Asp
    130                 135                 140

Ser Ser Glu Lys Ala Asp Ile Arg Leu Val Tyr Leu Ala Met Ala His
145                 150                 155                 160

Leu Leu Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Thr
                165                 170                 175

Glu Asn Ser Ser Val Thr Glu Thr Phe Arg Gln Phe Leu Ser Thr Tyr
            180                 185                 190

Asn Gln Gln Phe Ser Glu Ala Gly Asp Lys Gln Thr Glu Lys Leu Asp
        195                 200                 205
```

```
Glu Ala Val Asp Cys Ser Phe Val Phe Thr Glu Lys Met Ser Lys Thr
    210                 215                 220

Lys Lys Ala Glu Thr Leu Leu Lys Tyr Phe Pro His Glu Lys Ser Asn
225                 230                 235                 240

Gly Tyr Leu Ser Gln Phe Ile Lys Leu Met Val Gly Asn Gln Gly Asn
                245                 250                 255

Phe Lys Asn Val Phe Gly Leu Glu Glu Glu Ala Lys Leu Gln Phe Ser
            260                 265                 270

Lys Glu Thr Tyr Glu Glu Asp Leu Glu Glu Leu Leu Glu Lys Ile Gly
        275                 280                 285

Asp Asp Tyr Ile Asp Leu Phe Val Gln Ala Lys Asn Val Tyr Asp Ala
    290                 295                 300

Val Leu Leu Ser Glu Ile Leu Ser Asp Ser Thr Lys Asn Thr Arg Ala
305                 310                 315                 320

Lys Leu Ser Ala Gly Met Ile Arg Arg Tyr Asp Ala His Lys Glu Asp
                325                 330                 335

Leu Val Leu Leu Lys Arg Phe Val Lys Glu Asn Leu Pro Lys Lys Tyr
            340                 345                 350

Arg Ala Phe Phe Gly Asp Asn Ser Val Asn Gly Tyr Ala Gly Tyr Ile
        355                 360                 365

Glu Gly His Ala Thr Gln Glu Ala Phe Tyr Lys Phe Val Lys Lys Glu
    370                 375                 380

Leu Thr Gly Ile Arg Gly Ser Glu Val Phe Leu Thr Lys Ile Glu Gln
385                 390                 395                 400

Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro
```

```
                405                 410                 415

His Gln Ile His Leu Ser Glu Leu Arg Ala Ile Ile Ala Asn Gln Lys
            420                 425                 430

Lys His Tyr Pro Phe Leu Lys Glu Glu Gln Glu Lys Leu Glu Ser Leu
        435                 440                 445

Leu Thr Phe Lys Ile Pro Tyr Tyr Val Gly Pro Leu Ala Lys Lys Gln
    450                 455                 460

Glu Asn Ser Pro Phe Ala Trp Leu Ile Arg Lys Ser Glu Glu Lys Ile
465                 470                 475                 480

Lys Pro Trp Asn Leu Pro Glu Ile Val Asp Met Glu Gly Ser Ala Val
                485                 490                 495

Arg Phe Ile Glu Arg Met Ile Asn Thr Asp Met Tyr Met Pro His Asn
            500                 505                 510

Lys Val Leu Pro Lys Asn Ser Leu Leu Tyr Gln Lys Phe Ser Ile Tyr
        515                 520                 525

Asn Glu Leu Thr Lys Val Arg Tyr Gln Asp Glu Arg Gly Gln Met Asn
    530                 535                 540

Tyr Phe Ser Ser Ile Glu Lys Lys Glu Ile Phe His Glu Leu Phe Glu
545                 550                 555                 560

Lys Asn Arg Lys Val Thr Lys Lys Asp Leu Gln Glu Phe Leu Tyr Leu
                565                 570                 575

Lys Tyr Asp Ile Lys His Ala Glu Leu Ser Gly Ile Glu Lys Ala Phe
            580                 585                 590

Asn Ala Ser Tyr Thr Thr Tyr His Asp Phe Leu Thr Met Ser Glu Asn
        595                 600                 605
```

```
Lys Arg Glu Met Lys Gln Trp Leu Glu Asp Pro Glu Leu Ala Ser Met
    610                 615                 620

Phe Glu Glu Ile Ile Lys Thr Leu Thr Val Phe Glu Asp Arg Glu Met
625                 630                 635                 640

Ile Lys Thr Arg Leu Ser His His Glu Ala Thr Leu Gly Lys His Ile
                645                 650                 655

Ile Lys Lys Leu Thr Lys Lys His Tyr Thr Gly Trp Gly Arg Leu Ser
            660                 665                 670

Lys Glu Leu Ile Gln Gly Ile Arg Asp Lys Gln Ser Asn Lys Thr Ile
        675                 680                 685

Leu Asp Tyr Leu Ile Asn Asp Asp Asp Phe Pro His His Arg Asn Arg
    690                 695                 700

Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu Ser Phe Lys Lys Glu
705                 710                 715                 720

Ile Lys Lys Ala Gln Met Ile Thr Asp Thr Glu Asn Leu Glu Glu Ile
                725                 730                 735

Val Lys Glu Leu Thr Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
            740                 745                 750

Ser Leu Lys Ile Val Asp Glu Ile Val Gly Ile Met Gly Tyr Glu Pro
        755                 760                 765

Ala Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Arg
    770                 775                 780

Gly Leu Lys Ser Ser Arg Pro Arg Leu Lys Ala Leu Glu Glu Ser Leu
785                 790                 795                 800

Lys Asp Phe Gly Ser Gln Leu Leu Lys Glu Tyr Pro Thr Asp Asn Ser
```

```
                805                 810                 815

Ser Leu Gln Lys Asp Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Arg
            820                 825                 830

Asp Met Tyr Thr Gly Ala Pro Leu Asp Ile His Arg Leu Ser Asp Tyr
        835                 840                 845

Asp Ile Asp His Ile Ile Pro Arg Ser Phe Thr Thr Asp Asn Ser Ile
    850                 855                 860

Asp Asn Lys Val Leu Val Ser Ser Lys Glu Asn Arg Leu Lys Lys Asp
865                 870                 875                 880

Asp Val Pro Ser Glu Lys Val Val Lys Lys Met Arg Ser Phe Trp Tyr
                885                 890                 895

Asp Leu Tyr Ser Ser Lys Leu Ile Ser Lys Arg Lys Leu Asp Asn Leu
            900                 905                 910

Thr Lys Ile Lys Leu Thr Glu Glu Asp Lys Ala Gly Phe Ile Lys Arg
        915                 920                 925

Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gly Ile Leu
    930                 935                 940

His His Arg Phe Asn Lys Ala Glu Asp Thr Asn Asp Pro Ile Arg Lys
945                 950                 955                 960

Val Arg Ile Ile Thr Leu Lys Ser Ala Leu Val Ser Gln Phe Arg Asn
                965                 970                 975

Arg Phe Gly Ile Tyr Lys Val Arg Glu Ile Asn Glu Tyr His His Ala
            980                 985                 990

His Asp Ala Tyr Leu Asn Gly Val  Val Ala Leu Ala Leu  Leu Lys Lys
        995                 1000                1005
```

```
Tyr Pro  Gln Leu Ala Pro Glu  Phe Val Tyr Gly Glu  Tyr Leu Lys
    1010                1015                1020

Phe Asn  Ala His Lys Ala Asn  Lys Ala Thr Val Lys  Lys Glu Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Lys Phe  Phe Glu Ser Asp Thr  Pro Val Cys
    1040                1045                1050

Asp Glu  Asn Gly Glu Ile Phe  Trp Asp Lys Ser Lys  Ser Ile Ala
    1055                1060                1065

Gln Val  Lys Lys Val Ile Asn  His His His Met Asn  Ile Val Lys
    1070                1075                1080

Lys Thr  Glu Ile Gln Lys Gly  Gly Phe Ser Lys Glu  Thr Val Glu
    1085                1090                1095

Pro Lys  Lys Asp Ser Ser Lys  Leu Leu Pro Arg Lys  Asn Asn Trp
    1100                1105                1110

Asp Pro  Ala Lys Tyr Gly Gly  Leu Gly Ser Pro Asn  Val Ala Tyr
    1115                1120                1125

Thr Val  Ala Phe Thr Tyr Glu  Lys Gly Lys Ala Arg  Lys Arg Thr
    1130                1135                1140

Asn Ala  Leu Glu Gly Ile Thr  Ile Met Glu Arg Glu  Ala Phe Glu
    1145                1150                1155

Gln Ser  Pro Val Leu Phe Leu  Lys Asn Lys Gly Tyr  Glu Gln Ala
    1160                1165                1170

Glu Ile  Glu Met Lys Leu Pro  Lys Tyr Ala Leu Phe  Glu Leu Glu
    1175                1180                1185

Asn Gly  Arg Lys Arg Met Val  Ala Ser Asn Lys Glu  Ala Gln Lys
```

```
    1190                1195                1200

Ala Asn  Ser Phe Leu Leu Pro  Glu His Leu Val Thr  Leu Leu Tyr
    1205                1210                1215

His Ala  Lys Gln Tyr Asp Glu  Ile Ser His Lys Glu  Ser Phe Asp
    1220                1225                1230

Tyr Val  Asn Glu His His Lys  Glu Phe Ser Glu Val  Phe Ala Arg
    1235                1240                1245

Val Leu  Glu Phe Ala Gly Lys  Tyr Thr Leu Ala Glu  Lys Asn Ile
    1250                1255                1260

Glu Lys  Leu Glu Lys Ile Tyr  Lys Glu Asn Gln Thr  Asp Asp Leu
    1265                1270                1275

Ala Lys  Leu Ala Ser Ser Phe  Val Asn Leu Met Gln  Phe Asn Ala
    1280                1285                1290

Met Gly  Ala Pro Ala Asp Phe  Lys Phe Phe Asp Val  Thr Ile Pro
    1295                1300                1305

Arg Lys  Arg Tyr Thr Ser Leu  Thr Glu Ile Trp Gln  Ser Thr Ile
    1310                1315                1320

Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Arg Met
    1325                1330                1335

Gly Lys
    1340
```

<210> 122
<211> 1363
<212> PRT
<213> Lactobacillus rhamnosus

<400> 122

```
Met Thr Lys Leu Asn Gln Pro Tyr Gly Ile Gly Leu Asp Ile Gly Ser
1               5                  10                  15

Asn Ser Ile Gly Phe Ala Val Val Asp Ala Asn Ser His Leu Leu Arg
            20                  25                  30

Leu Lys Gly Glu Thr Ala Ile Gly Ala Arg Leu Phe Arg Glu Gly Gln
        35                  40                  45

Ser Ala Ala Asp Arg Arg Gly Ser Arg Thr Thr Arg Arg Arg Leu Ser
    50                  55                  60

Arg Thr Arg Trp Arg Leu Ser Phe Leu Arg Asp Phe Phe Ala Pro His
65                  70                  75                  80

Ile Thr Lys Ile Asp Pro Asp Phe Phe Leu Arg Gln Lys Tyr Ser Glu
                85                  90                  95

Ile Ser Pro Lys Asp Lys Asp Arg Phe Lys Tyr Glu Lys Arg Leu Phe
            100                 105                 110

Asn Asp Arg Thr Asp Ala Glu Phe Tyr Glu Asp Tyr Pro Ser Met Tyr
        115                 120                 125

His Leu Arg Leu His Leu Met Thr His Thr His Lys Ala Asp Pro Arg
    130                 135                 140

Glu Ile Phe Leu Ala Ile His His Ile Leu Lys Ser Arg Gly His Phe
145                 150                 155                 160

Leu Thr Pro Gly Ala Ala Lys Asp Phe Asn Thr Asp Lys Val Asp Leu
                165                 170                 175

Glu Asp Ile Phe Pro Ala Leu Thr Glu Ala Tyr Ala Gln Val Tyr Pro
            180                 185                 190

Asp Leu Glu Leu Thr Phe Asp Leu Ala Lys Ala Asp Asp Phe Lys Ala
        195                 200                 205
```

```
Lys Leu Leu Asp Glu Gln Ala Thr Pro Ser Asp Thr Gln Lys Ala Leu
    210                 215                 220

Val Asn Leu Leu Leu Ser Ser Asp Gly Glu Lys Glu Ile Val Lys Lys
225                 230                 235                 240

Arg Lys Gln Val Leu Thr Glu Phe Ala Lys Ala Ile Thr Gly Leu Lys
                245                 250                 255

Thr Lys Phe Asn Leu Ala Leu Gly Thr Glu Val Asp Glu Ala Asp Ala
            260                 265                 270

Ser Asn Trp Gln Phe Ser Met Gly Gln Leu Asp Asp Lys Trp Ser Asn
        275                 280                 285

Ile Glu Thr Ser Met Thr Asp Gln Gly Thr Glu Ile Phe Glu Gln Ile
    290                 295                 300

Gln Glu Leu Tyr Arg Ala Arg Leu Leu Asn Gly Ile Val Pro Ala Gly
305                 310                 315                 320

Met Ser Leu Ser Gln Ala Lys Val Ala Asp Tyr Gly Gln His Lys Glu
                325                 330                 335

Asp Leu Glu Leu Phe Lys Thr Tyr Leu Lys Lys Leu Asn Asp His Glu
            340                 345                 350

Leu Ala Lys Thr Ile Arg Gly Leu Tyr Asp Arg Tyr Ile Asn Gly Asp
        355                 360                 365

Asp Ala Lys Pro Phe Leu Arg Glu Asp Phe Val Lys Ala Leu Thr Lys
    370                 375                 380

Glu Val Thr Ala His Pro Asn Glu Val Ser Glu Gln Leu Leu Asn Arg
385                 390                 395                 400
```

```
Met Gly Gln Ala Asn Phe Met Leu Lys Gln Arg Thr Lys Ala Asn Gly
                405                 410                 415

Ala Ile Pro Ile Gln Leu Gln Gln Arg Glu Leu Asp Gln Ile Ile Ala
            420                 425                 430

Asn Gln Ser Lys Tyr Tyr Asp Trp Leu Ala Ala Pro Asn Pro Val Glu
        435                 440                 445

Ala His Arg Trp Lys Met Pro Tyr Gln Leu Asp Glu Leu Leu Asn Phe
    450                 455                 460

His Ile Pro Tyr Tyr Val Gly Pro Leu Ile Thr Pro Lys Gln Gln Ala
465                 470                 475                 480

Glu Ser Gly Glu Asn Val Phe Ala Trp Met Val Arg Lys Asp Pro Ser
                485                 490                 495

Gly Asn Ile Thr Pro Tyr Asn Phe Asp Glu Lys Val Asp Arg Glu Ala
            500                 505                 510

Ser Ala Asn Thr Phe Ile Gln Arg Met Lys Thr Thr Asp Thr Tyr Leu
        515                 520                 525

Ile Gly Glu Asp Val Leu Pro Lys Gln Ser Leu Leu Tyr Gln Lys Tyr
    530                 535                 540

Glu Val Leu Asn Glu Leu Asn Asn Val Arg Ile Asn Asn Glu Cys Leu
545                 550                 555                 560

Gly Thr Asp Gln Lys Gln Arg Leu Ile Arg Glu Val Phe Glu Arg His
                565                 570                 575

Ser Ser Val Thr Ile Lys Gln Val Ala Asp Asn Leu Val Ala His Gly
            580                 585                 590

Asp Phe Ala Arg Arg Pro Glu Ile Arg Gly Leu Ala Asp Glu Lys Arg
        595                 600                 605
```

```
Phe Leu Ser Ser Leu Ser Thr Tyr His Gln Leu Lys Glu Ile Leu His
    610                 615                 620

Glu Ala Ile Asp Asp Pro Thr Lys Leu Leu Asp Ile Glu Asn Ile Ile
625                 630                 635                 640

Thr Trp Ser Thr Val Phe Glu Asp His Thr Ile Phe Glu Thr Lys Leu
                645                 650                 655

Ala Glu Ile Glu Trp Leu Asp Pro Lys Lys Ile Asn Glu Leu Ser Gly
            660                 665                 670

Ile Arg Tyr Arg Gly Trp Gly Gln Phe Ser Arg Lys Leu Leu Asp Gly
        675                 680                 685

Leu Lys Leu Gly Asn Gly His Thr Val Ile Gln Glu Leu Met Leu Ser
    690                 695                 700

Asn His Asn Leu Met Gln Ile Leu Ala Asp Glu Thr Leu Lys Glu Thr
705                 710                 715                 720

Met Thr Glu Leu Asn Gln Asp Lys Leu Lys Thr Asp Asp Ile Glu Asp
                725                 730                 735

Val Ile Asn Asp Ala Tyr Thr Ser Pro Ser Asn Lys Lys Ala Leu Arg
            740                 745                 750

Gln Val Leu Arg Val Val Glu Asp Ile Lys His Ala Ala Asn Gly Gln
        755                 760                 765

Asp Pro Ser Trp Leu Phe Ile Glu Thr Ala Asp Gly Thr Gly Thr Ala
    770                 775                 780

Gly Lys Arg Thr Gln Ser Arg Gln Lys Gln Ile Gln Thr Val Tyr Ala
785                 790                 795                 800
```

```
Asn Ala Ala Gln Glu Leu Ile Asp Ser Ala Val Arg Gly Glu Leu Glu
                805                 810                 815

Asp Lys Ile Ala Asp Lys Ala Ser Phe Thr Asp Arg Leu Val Leu Tyr
            820                 825                 830

Phe Met Gln Gly Gly Arg Asp Ile Tyr Thr Gly Ala Pro Leu Asn Ile
        835                 840                 845

Asp Gln Leu Ser His Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Leu
    850                 855                 860

Ile Lys Asp Asp Ser Leu Asp Asn Arg Val Leu Val Asn Ala Thr Ile
865                 870                 875                 880

Asn Arg Glu Lys Asn Asn Val Phe Ala Ser Thr Leu Phe Ala Gly Lys
                885                 890                 895

Met Lys Ala Thr Trp Arg Lys Trp His Glu Ala Gly Leu Ile Ser Gly
            900                 905                 910

Arg Lys Leu Arg Asn Leu Met Leu Arg Pro Asp Glu Ile Asp Lys Phe
        915                 920                 925

Ala Lys Gly Phe Val Ala Arg Gln Leu Val Glu Thr Arg Gln Ile Ile
    930                 935                 940

Lys Leu Thr Glu Gln Ile Ala Ala Ala Gln Tyr Pro Asn Thr Lys Ile
945                 950                 955                 960

Ile Ala Val Lys Ala Gly Leu Ser His Gln Leu Arg Glu Glu Leu Asp
                965                 970                 975

Phe Pro Lys Asn Arg Asp Val Asn His Tyr His His Ala Phe Asp Ala
            980                 985                 990

Phe Leu Ala Ala Arg Ile Gly Thr  Tyr Leu Leu Lys Arg  Tyr Pro Lys
        995                 1000                1005
```

```
Leu Ala  Pro Phe Phe Thr Tyr  Gly Glu Phe Ala Lys  Val Asp Val
    1010                1015                1020

Lys Lys  Phe Arg Glu Phe Asn  Phe Ile Gly Ala Leu  Thr His Ala
    1025                1030                1035

Lys Lys  Asn Ile Ile Ala Lys  Asp Thr Gly Glu Ile  Val Trp Asp
    1040                1045                1050

Lys Glu  Arg Asp Ile Arg Glu  Leu Asp Arg Ile Tyr  Asn Phe Lys
    1055                1060                1065

Arg Met  Leu Ile Thr His Glu  Val Tyr Phe Glu Thr  Ala Asp Leu
    1070                1075                1080

Phe Lys  Gln Thr Ile Tyr Ala  Ala Lys Asp Ser Lys  Glu Arg Gly
    1085                1090                1095

Gly Ser  Lys Gln Leu Ile Pro  Lys Lys Gln Gly Tyr  Pro Thr Gln
    1100                1105                1110

Val Tyr  Gly Gly Tyr Thr Gln  Glu Ser Gly Ser Tyr  Asn Ala Leu
    1115                1120                1125

Val Arg  Val Ala Glu Ala Asp  Thr Thr Ala Tyr Gln  Val Ile Lys
    1130                1135                1140

Ile Ser  Ala Gln Asn Ala Ser  Lys Ile Ala Ser Ala  Asn Leu Lys
    1145                1150                1155

Ser Arg  Glu Lys Gly Lys Gln  Leu Leu Asn Glu Ile  Val Val Lys
    1160                1165                1170

Gln Leu  Ala Lys Arg Arg Lys  Asn Trp Lys Pro Ser  Ala Asn Ser
    1175                1180                1185
```

```
Phe Lys  Ile Val Ile Pro Arg  Phe Gly Met Gly Thr  Leu Phe Gln
    1190                 1195                 1200


Asn Ala  Lys Tyr Gly Leu Phe  Met Val Asn Ser Asp  Thr Tyr Tyr
    1205                 1210                 1215


Arg Asn  Tyr Gln Glu Leu Trp  Leu Ser Arg Glu Asn  Gln Lys Leu
    1220                 1225                 1230


Leu Lys  Lys Leu Phe Ser Ile  Lys Tyr Glu Lys Thr  Gln Met Asn
    1235                 1240                 1245


His Asp  Ala Leu Gln Val Tyr  Lys Ala Ile Ile Asp  Gln Val Glu
    1250                 1255                 1260


Lys Phe  Phe Lys Leu Tyr Asp  Ile Asn Gln Phe Arg  Ala Lys Leu
    1265                 1270                 1275


Ser Asp  Ala Ile Glu Arg Phe  Glu Lys Leu Pro Ile  Asn Thr Asp
    1280                 1285                 1290


Gly Asn  Lys Ile Gly Lys Thr  Glu Thr Leu Arg Gln  Ile Leu Ile
    1295                 1300                 1305


Gly Leu  Gln Ala Asn Gly Thr  Arg Ser Asn Val Lys  Asn Leu Gly
    1310                 1315                 1320


Ile Lys  Thr Asp Leu Gly Leu  Leu Gln Val Gly Ser  Gly Ile Lys
    1325                 1330                 1335


Leu Asp  Lys Asp Thr Gln Ile  Val Tyr Gln Ser Pro  Ser Gly Leu
    1340                 1345                 1350


Phe Lys  Arg Arg Ile Pro Leu  Ala Asp Leu
    1355                 1360


<210>  123
<211>  1234
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<212> PRT
<213> Prevotella tannerae

<400> 123

```
Met Pro Asn Phe Trp Ser Ile Phe Thr Glu Asn Leu Gln Thr Tyr Leu
1               5                  10                  15


Met Lys Thr Arg Ile Leu Gly Leu Asp Thr Gly Thr Asn Ser Leu Gly
            20                  25                  30


Trp Ala Val Val Asp Arg Asp Glu Asn Asn Gln Tyr Thr Pro Ile Cys
        35                  40                  45


Arg Gly Asp Leu Ile Phe Thr Glu Gly Val Lys Gln Glu Lys Gly Ile
    50                  55                  60


Glu Phe Ser Leu Ala Ala Glu Arg Thr Ser Tyr Arg Ala Ser Arg Arg
65                  70                  75                  80


His Tyr Phe Arg Arg Arg Leu Arg Lys Val Glu Val Leu Lys Val Leu
                85                  90                  95


Val Lys His Lys Leu Cys Pro Pro Leu Ser Asp Glu Ala Leu Asn Arg
            100                 105                 110


Trp His Thr Lys Lys Glu Tyr Pro Leu Asp Glu Asp Phe Ile Leu Trp
        115                 120                 125


Gln Arg Thr Asn Glu Ala Asp Asn Lys Asn Pro Tyr His Asp Arg His
    130                 135                 140


Ile Cys Leu His Arg Lys Leu Asn Leu Lys Asp Ser Gln Thr Asp Arg
145                 150                 155                 160


Tyr Thr Leu Gly Arg Ala Leu Tyr His Leu Thr Gln Arg Arg Gly Phe
                165                 170                 175


Leu Ser Asn Arg Leu Asp Gln Asn Glu Glu Ala Glu Glu Thr Gly Lys
```

```
            180                 185                 190

Val Lys Ser Ala Ile Ser Glu Leu Ser Lys Glu Met Lys Glu Ala Gly
        195                 200                 205

Cys Glu Phe Leu Gly Asp Tyr Phe Tyr Leu Leu Tyr Arg Thr Glu Gly
    210                 215                 220

Asn Arg Val Arg Ile Arg Ser Arg Tyr Thr Asp Arg Glu Lys His Tyr
225                 230                 235                 240

Leu Gln Glu Phe Lys Glu Ile Cys Arg Val Gln Glu Leu Asp Glu Asp
                245                 250                 255

Leu Ala Lys Ala Leu Glu Lys Thr Ile Phe Phe Gln Arg Pro Leu Lys
            260                 265                 270

Ser Gln Arg Gln Gly Val Gly Lys Cys Thr Met Glu Lys Gly His Ser
        275                 280                 285

Arg Cys Ala Val Ser His Pro Leu Tyr Glu Glu Tyr Arg Leu Leu Cys
    290                 295                 300

Tyr Leu Asn Asn Ile Arg Ile Lys Thr Pro Ser Asp Asp Arg Leu Arg
305                 310                 315                 320

Pro Leu Asn Ala Glu Glu Arg Glu Lys Ile Thr Pro Leu Phe Tyr Lys
                325                 330                 335

Glu Lys Asn Phe Asp Phe Glu Lys Ile Ala Lys Lys Leu Ala Gly Lys
            340                 345                 350

Thr Pro Phe Gly Trp Ile Arg Asp Ala Glu Asp Trp Pro Tyr Gln Phe
        355                 360                 365

Asn Tyr Arg Met Thr Gln Glu Ala Pro Ala Cys Pro Thr Thr Ala Gln
    370                 375                 380
```

```
Leu Ile Lys Val Phe Gly Glu Asp Trp Lys Ala Ala Leu Ala Glu Thr
385                 390                 395                 400

Tyr Thr Met Ser Ala Lys Gln Asp Gly Thr Leu Lys Thr Glu Asp Glu
                405                 410                 415

Ile Cys Thr Asp Ile Trp Asn Val Leu Tyr Ser Phe Ser Ser Lys Glu
            420                 425                 430

Lys Leu Lys Glu Phe Gly Leu Lys Lys Leu Gln Leu Asp Glu Val Gln
        435                 440                 445

Ala Lys Ala Phe Ser Glu Ile Arg Leu Thr Arg Asp Phe Ala Ser Leu
    450                 455                 460

Ser Leu Lys Ala Ile Arg Lys Ile Leu Phe Phe Leu Arg Thr Gly Glu
465                 470                 475                 480

Asp Tyr Ser Lys Ala Ile Phe Leu Ala Asn Ile Pro Thr Ile Val Gly
                485                 490                 495

Glu Glu Ile Trp Asn Asp Ile Glu Arg Arg Ser Arg Leu Leu Tyr Lys
            500                 505                 510

Val Asp Leu Ala Leu Arg Pro Gln Glu Glu Arg Asp Ala Glu Glu His
        515                 520                 525

Arg Thr Ile Ala Glu Arg Ile Lys Ala Ala Val Ala Ala Glu Val Pro
    530                 535                 540

Asp Ala Pro Ile Asp Leu Leu Tyr His Pro Ser Met Ile Glu Ala Tyr
545                 550                 555                 560

Pro Asp Ala Lys Arg Asn Glu Arg Phe Asp Cys Tyr Gln Leu Gly Ser
                565                 570                 575

Pro Lys Thr Asn Ala Val Arg Asn Pro Met Ala Met Arg Ser Leu His
```

```
            580                 585                 590

Met Val Arg Lys Val Ile Asn His Leu Leu Arg Lys His Ile Ile Asp
        595                 600                 605

Glu Lys Thr Glu Ile His Ile Glu Tyr Ala Arg Glu Leu Asn Asp Ala
    610                 615                 620

Asn Lys Arg Gln Ala Ile Ala Asp Trp Gln Arg Glu Leu Ser Lys Arg
625                 630                 635                 640

His Thr Ala Tyr Ala Gln Asn Ile Arg Gln Leu Tyr Lys Ala Glu Thr
                645                 650                 655

Gly Leu Val Ile Glu Pro Thr Lys Ala Asp Ile Leu Lys Tyr Gln Leu
            660                 665                 670

Trp Glu Glu Gln Gln His Val Cys Leu Tyr Thr Gly Lys Lys Ile Gly
        675                 680                 685

Ile Ala Asp Phe Leu Gly Ala Asn Pro Lys Phe Asp Ile Glu His Thr
    690                 695                 700

Ile Pro Arg Ser Arg Gly Gly Asp Ser Thr Gln Glu Asn Leu Thr Leu
705                 710                 715                 720

Cys Glu Ser Lys Phe Asn Arg Asp Ile Lys Arg Asp Lys Leu Pro Thr
                725                 730                 735

Glu Leu Ala Asn Tyr Glu Glu Ile Leu Ala Arg Ile Glu His Trp Lys
            740                 745                 750

Lys Gln Cys Tyr Ala Leu Lys Leu Lys Arg Asp Gly Ile Arg Thr His
        755                 760                 765

Ser Gly Leu Glu Lys Ser Ile Lys Asp Ser Arg Ile Arg Arg Arg His
    770                 775                 780
```

```
Leu Val Gly Leu Glu Tyr Gly Tyr Leu Lys Gly Lys Tyr Asp Arg Phe
785                 790                 795                 800

Thr Met Lys Glu Val Pro Glu Gly Phe Ser Arg Arg Gln Gly Ala Gly
                805                 810                 815

Ile Gly Leu Ile Ser Lys Tyr Ala Gly Leu Phe Leu Lys Ser Leu Phe
            820                 825                 830

Lys Asp Pro Lys Asn Pro Asn Arg Ser Asn Val Tyr Val Val Lys Gly
        835                 840                 845

Ala Ile Thr Ala Glu Phe Arg Lys Leu Trp Gly Leu Gln Gln Ala Asp
    850                 855                 860

Glu Ala Lys Ser Arg Glu Asn His Thr His His Cys Ile Asp Ala Tyr
865                 870                 875                 880

Thr Ile Ala Cys Ile Gly Pro Cys Glu Tyr Ala Ala Leu Ala Ala Tyr
                885                 890                 895

Tyr Arg Ser Asp Glu Glu Phe Lys Tyr Gly Arg Arg Arg Glu Lys Pro
            900                 905                 910

Gln Phe Glu Lys Pro Trp Pro Thr Phe Thr Glu Asp Leu Leu Lys Leu
        915                 920                 925

Gln Glu Glu Leu Leu Ile Val His Gln Thr Thr Asp Lys Leu Gly Lys
    930                 935                 940

Arg Asp Arg Arg Lys Val Lys Thr Pro Arg Gly Lys Phe Leu Thr Gly
945                 950                 955                 960

Gly Asp Ser Ala Arg Gly Arg Leu His Gln Glu Thr Tyr Tyr Gly Ala
                965                 970                 975

Ile Asn Tyr Asp Gly Asn Ile Lys Tyr Val Val Arg Lys Pro Leu Asp
```

```
           980                 985                 990

Ser Leu Thr Glu Lys Asp Leu Asp  Lys Ile Val Asp Glu  Thr Val Met
        995                 1000                1005

Gly Ile  Val Lys Gly Ala Val  Glu Ala Lys Gly Ser  Leu Lys Glu
    1010                1015                1020

Ala Leu  Ala Asp Gly Ile Tyr  Met Asn Lys Glu Lys  Gly Ile Leu
    1025                1030                1035

Ile Lys  Arg Val Arg Ile Phe  Ser Asp Val Ser Glu  Pro Ile Asn
    1040                1045                1050

Leu Lys  Gln Leu Arg Asp Val  Ser Thr Lys Glu Tyr  Lys Arg His
    1055                1060                1065

Ile His  Leu Arg Lys Asp Glu  Asn Tyr Leu Phe Ala  Ile Tyr Glu
    1070                1075                1080

Gly Ile  Asp Lys Lys Lys Asn  Lys Lys Gln Thr Glu  Thr Ala Thr
    1085                1090                1095

Val Asp  Tyr Leu Asp Ala Ala  Lys Phe Tyr Lys Asp  Ser Lys Arg
    1100                1105                1110

Arg Asp  Lys Ala Asn Ser Leu  Val Gly Asp Tyr Ser  Lys Lys Asn
    1115                1120                1125

Lys Leu  Pro Leu Lys Cys Ile  Leu Lys Lys Arg Gln  Met Val Leu
    1130                1135                1140

Phe Tyr  Glu His Ser Pro Glu  Glu Ile Arg Phe Lys  Asp Lys Lys
    1145                1150                1155

Asp Leu  Ser Arg Arg Leu Tyr  Ile Val Thr Ser Ile  Ala Lys Asp
    1160                1165                1170
```

Gly Arg Val Lys Phe Leu His His Gln Ala Ala Thr Ala Thr Gly
    1175   1180   1185

Ile Gln Ser Ser Pro Ser Pro Phe Thr Asn Asp Gly Glu His Gln
    1190   1195   1200

Pro Tyr Tyr Arg Leu Ser Ala Ser Asn Ile Lys Val Leu Val Ala
    1205   1210   1215

Gly Ile Asp Phe Asp Ile Asn Ile Leu Gly Glu Ile Thr Pro Lys
    1220   1225   1230

Leu

<210> 124
<211> 1496
<212> PRT
<213> Prevotella veroralis

<400> 124

Met Lys Thr Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1   5   10   15

Ala Lys Val Cys Val Asp Asp Asn Gly Asn Tyr Leu Arg Asp Ile Lys
            20   25   30

Leu Gly Ser Arg Ile Ile Pro Met Ser Gln Asp Val Leu Gly Asn Phe
        35   40   45

Asp Lys Gly Val Thr Glu Ser Gln Thr Ser Val Arg Thr Gly Phe Arg
    50   55   60

Gly Val Arg Arg Ile Arg Glu Arg Ser Leu Leu Arg Arg Glu Arg Leu
65   70   75   80

His Arg Val Leu His Val Leu Gly Tyr Leu Pro Pro His Tyr Asp Ser
                85   90   95

```
Ala Ile Gly Trp Asn Lys Asn Glu Pro Ser Thr Tyr Gly Lys Phe Leu
            100                 105                 110

Asn His Gly Glu Pro Lys Leu Ala Trp Glu His Lys Glu Asp Gly Ser
        115                 120                 125

Met Arg Phe Leu Phe Met Glu Ser Phe His Glu Met Met Ala Asp Phe
    130                 135                 140

Ala Lys Ser Gln Pro Ser Leu Val Ser Asp Gly Lys Lys Ile Pro Leu
145                 150                 155                 160

Asp Trp Thr Ile Tyr Tyr Leu Arg Lys Lys Ala Leu Ser Gln Pro Ile
                165                 170                 175

Arg Lys Glu Glu Leu Ala Trp Leu Leu Leu Asn Phe Asn Gln Lys Arg
            180                 185                 190

Gly Tyr Tyr Gln Leu Arg Gly Glu Glu Asp Asp Asp Asn Pro Thr Lys
        195                 200                 205

Cys Glu Glu Tyr Tyr Glu Leu Lys Val Val Gly Ile Glu Ala Asp Glu
    210                 215                 220

Glu Gly Lys Asn Gly Asn Thr Trp Tyr Asn Val Lys Leu Glu Asn Gly
225                 230                 235                 240

Trp Ile Tyr Arg Arg Gln Ser Lys Ile Pro Leu Asp Asp Trp Ile Gly
                245                 250                 255

Lys Val Arg Glu Phe Ile Val Thr Thr Glu Tyr Glu Lys Asp Gly Ile
            260                 265                 270

Thr Leu Lys Lys Asp Lys Asn Gly Asp Val Lys Arg Ser Phe Arg Ser
        275                 280                 285
```

```
Pro Ser Glu Asp Asp Trp Gly Leu Arg Lys Lys Arg Thr Glu Lys Leu
    290                 295                 300

Leu Asp Ser Ser Lys Met Thr Val Gly Ala Phe Val Tyr Asp His Leu
305                 310                 315                 320

Leu Ala Glu Pro Ser Asp Lys Ile Arg Gly Lys Phe Ile Arg Thr Ile
                325                 330                 335

Glu Arg Lys Tyr Tyr Lys Lys Glu Leu Tyr Ala Ile Leu Cys Glu Gln
            340                 345                 350

Ser Lys Tyr His Glu Glu Leu Arg Ser Gly Asp Tyr Leu Asn Lys Cys
        355                 360                 365

Ala Glu Glu Leu Tyr Lys Asn Asn Gln Pro His Arg Asn Ser Leu Leu
    370                 375                 380

Thr Lys Asp Leu Ala Tyr Leu Leu Leu Glu Asp Leu Ile Phe Tyr Gln
385                 390                 395                 400

Arg Pro Leu Lys Thr Lys Lys Ser Leu Ile Ala Glu Cys Pro Tyr Glu
                405                 410                 415

Ala Tyr Lys Tyr Val Asp Lys Glu Thr Gly Glu Ile Lys Arg Gln Gly
            420                 425                 430

Ile Lys Cys Ile Ala Lys Ser Asn Pro Tyr Tyr Gln Glu Phe Arg Leu
        435                 440                 445

Trp Gln Phe Ile Ser Asn Leu Arg Leu Phe Asn Lys Ala Asp Asp Lys
    450                 455                 460

Glu Val Thr Ala Asp Tyr Leu Pro Thr Gln Asp Asp Tyr Val Arg Leu
465                 470                 475                 480

Phe Ala Tyr Leu Asn Asp Arg Lys Glu Ile Asn Gln Glu Thr Leu Leu
                485                 490                 495
```

```
Lys Glu Phe Phe Lys Leu Lys Lys Ile Thr Val Asn Ser Glu Lys Val
            500                 505                 510

Phe Pro Ile Arg Trp Asn Tyr Ile Glu Asp Lys Glu Lys Lys Tyr Pro
        515                 520                 525

Cys Asn Glu Thr Arg His Glu Leu Leu Leu Ala Leu Asp Arg Ala Arg
    530                 535                 540

Ile Asp His Ser Trp Leu Glu Lys Pro Gly Gln Glu Tyr Arg Leu Trp
545                 550                 555                 560

His Leu Leu Tyr Ser Val Glu Ser Lys Glu Glu Thr Lys Glu Ala Leu
                565                 570                 575

Arg Lys Leu Lys Asp Asp Asp Ala Phe Val Glu Ser Phe Leu Lys Val
            580                 585                 590

Lys Pro Phe Lys Arg Glu Tyr Gly Ala Tyr Ser Glu Lys Ala Ile Lys
        595                 600                 605

Lys Leu Leu Ala Val Met Arg Met Gly Ser Leu Trp Arg Glu Thr Asp
    610                 615                 620

Ile Cys Asp Thr Thr Lys Gly Asn Ile Thr Lys Ile Leu Gln Gly Glu
625                 630                 635                 640

Ile Asp Glu Lys Leu Lys Glu Lys Ile Ser Ala Ser Val Ser Ser Tyr
                645                 650                 655

Asn Gln Leu Ser Asp Phe Gln Gly Leu Pro Val Trp Leu Ala Cys Tyr
            660                 665                 670

Val Val Tyr Gly Arg His Ser Glu Ala Ala Glu Ile Gln His Trp Lys
        675                 680                 685
```

```
Thr Pro Glu Ser Leu Leu Ala Tyr Ile Asn Gly Phe Lys Gln His Ser
    690                 695                 700

Leu Arg Asn Pro Ile Val Glu Gln Cys Ile Leu Glu Thr Leu Arg Thr
705                 710                 715                 720

Val His Asp Ile Trp Lys Glu Val Gly His Ile Asp Glu Ile His Val
                725                 730                 735

Glu Leu Gly Arg Asn Met Lys Ser Thr Ala Asp Gln Arg Ala Arg Ile
            740                 745                 750

Ser Glu Asn Val Leu Arg Asn Glu Asn Thr Asn Leu Arg Ile Lys Ser
        755                 760                 765

Leu Leu Leu Glu Leu Lys Asn Asp Pro Asn Ile Lys Asp Val Arg Pro
    770                 775                 780

Tyr Ser Pro Met Gln Gln Glu Lys Leu Arg Ile Tyr Glu Glu Gly Val
785                 790                 795                 800

Leu Gln Glu Leu Thr Lys Asp Asp Lys Asp Phe Thr Glu Ile Thr Lys
                805                 810                 815

Ile Ser Thr Met Ala Gln Pro Ser Ala Lys Glu Leu Gln Arg Tyr Lys
            820                 825                 830

Leu Trp Leu Glu Gln Lys Tyr Arg Ser Pro Tyr Thr Gly Lys Ser Ile
        835                 840                 845

Ser Leu Thr Lys Leu Phe Thr Ser Ala Tyr Gln Ile Glu His Val Ile
    850                 855                 860

Pro Gln Ser Arg Tyr Phe Asp Asp Ser Phe Ser Asn Lys Val Ile Cys
865                 870                 875                 880

Glu Ser Glu Val Asn Ser Leu Lys Asp Asn Met Leu Gly Tyr Glu Phe
                885                 890                 895
```

```
Ile Lys Asn His Gly Gly Glu Ile Ile His Cys Thr Met Leu Gly Asp
            900                 905                 910

Val Lys Val Leu Ser Glu Ser Glu Tyr Lys Ala Phe Val Asn Asp His
        915                 920                 925

Tyr Ala His Asn Lys Arg Lys Arg Glu Asn Leu Leu Leu Glu Asp Ile
    930                 935                 940

Pro Gln Glu Phe Leu Asn Arg Gln Met Asn Asp Ser Arg Tyr Ile Ser
945                 950                 955                 960

Lys Val Val Lys Ala Leu Leu Ser Asn Ile Val Arg Ala Glu Gly Glu
                965                 970                 975

Glu Glu Ala Thr Ser Lys Phe Val Val Ser Cys Ser Gly Gly Ile Thr
            980                 985                 990

Asp Arg Leu Lys Lys Asp Trp Gly  Leu Asn Asp Val Trp  Asn Lys Ile
        995                 1000                1005

Val Tyr  Pro Arg Phe Glu Arg  Leu Asn Arg Leu Thr  Gly Thr Glu
    1010                1015                1020

Ala Phe  Gly Gln Trp Glu Asn  Lys Asp Gly Lys Arg  Val Phe Gln
    1025                1030                1035

Thr Ala  Val Pro Leu Glu Leu  Gln Arg Gly Phe Asn  Lys Lys Arg
    1040                1045                1050

Ile Asp  His Arg His His Ala  Met Asp Ala Leu Val  Ile Ala Cys
    1055                1060                1065

Thr Ser  Arg Asn Ile Ile Asn  Tyr Leu Asn Asn Glu  Ser Ala Asn
    1070                1075                1080
```

```
Asn Pro  Lys Lys Arg Glu Asp  Leu Arg Gln Lys Leu  Cys Asp Lys
    1085                1090                1095

Asn Arg  Thr Ile Arg Lys Pro  Trp Glu Thr Phe Thr  Gln Asp Ala
    1100                1105                1110

Thr Ala  Ala Leu Glu Asp Val  Ile Val Ser Phe Lys  Asn Tyr Val
    1115                1120                1125

Arg Ile  Ile Asn Lys Ala Thr  Asn Tyr Tyr Glu Arg  Tyr Asp Val
    1130                1135                1140

Glu Gly  Lys Lys Val Ile Ala  Glu Gln Arg Gly Asp  Asp Met Trp
    1145                1150                1155

Ala Ile  Arg Lys Pro Met His  Glu Ala Thr Tyr Tyr  Gly Arg Val
    1160                1165                1170

Asn Leu  Arg Arg Lys Lys Lys  Val Asn Leu Arg Val  Ala Leu Glu
    1175                1180                1185

Asn Ile  Ser Ser Ile Cys Asp  Asn Lys Leu Arg Ile  Tyr Ile Asn
    1190                1195                1200

Gly Leu  Val Glu Lys Gly Phe  Asn Thr Lys Gln Ile  Leu Asp Lys
    1205                1210                1215

Phe Lys  Asn Thr Asn Asp His  Phe Ser Met Gln Lys  Ile Asp Lys
    1220                1225                1230

Val Glu  Ile Trp Gln Phe Thr  Asn Glu Glu Glu Lys  Leu Val Ala
    1235                1240                1245

Thr Arg  Lys Pro Leu Asp Thr  Ser Phe Asp Thr Lys  Lys Ile Ala
    1250                1255                1260

Ser Ile  Thr Asp Thr Gly Ile  Gln Thr Ile Leu Leu  Asn Tyr Leu
    1265                1270                1275
```

```
Glu Thr  Lys Gly Gly Asp Ser  Thr Ile Ala Phe Thr  Pro Glu Gly
    1280                1285                1290

Ile Val  Glu Met Asn Gln Asn  Ile Ser Lys Tyr Asn  Asn Gly Lys
    1295                1300                1305

Glu His  Met Pro Ile Leu Lys  Val Arg Leu Tyr Thr  Lys Leu Gly
    1310                1315                1320

Lys Lys  Ile Pro Val Gly Gln  Thr Gly Cys Lys Ala  Lys Gln Phe
    1325                1330                1335

Val Ile  Ala Glu Ala Gly Thr  Asn Leu Tyr Phe Ala  Ile Tyr Glu
    1340                1345                1350

Asp Glu  Glu Gly Lys Arg Ser  Tyr Arg Thr Ile Pro  Leu Asn Glu
    1355                1360                1365

Val Val  Glu Arg Leu Lys Gln  Gly Leu Ser Pro Val  Pro Glu Lys
    1370                1375                1380

Asn Asp  Lys Asp Val His Leu  Lys Phe Tyr Leu Ser  Pro Asn Asp
    1385                1390                1395

Leu Val  Tyr Val Pro Ile Glu  Asp Glu His Glu Ser  Leu Ala Lys
    1400                1405                1410

Asp His  Ile Tyr Lys Phe Val  Asp Ser Ser Gly Thr  Thr Ala Asn
    1415                1420                1425

Phe Ile  Pro His Arg Ser Ala  Asn Val Ile Phe Glu  Leu Asn Lys
    1430                1435                1440

Lys Asp  Ala Glu Lys Phe Cys  Ser Gly Ser Ile Ile  Gln Asn Glu
    1445                1450                1455
```

```
Tyr Gly  Val Gly Ser Ser Gln  Ser Lys Asn Gln Lys  Ala Ile Thr
    1460                1465                1470


Gly Glu  Met Ile Lys Ala Val  Cys Arg Lys Leu Glu  Val Asp Arg
    1475                1480                1485


Leu Gly  Asn Val Ile Lys Val  Ile
    1490                1495


<210>  125
<211>  1082
<212>  PRT
<213>  Neisseria cinerea

<400>  125

Met Ala Ala Phe Lys Pro Asn Pro Met Asn Tyr Ile Leu Gly Leu Asp
1               5                   10                  15


Ile Gly Ile Ala Ser Val Gly Trp Ala Ile Val Glu Ile Asp Glu Glu
            20                  25                  30


Glu Asn Pro Ile Arg Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
        35                  40                  45


Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Ala Ala Arg Arg Leu
    50                  55                  60


Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65                  70                  75                  80


Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
                85                  90                  95


Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100                 105                 110


Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
        115                 120                 125
```

```
Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160

Gly Val Ala Asp Asn Thr His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Asn Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Asn Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Val Ser Asp Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Thr Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Val Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Asp Leu Asp Asp Thr Ala Phe Phe Lys Gly Leu Arg
```

```
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Val Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Asn Arg Tyr Asp Glu Ala Cys Thr Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
                485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525
```

```
Asp Arg Glu Lys Ser Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Gly
                565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Ala Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655

Phe Asp Glu Asp Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Ile Asn Arg Phe Leu Cys Gln Phe Val Ala Asp His Met Leu Leu Thr
        675                 680                 685

Gly Lys Gly Lys Arg Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700

Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala Glu Asn Asp
705                 710                 715                 720

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Ile Ala
```

```
                725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765

Lys Ala His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
                805                 810                 815

Arg Pro Glu Ala Val His Lys Tyr Val Thr Pro Leu Phe Ile Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
        835                 840                 845

Ser Ala Lys Arg Leu Asp Glu Gly Ile Ser Val Leu Arg Val Pro Leu
    850                 855                 860

Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Glu Arg
865                 870                 875                 880

Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
                885                 890                 895

Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910

Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Val Glu Gln Val
        915                 920                 925
```

```
Gln Lys Thr Gly Val Trp Val His Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940

Ala Thr Ile Val Arg Val Asp Val Phe Glu Lys Gly Gly Lys Tyr Tyr
945                 950                 955                 960

Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
                965                 970                 975

Arg Ala Val Val Gln Gly Lys Asp Glu Glu Asp Trp Thr Val Met Asp
            980                 985                 990

Asp Ser Phe Glu Phe Lys Phe Val  Leu Tyr Ala Asn Asp  Leu Ile Lys
        995                 1000                1005

Leu Thr  Ala Lys Lys Asn Glu  Phe Leu Gly Tyr Phe  Val Ser Leu
    1010                1015                1020

Asn Arg  Ala Thr Gly Ala Ile  Asp Ile Arg Thr His  Asp Thr Asp
    1025                1030                1035

Ser Thr  Lys Gly Lys Asn Gly  Ile Phe Gln Ser Val  Gly Val Lys
    1040                1045                1050

Thr Ala  Leu Ser Phe Gln Lys  Tyr Gln Ile Asp Glu  Leu Gly Lys
    1055                1060                1065

Glu Ile  Arg Pro Cys Arg Leu  Lys Lys Arg Pro Pro  Val Arg
    1070                1075                1080
```

<210> 126
<211> 1512
<212> PRT
<213> Fibrobacter succinogenes

<400> 126

```
Met Lys Lys Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15
```

```
Ala Val Val Asn Ala Asp Glu Ile Thr Arg Asp Asp Gly Ser Arg Tyr
            20                  25                  30

Leu Lys Pro Asn Gly Ile Ser Ala Ala Gly Ser Arg Ile Ile Pro Met
        35                  40                  45

Ser Ala Asp Ile Leu Gly Asp Phe Glu Lys Gly Asn Ser Ile Ser Gln
    50                  55                  60

Thr Ala Glu Arg Thr Arg Met Arg Met Ala Arg Arg Leu His Glu Arg
65                  70                  75                  80

Ala Leu Leu Arg Arg Glu Arg Leu Leu Arg Val Leu Asn Leu Leu Asp
                85                  90                  95

Phe Leu Pro Lys His Phe Ala Asp Lys Ile Asp Arg Tyr Gly Lys Phe
            100                 105                 110

Thr Asp Asp Ser Glu Pro Lys Leu Ala Trp Arg Lys Asn Thr Glu Gly
        115                 120                 125

Lys Tyr Glu Phe Ile Phe Gln Asp Ala Phe Asn Glu Met Leu Ala Glu
    130                 135                 140

Phe Lys Asp Lys Gln Pro Glu Ile Val Glu Glu Gly Lys Lys Ile Pro
145                 150                 155                 160

Tyr Asp Trp Thr Ile Tyr Tyr Leu Arg Lys Lys Ala Leu Glu Lys Ala
                165                 170                 175

Leu Ser Lys Glu Glu Leu Ser Trp Ile Leu Leu Gln Phe Asn Gln Lys
            180                 185                 190

Arg Gly Tyr Tyr Gln Leu Arg Gly Glu Glu Glu Glu Ile Pro Gln Asp
        195                 200                 205
```

```
Lys Lys Ile Glu Tyr Leu Ala Gln Lys Val Val Lys Val Glu Ala Thr
    210                 215                 220

Asp Gln Lys Lys Gly Asp Asp Val Trp Tyr Asn Val Tyr Leu Glu Asn
225                 230                 235                 240

Gly Met Ile Tyr Arg Arg Thr Ser Lys Ala Pro Leu Asp Trp Glu Gly
                245                 250                 255

Lys Val Lys Glu Phe Ile Val Thr Thr Glu Val Glu Asn Asp Gly Glu
            260                 265                 270

Thr Pro Lys Lys Asp Lys Glu Gly Asn Ile Lys Arg Ser Phe Arg Ala
        275                 280                 285

Pro Lys Glu Asp Asp Trp Thr Leu Leu Lys Lys Lys Thr Glu Ala Asp
    290                 295                 300

Ile Glu Asn Ser His Lys Thr Val Gly Cys Tyr Ile Tyr Asp Ser Leu
305                 310                 315                 320

Leu Asn Asn Pro Lys Gln Lys Ile Ile Gly Lys Leu Val Arg Thr Val
                325                 330                 335

Glu Arg Lys Phe Tyr Lys Glu Glu Leu Thr Gln Ile Leu Lys Lys Gln
            340                 345                 350

Val Glu Leu Ile Pro Glu Leu Arg Asp Asp Asn Leu Tyr Lys Gln Cys
        355                 360                 365

Ile Glu Glu Leu Tyr Pro Ile Asn Glu Ala His Arg Asn Thr Ile Ala
    370                 375                 380

Lys Thr Asp Phe Ala Asn Leu Phe Ile Asn Asp Ile Leu Phe Tyr Gln
385                 390                 395                 400

Arg Pro Leu Lys Ser Lys Lys Ser Gln Ile Asp Asn Cys Pro Tyr Glu
                405                 410                 415
```

```
Glu Arg Ile Phe Ile Asp Ser Lys Thr Gly Glu Lys Lys Lys Val Pro
            420                 425                 430

Val Lys Cys Ile Ala Lys Ser Asn Pro Leu Phe Gln Glu Phe Arg Leu
        435                 440                 445

Trp Gln Phe Ile Gln Asn Leu Arg Ile Tyr Gln Arg Glu Lys Glu Ile
    450                 455                 460

Asp Gly Lys Leu Leu Thr Asp Ile Asp Ile Thr Ser Glu Cys Leu Lys
465                 470                 475                 480

Ser Glu Glu Asp Tyr Val Arg Leu Phe Asp Trp Leu Asn Asp Arg Glu
                485                 490                 495

Thr Ile Glu Gln Glu Asp Leu Leu Lys His Leu Phe Asn Thr Lys Lys
            500                 505                 510

Ser Lys Asn Lys Glu Asn Pro Tyr Arg Trp Asn Tyr Val Glu Asp Lys
        515                 520                 525

Val Tyr Pro Cys Asn Glu Thr Arg Ala Thr Ile Leu Lys Gly Phe Ser
    530                 535                 540

Lys Cys Gly Ile Asn Ala Ser Val Leu Ser Pro Glu Leu Glu Met Ala
545                 550                 555                 560

Leu Trp His Ile Leu Tyr Ser Val Glu Asp Lys Lys Glu Ile Glu Thr
                565                 570                 575

Ala Leu Thr His Phe Ala Gln Lys Gln Gly Trp Asn Asp Asp Phe Ala
            580                 585                 590

Lys Val Phe Ser Lys Ala Lys Pro Phe Lys Lys Asp Tyr Gly Ser Tyr
        595                 600                 605
```

```
Ser Glu Lys Ala Ile Lys Lys Leu Leu Ser Leu Met Arg Met Gly Lys
    610                 615                 620

Tyr Trp Asn Gln Asp Asn Ile Asp Lys Asn Thr Leu Asp Arg Ile Asp
625                 630                 635                 640

Lys Ile Ile Asn Gly Glu Tyr Asp Glu Lys Ile Ser Asn Arg Val Arg
                645                 650                 655

Asp Asn Ala Ile Asn Leu Lys Asp Ile Ser Asp Phe Arg Gly Leu Pro
            660                 665                 670

Val Trp Leu Ala Cys Tyr Ile Val Tyr Asp Arg His Ser Glu Ala Lys
        675                 680                 685

Asp Cys Thr Lys Trp Asn Ser Pro Glu Glu Ile Asp Ser Tyr Leu Lys
    690                 695                 700

Lys Phe Lys Gln His Ser Leu Arg Asn Pro Ile Val Glu Gln Val Val
705                 710                 715                 720

Thr Glu Thr Leu Arg Thr Val Arg Asp Ile Trp Ile Gln Glu Glu Gln
                725                 730                 735

Ile Asp Glu Ile His Leu Glu Leu Gly Arg Asp Leu Lys Asn Pro Ala
            740                 745                 750

Asp Lys Arg Lys Lys Met Ser Glu Asn Ile Leu Lys Asn Glu Asn Thr
        755                 760                 765

Asn Leu Arg Ile Lys Ala Met Leu Met Glu Phe Met Asn Pro Ser Met
    770                 775                 780

Gly Ile Glu Asn Val Arg Pro Tyr Ser Pro Ser Gln Gln Asp Ile Leu
785                 790                 795                 800

Arg Ile Tyr Glu Glu Asn Ala Leu Asp Asn Leu Thr Lys Asp Asp Lys
                805                 810                 815
```

```
Asp Phe Asp Phe Ile Ser Lys Ile Ser Lys Gln Ala Gln Pro Ser Lys
            820                 825                 830

Thr Asp Ile Ile Arg Tyr Lys Cys Trp Leu Glu Gln Lys Tyr Arg Ser
        835                 840                 845

Pro Tyr Thr Gly Lys Thr Ile Ser Leu Ser Lys Leu Phe Thr Pro Ala
    850                 855                 860

Tyr Glu Ile Glu His Val Ile Pro Gln Ser Leu Tyr Phe Asp Asp Ser
865                 870                 875                 880

Phe Ser Asn Lys Val Ile Cys Glu Ala Glu Val Asn Lys Leu Lys Asp
                885                 890                 895

Arg Gln Leu Gly Tyr Lys Phe Ile Ala Glu His His Gly Glu Lys Val
            900                 905                 910

Gln Leu Ser Gln Gly Glu Val Val Glu Ile Leu Ser Val Asp Ala Tyr
        915                 920                 925

Glu Lys Phe Val Lys Glu Asn Tyr Ala Asn Asn Arg Ile Lys Met Lys
    930                 935                 940

Lys Leu Leu Met Glu Ser Ile Pro Asp Glu Phe Ile Glu Arg Gln Leu
945                 950                 955                 960

Asn Asp Ser Arg Tyr Ile Ser Lys Val Val Lys Gly Leu Leu Ser Asn
                965                 970                 975

Ile Val Arg Glu Lys Ile Asp Asp Glu Asn Tyr Glu Pro Glu Ala Val
            980                 985                 990

Ser Lys Asn Leu Ile Ser Cys Asn  Gly Ala Ile Thr Asp  Arg Leu Lys
        995                 1000                1005
```

```
Lys Asp  Trp Gly Met Asn Asp  Val Trp Asn Ser Ile  Ile Leu Pro
    1010                1015                1020

Arg Phe  Ile Arg Met Asn Gln  Ile Thr Gly Lys Asp  Cys Phe Thr
    1025                1030                1035

Thr Thr  Asn Ala Glu Gly His  Leu Ile Pro Gln Met  Pro Leu Glu
    1040                1045                1050

Leu Gln  Lys Gly Phe Asn Lys  Lys Arg Ile Asp His  Arg His His
    1055                1060                1065

Ala Met  Asp Ala Ile Val Ile  Ala Cys Thr Thr Arg  Asp His Val
    1070                1075                1080

Asn Leu  Leu Asn Asn Glu Ala  Ala His Ser Lys Phe  Asn Ala Thr
    1085                1090                1095

Arg Tyr  Gln Leu Gln Arg Lys  Leu Arg Arg Phe Glu  Lys Ala Val
    1100                1105                1110

Ile Asp  Gly Lys Glu Arg Glu  Val Ala Lys Glu Phe  Leu Lys Pro
    1115                1120                1125

Trp Asp  Ser Phe Ser Ser Asp  Ser Lys Asn Ile Leu  Glu Asn Ile
    1130                1135                1140

Ile Val  Ser Phe Lys Gln Asn  Gln Arg Val Ile Asn  Lys Thr Thr
    1145                1150                1155

Asn Ala  Phe Leu His Phe Asp  Glu Asn Gly Lys Lys  Thr Phe Ile
    1160                1165                1170

Lys Gln  Gly Lys Gly Asp Ser  Trp Ala Ile Arg Lys  Ser Met His
    1175                1180                1185

Lys Asp  Thr Val Phe Gly Glu  Ile Asn Leu Arg Lys  Val Arg Ser
    1190                1195                1200
```

```
Val Ser  Leu Asn Glu Ala Ile  Lys Val Pro Glu Arg  Val Leu Asn
    1205                1210                1215

Lys Lys  Ile Lys Glu Lys Ile  Leu Glu Leu Lys Asn  Asn Lys Ile
    1220                1225                1230

Asp Ala  Lys Asn Ile Lys Lys  Tyr Ile Glu Glu Asn  His Thr Gly
    1235                1240                1245

Gly Tyr  Gly Ile Asp Ser Ser  Lys Ile Asp Val Phe  Tyr Phe Thr
    1250                1255                1260

Lys Glu  Thr Lys Glu Arg Phe  Phe Ala Thr Arg Lys  Thr Leu Asp
    1265                1270                1275

Thr Ser  Phe Asn Gln Ala Lys  Ile Lys Asp Ser Ile  Ala Asp Ser
    1280                1285                1290

Gly Ile  Gln Lys Ile Leu Leu  Ala His Leu Lys Ser  Lys Asn Gly
    1295                1300                1305

Asp Ala  Glu Gln Ala Phe Ser  Pro Asp Gly Ile Asp  Glu Met Asn
    1310                1315                1320

Lys Asn  Ile Val Glu Leu Asn  Asn Gly Lys Phe His  Gln Pro Ile
    1325                1330                1335

Leu Lys  Val Arg Val Tyr Glu  Lys Ala Asp Lys Phe  Ala Val Gly
    1340                1345                1350

Gln Lys  Gly Asn Lys Lys Val  Lys Phe Val Glu Ala  Ala Lys Gly
    1355                1360                1365

Thr Asn  Leu Phe Phe Ala Ile  Phe Glu Lys Asp Gly  Lys Arg Ser
    1370                1375                1380
```

```
Tyr Leu  Thr Ile Pro Leu Asn  Val Met Ile Asp Cys  Gln Lys Gln
    1385                1390                1395


Tyr Gly  Asn Gln Trp Lys Asn  Asn Ile Glu Ala Tyr  Leu Lys Glu
    1400                1405                1410


Lys Glu  Leu Val Glu Lys Asp  Val Lys Leu Gln Phe  Ile Leu Ser
    1415                1420                1425


Pro Asn  Asp Leu Val Tyr Leu  Pro Thr Glu Gly Ser  Ile Asp Lys
    1430                1435                1440


Lys Arg  Ile Tyr Lys Val Val  Ser Phe Thr Asn Asn  Arg Leu Tyr
    1445                1450                1455


Ala Ile  Pro Tyr Ala Ile Ala  Lys Ser Ile Val Asp  Lys Asn Glu
    1460                1465                1470


Phe Thr  Gln Leu Asn Lys Ile  Glu Phe Thr Asp Asn  Lys Glu Ser
    1475                1480                1485


Ile Lys  Asp Ala Cys Val Pro  Val Ile Ile Asp Arg  Leu Gly Asn
    1490                1495                1500


Val Ile  Glu Phe Asn Gly Lys  Arg Leu
    1505                1510


<210>  127
<211>  1259
<212>  PRT
<213>  Streptobacillus moniliformis

<400>  127

Met Lys Tyr Ile Leu Gly Leu Asp Leu Gly Val Ala Ser Ile Gly Trp
1               5                  10                  15


Ala Val Thr Glu Ile Asn Glu Lys Gly Glu Pro Val Gly Leu Ile Asp
            20                  25                  30
```

```
Ala Asn Ser Val Ile Phe Lys Pro Leu Asp Asn Asp Lys Gly Lys Leu
        35                  40                  45

Tyr Asn Val Glu Arg Arg Asp Lys Arg Gly Ser Arg Arg Ile Leu Arg
    50                  55                  60

Arg Lys Lys His Arg Val Glu Arg Thr Lys Met Leu Leu Val Asn Ser
65                  70                  75                  80

Ser Phe Leu Thr Asn Glu Glu Ile Asp Asn Leu Tyr Val Gly Lys Leu
                85                  90                  95

Asp Asn Ile Tyr Glu Val Arg Leu Lys Gly Leu Lys Glu Gln Leu Ser
            100                 105                 110

Lys Asn Glu Ile Ala Arg Leu Met Ile Tyr Tyr Cys Lys Asn Arg Gly
        115                 120                 125

Phe Lys Ser Asn Arg Lys Thr Glu Asp Leu Glu Ile Leu Lys Ser Leu
    130                 135                 140

Gly Glu Lys Ile Ser Glu Lys Asp Ser Asp Glu Lys Lys Leu Lys Pro
145                 150                 155                 160

Ile Ile Ala Lys Asn Thr Glu Leu Ile Glu Ser Lys Gly Leu Thr Pro
                165                 170                 175

Ile Glu Val Ile Tyr Met Ile Arg Glu Asn Asp Asn Ser Ile Leu Gly
            180                 185                 190

Phe Lys Asn Lys Glu Gly Asn Tyr Lys Phe Gly Phe Lys Arg Asn Gln
        195                 200                 205

Val Ile Asp Glu Val Arg Lys Ile Leu Gly Thr Gln Gln Ile Leu Ser
    210                 215                 220

Lys Glu Ile Val Asp Glu Tyr Ile Asp Ile Leu Ser Ser Gln Arg Asp
```

```
225                 230                 235                 240

Phe Ser Asp Gly Pro Gly Gly Asp Ser Lys Tyr Lys Ile Asp Tyr Thr
                245                 250                 255

Lys Leu Ala Gly Lys Cys Lys Tyr Thr Gly Glu Val Arg Ala Val Lys
            260                 265                 270

Ser Ala Pro Ser Tyr Glu Ile Phe Thr Met Leu Gln Lys Leu Asn Asp
        275                 280                 285

Ile Arg Tyr Val Lys Phe Thr Ser Glu Asp Lys Ile Glu Lys Lys Lys
    290                 295                 300

Leu Ser Lys Glu Val Ile His Lys Leu Tyr Asp Leu Val Val Glu Lys
305                 310                 315                 320

Asn Lys Thr Leu Thr Tyr Asp Leu Ile Glu Lys Ser Ile Asp Glu Glu
                325                 330                 335

Asn Ile Lys Leu Leu Asn Ile Pro Lys Leu Ser Lys Ser Lys Tyr Val
            340                 345                 350

Glu Leu Arg Lys Ser Tyr Phe Lys Glu Arg Asn Asp Asn Glu Asn Leu
        355                 360                 365

Thr Glu Glu Glu Ile Asn Ala Phe Asn Glu Lys Leu Asn Asn Glu Arg
    370                 375                 380

Met Lys Gln Glu Leu Ile Arg Asn Asn Leu Lys Ala Tyr Lys Glu Leu
385                 390                 395                 400

Lys Ser Lys Phe Lys Lys Asn Asn Ile Asp Glu Asn Arg Ile Lys Glu
                405                 410                 415

Leu Gly Gly Ile Tyr Phe Leu Asp Leu Val Ala Glu Leu Leu Thr Tyr
            420                 425                 430
```

```
Ser Lys Thr Asp Glu Lys Leu Glu Tyr Phe Val Glu Asn Val Glu Arg
        435                 440                 445

Tyr Ser Leu Phe Lys Glu Gln Arg Asp Ile Val Glu Ile Ile Lys Thr
    450                 455                 460

Phe Pro Asn Tyr Thr Lys Asn Gly Asn Leu Ser Leu Ser Leu Val Arg
465                 470                 475                 480

Glu Leu Asn Lys Leu Leu Met Glu Gly His Asp Tyr Glu Ser Ser Leu
                485                 490                 495

Ser Ser Leu Asn Tyr Tyr Ile Asp Thr Asp Val Asp Trp Glu Lys Phe
            500                 505                 510

Pro Thr Ile Ser Glu Ile Glu Asp Ser Leu Ser Thr Lys Ile Thr Asn
        515                 520                 525

Pro Asn Val Lys His Ile Leu Val Ile Leu Arg Lys Leu Tyr Asn Thr
    530                 535                 540

Leu Leu Phe Lys Tyr Gly Arg Pro Glu Lys Val His Leu Glu Leu Ser
545                 550                 555                 560

Arg Asp Phe Ser Asn Asp Phe Ser Thr Arg Asn Lys Ile Gln Lys Glu
                565                 570                 575

Gln Leu Glu Asn Lys Val Arg Arg Glu Val Ala Ala Phe Glu Met Tyr
            580                 585                 590

Gly Ala Asn Lys Asp Ile Val Ala Gly Lys Asp Arg Leu Ser Asn Asp
        595                 600                 605

Asp Phe Val Arg Ile Lys Leu Trp Glu Glu Gln Asn Lys Val Cys Met
    610                 615                 620

Tyr Ser Gly Arg Thr Ile Glu Lys Tyr Gln Leu Thr Ser Ala Glu Val
```

```
625                 630                 635                 640

Gln Ile Asp His Ile Leu Pro Tyr Ser Lys Ser Phe Asp Asn Ser Tyr
                645                 650                 655

Ser Asn Lys Val Leu Val Phe Ser Asn Glu Asn Gln Asp Lys Lys Glu
            660                 665                 670

Arg Thr Pro Tyr Gln Trp Leu Lys Gly Thr Glu Lys Trp Asn Glu Phe
        675                 680                 685

Lys Gln Arg Val Arg Leu Asn Leu Asn Ile Ser Asn Lys Lys Lys Glu
    690                 695                 700

Asn Leu Leu Phe Glu Asp Glu Val Val Asn Asn Glu Phe Leu Glu Arg
705                 710                 715                 720

Glu Leu His Ala Thr Ser Tyr Ser Ser Arg Leu Ala Leu Asn Ile Phe
                725                 730                 735

Gln Arg Leu Ile Pro Val Ser Asp Glu Asp Lys Tyr Asp Glu His Gly
            740                 745                 750

Asn Glu Lys Val Lys Tyr Leu Tyr Asn Arg Asn Val Ile Ala Phe Gln
        755                 760                 765

Gly Lys Met Thr Ser Met Leu Arg Asn Leu Tyr Ser Leu Asn Lys Tyr
    770                 775                 780

Thr His Ser Phe Glu Ser Asp Thr Leu Asp Ile Asp Asn Lys Ala Phe
785                 790                 795                 800

Ile Leu Lys Glu Phe Glu Ile Asn Lys Asp Asn Leu Lys Met Thr Ala
                805                 810                 815

Tyr Asn Val Asn Thr Gly Leu Glu Ile Thr Ser Glu Thr Lys Val Glu
            820                 825                 830
```

```
Lys Asn Lys Ser Gly Glu Phe Lys Thr Ile Lys Asp Glu Leu Leu Lys
        835                 840                 845

Lys Glu Leu Asp Lys Lys Glu Asn Leu Ile Glu Ile Ser Asp Tyr Phe
    850                 855                 860

Lys Asp Lys Val Leu Phe Asp Leu Lys Ile Val Asp Phe Glu Glu Ile
865                 870                 875                 880

Asp Thr Val Glu Pro Glu Ile Ile Ser Ile Leu Tyr Lys Met Ile Thr
                885                 890                 895

Ala Leu Lys Glu Glu Val Tyr Ser Lys Asn Arg Glu Asn His Leu His
            900                 905                 910

His Ser Leu Asp Ala Phe Leu Leu Thr Ile Met Asn Arg Ser Met Gln
        915                 920                 925

Met Lys Leu Ile Lys Tyr Asn Gln Leu Ile Ser Val Leu Lys Asn Lys
    930                 935                 940

Glu Ile Glu Ile Phe Asn Glu Glu Lys Gly Glu Tyr Ile Asp Ser Lys
945                 950                 955                 960

Glu Phe Ala Glu Glu Leu Gln Lys Gln Lys Ile Ile Asp Ile Asp Gly
                965                 970                 975

Asn Glu Arg Gly Ile Lys Phe Asn Val Asn Gly Lys Thr His Arg Leu
            980                 985                 990

Asn Leu Val Lys Pro Tyr Glu Asn  Phe Leu Asp Asp Ile  Lys Asn Lys
        995                 1000                1005

Ile Phe  Asp Lys Arg Glu Asn  Asn Lys Leu Pro Tyr  His Val Val
    1010                1015                1020

Lys Ser  Lys Val Ser Gly Ala  Leu His Ala Glu Thr  Ile Leu Gly
```

```
    1025                1030                1035

Glu Ser  Lys Gly Glu Ile Thr  Lys Arg Ile Ser Val  Phe Asp Ile
    1040                1045                1050

Asn Tyr  Lys Asn Leu Gly Lys  Ile Phe Asp Lys Asp  Gly Ser Gln
    1055                1060                1065

Lys Glu  Ile Tyr Glu Thr Leu  Val Lys Trp Leu Glu  Ala Lys Ser
    1070                1075                1080

Lys Asp  Tyr Pro Lys Leu Lys  Asn Gly Asn Ile Ile  Lys Lys Val
    1085                1090                1095

Lys Ile  Val Asp Gly Asn Lys  Asp Lys Leu Ile Lys  Leu Gly Asn
    1100                1105                1110

Lys Arg  Tyr Val Glu Met Gly  Arg Thr Thr Val Lys  Ile Leu Val
    1115                1120                1125

Leu Lys  Lys Glu Ala Glu Glu  Gly Leu Lys Phe Ala  Ser Ile Gly
    1130                1135                1140

Arg Tyr  Lys Tyr Asn Leu Leu  Lys Ser Glu Lys Asp  Val Asn Ile
    1145                1150                1155

Ser Ile  Trp Lys Asp Ala Ile  His Phe Cys Lys Val  Arg Tyr Asn
    1160                1165                1170

Lys Leu  Lys Glu Asn Gly Tyr  Arg Leu Ile His Glu  Leu Ile Pro
    1175                1180                1185

Gly Glu  Thr Ile Glu Leu Glu  Leu Asn Lys Gly Asn  Ile Ser Lys
    1190                1195                1200

Cys Leu  Val Val Gly Phe Ser  Gly Gly Lys Ile Glu  Ile Ser Ser
    1205                1210                1215
```

```
Val Ile  Gly Asp Ala Leu Asp  Leu Ile Asn Asp Lys  Ile Ser Thr
    1220                1225                1230


Arg Ile  Lys Glu Arg Tyr Tyr  Ile Thr Val Ser Thr  Ile Lys Ser
    1235                1240                1245


Ile Lys  Lys Ile Asn Lys Asn  Ile Leu Gly Asp
    1250                1255


<210>  128
<211>  1091
<212>  PRT
<213>  Mobiluncus mulieris

<400>  128

Met Asp Ser Arg Lys Tyr Arg Val Gly Ile Asp Val Gly Thr Asn Ser
1               5                   10                  15


Val Gly Phe Ala Ala Val Glu Glu Asp Asp Ser Gly Ser Pro Thr Arg
            20                  25                  30


Phe Leu Asn Thr Met Val Val Ile His Asp Ser Gly Val Asp Pro Glu
        35                  40                  45


Gln Lys Lys Tyr Ala Ile Thr Arg Leu Ala Ser Ala Gly Thr Ala Arg
    50                  55                  60


Arg Thr Arg Arg Leu Tyr Arg Thr Arg Arg Gln Arg Leu Arg Glu Leu
65                  70                  75                  80


Asp Asp Phe Ile Ser Asn Glu Leu Gly Tyr Pro Leu Val Asn Leu Glu
                85                  90                  95


Asn Phe Ala Asp Pro Tyr Glu Pro Trp Lys Val Arg Ala Asp Leu Ala
            100                 105                 110


Thr Thr Lys Leu Pro Asn Asp Glu Leu Pro Glu Ala Met Ser Ile Ala
        115                 120                 125
```

```
Leu Arg His Met Ala Arg His Arg Gly Trp Arg Ser Pro Tyr Gln Arg
    130                 135                 140

Val Glu Ala Leu His Leu His Ala Glu Ile Ser Lys Glu Phe Ala Ala
145                 150                 155                 160

Leu Lys Glu Arg Val Val Glu Lys Thr Gly Asp Val Phe Ser Asp Asp
                165                 170                 175

Ala Thr Pro Ala Glu Val Leu Val Asp Leu Met Gly Arg Gln Lys Val
            180                 185                 190

Arg Gly Ala Asp Gly Val Leu Ser Gly Lys Leu Arg Gln Ser Asp Asn
        195                 200                 205

Ala Asn Glu Leu Arg Lys Ile Ala Ser Val Gln Gly Ile Asp Asp Glu
    210                 215                 220

Thr Leu Asn Arg Ile Ile Asp Arg Val Phe Ser Ser Lys Ser Pro Lys
225                 230                 235                 240

Gly Lys Ala Ser Glu Arg Val Gly Met Asp Ala Leu Pro Gly Gln Gly
                245                 250                 255

Ser Lys Pro Arg Ala Leu Lys Ala Met Pro Ser Phe Gln Lys Phe Arg
            260                 265                 270

Val Val Ser Val Ile Cys Asn Leu Arg Ile Lys Asp Ser Gly Gly Asp
        275                 280                 285

Ala Arg Pro Leu Ser Met Glu Glu Lys Glu Lys Leu Ile Asp Tyr Leu
    290                 295                 300

Met Ser Ser Thr Thr Asp Asp His Val Thr Trp Thr Asp Val Ala Asp
305                 310                 315                 320
```

```
Leu Leu His Val Lys Arg Ser Gln Leu Gln Gly Thr Ala Lys Glu Gly
                325                 330                 335

Phe Asp Gly Glu Arg Pro Tyr Thr Arg Pro Pro Val Asn Ser Thr Trp
            340                 345                 350

Ser Lys Ile Lys Asp Ser Lys Ile Lys Ser Leu Val Ala Leu Trp Lys
        355                 360                 365

Thr Gly Asp Val Asp Val Gln Ser Ala Ile Val Glu Ala Leu Ser Asn
    370                 375                 380

Ala Ser Val Leu Glu Asp Ser Arg Pro Gly Ala Asp Ile Val Val Ala
385                 390                 395                 400

Tyr Leu Glu Ser Leu Asp Asp Lys Glu Leu Glu Ser Leu Asp Lys Val
                405                 410                 415

Gly Leu Pro Ala Gly Arg Ala Ser Tyr Ser Glu Asp Ser Leu Glu Arg
            420                 425                 430

Leu Thr Glu Arg Met Leu Arg Asp Asp Cys Asp Leu Phe Glu Ala Arg
        435                 440                 445

Lys Arg Glu Phe Asn Val Ala Asp Asp Trp Lys Pro Pro Ala Asp Pro
    450                 455                 460

Ile Tyr Ala Pro Val Gly Asn Pro Gly Val Asp Arg Val Leu Lys Ile
465                 470                 475                 480

Val Asn Arg Leu Leu Met Ala Ala Glu Arg Glu Trp Gly Ala Pro Thr
                485                 490                 495

Gln Ile Asn Ile Glu His Val Arg Ser Gly Phe Ser Ser Glu Leu Met
            500                 505                 510

Gln Arg Glu Phe Glu Arg Glu Asn Glu Arg Arg Arg Ala Gln Asn Glu
        515                 520                 525
```

```
Glu Ala Val Lys Ala Ile Leu Thr Glu Lys Gly Gly Asn Ser Arg Val
    530                 535                 540

Ser Lys Tyr Asp Ile Thr Arg Tyr Tyr Ala Val Lys Arg Gln His Cys
545                 550                 555                 560

Gln Cys Leu Tyr Cys Gly Thr Pro Ile Thr Phe Ser Asp Cys Glu Leu
                565                 570                 575

Asp His Ile Val Pro Arg Lys Gly Val Gly Ser Thr Asn Thr Arg Val
            580                 585                 590

Asn Leu Ala Ala Ala Cys Arg Ser Cys Asn Arg Asp Lys Ser Asn Leu
        595                 600                 605

Pro Phe Ala Val Trp Ala Gly Lys Ala Ser Asn Phe Asp Val Ser Ile
    610                 615                 620

Asp Asp Ala Val Ser Arg Val Lys Gln Trp Gln Arg Ser Gln Asn Glu
625                 630                 635                 640

Gly Val Arg Glu Phe Arg Ala Phe Gln Asn Glu Val Ile Ser Arg Leu
                645                 650                 655

Leu Lys Thr Thr Glu Asp Pro Glu Ile Asp Ser Arg Ser Leu Glu Ser
            660                 665                 670

Val Ala Trp Met Ala Arg Glu Leu His His Arg Val Glu Tyr Tyr Phe
        675                 680                 685

Gln Ser Lys Gly Ala Gln Thr Gln Val Ser Val Tyr Arg Gly Ala Val
    690                 695                 700

Thr Ala Gln Ala Arg Lys Ser Ser Gly Leu Glu Asp Lys Val Lys Met
705                 710                 715                 720
```

```
Ile Gly Gly Gly Gly Lys Thr Arg Leu Asp Arg Arg His His Ala Met
                725                 730                 735

Asp Ala Ala Thr Ile Ala Leu Met Thr Pro Gly Ile Ser Thr Thr Leu
            740                 745                 750

Ser Glu Lys Asn Asn Leu Arg Asp Ala Gln Lys Phe Thr Gly Gln Ser
        755                 760                 765

Glu Thr Trp Lys Asp Tyr Cys Gly Arg Thr Glu Thr Ala Arg Lys His
    770                 775                 780

Phe Ala Val Trp Lys Ser Asn Met Glu Arg Leu Thr Asp Leu Phe Asn
785                 790                 795                 800

Asp Lys Leu Glu Asn Asp Ala Ile Pro Val Val Gln Pro Leu Arg Leu
                805                 810                 815

Arg Leu Ser Asn Ser Lys Ala His Asp Asp Gly Ile Gly Lys Leu Asp
            820                 825                 830

Ser Lys Lys Leu Gly Ser Val Trp Ser Leu Ala Asp Ile Asp Arg Ala
        835                 840                 845

Ala Thr Pro Gln Ile Trp Thr Ala Leu Thr Arg Cys Asp Asp Phe Asp
    850                 855                 860

Pro Thr Lys Gly Leu Pro Glu Asn Ala Asn Arg Val Ile Arg Ala Gln
865                 870                 875                 880

Gly Val Lys Tyr Glu Ser Glu Asp Asn Ile Pro Val Phe Pro Ser Asn
                885                 890                 895

Val Ala Ala Ile Ala Val Arg Asp Gly Tyr Ala Glu Ile Gly Ser Thr
            900                 905                 910

Ile His His Ala Arg Ile Tyr Arg Ile Asp Asp Gly Lys Lys Thr Phe
        915                 920                 925
```

```
Tyr Ser Met Ile Arg Val Phe Ala Val Asp Leu Leu Lys His Gln Ala
    930                 935                 940

Glu Asp Leu Phe Thr Val Lys Leu Pro Pro Ser Ala Ile Ser Ile Arg
945                 950                 955                 960

Thr Cys Glu Asp Ser Leu Arg Arg Ala Leu Ser Asn Gly Thr Ala Glu
                965                 970                 975

Tyr Leu Gly Trp Leu Val Pro Gly Asp Glu Ile Ile Val Asp Thr Ser
            980                 985                 990

Asp Lys Ala Phe His Thr Gly Gln  Ile Gly Asp Leu Leu  Arg Asn Phe
        995                 1000                1005

Pro Val  Asn Ser Phe Arg Leu  Thr Gly Phe Pro Ser  Asn Ser Arg
    1010                1015                1020

Leu Arg  Leu Lys Pro Val Leu  Leu Ala Gly Glu Gly  Leu Arg Asp
    1025                1030                1035

Asp Ala  Glu Asp Ser Ile Lys  Lys Ile Leu Leu Gly  Gln Gly Trp
    1040                1045                1050

Arg Pro  Ala Ile Asn Val Leu  Phe Ser Lys Gly Lys  Pro Arg Ile
    1055                1060                1065

Val Arg  Arg Asn Ser Leu Gly  Ile Glu Arg Pro Ser  Ser Asn Asn
    1070                1075                1080

Gly Leu  Pro Phe Ser Trp Glu  Ala
    1085                1090
```

<210> 129
<211> 872
<212> PRT
<213> Candidatus Parvarchaeum

<400> 129

```
Met Leu Gly Ser Ser Arg Tyr Leu Arg Tyr Asn Leu Thr Ser Phe Glu
1               5                  10                  15

Gly Lys Glu Pro Phe Leu Ile Met Gly Tyr Tyr Lys Glu Tyr Asn Lys
            20                  25                  30

Glu Leu Ser Ser Lys Ala Gln Lys Glu Phe Asn Asp Gln Ile Ser Glu
        35                  40                  45

Phe Asn Ser Tyr Tyr Lys Leu Gly Ile Asp Leu Gly Asp Lys Thr Gly
    50                  55                  60

Ile Ala Ile Val Lys Gly Asn Lys Ile Ile Leu Ala Lys Thr Leu Ile
65                  70                  75                  80

Asp Leu His Ser Gln Lys Leu Asp Lys Arg Arg Glu Ala Arg Arg Asn
                85                  90                  95

Arg Arg Thr Arg Leu Ser Arg Lys Lys Arg Leu Ala Arg Leu Arg Ser
            100                 105                 110

Trp Val Met Arg Gln Lys Val Gly Asn Gln Arg Leu Pro Asp Pro Tyr
        115                 120                 125

Lys Ile Met His Asp Asn Lys Tyr Trp Ser Ile Tyr Asn Lys Ser Asn
    130                 135                 140

Ser Ala Asn Lys Lys Asn Trp Ile Asp Leu Leu Ile His Ser Asn Ser
145                 150                 155                 160

Leu Ser Ala Asp Asp Phe Val Arg Gly Leu Thr Ile Ile Phe Arg Lys
                165                 170                 175

Arg Gly Tyr Leu Ala Phe Lys Tyr Leu Ser Arg Leu Ser Asp Lys Glu
            180                 185                 190
```

```
Phe Glu Lys Tyr Ile Asp Asn Leu Lys Pro Pro Ile Ser Lys Tyr Glu
        195                 200                 205

Tyr Asp Glu Asp Leu Glu Glu Leu Ser Ser Arg Val Glu Asn Gly Glu
    210                 215                 220

Ile Glu Glu Lys Lys Phe Glu Gly Leu Lys Asn Lys Leu Asp Lys Ile
225                 230                 235                 240

Asp Lys Glu Ser Lys Asp Phe Gln Val Lys Gln Arg Glu Glu Val Lys
                245                 250                 255

Lys Glu Leu Glu Asp Leu Val Asp Leu Phe Ala Lys Ser Val Asp Asn
            260                 265                 270

Lys Ile Asp Lys Ala Arg Trp Lys Arg Glu Leu Asn Asn Leu Leu Asp
        275                 280                 285

Lys Lys Val Arg Lys Ile Arg Phe Asp Asn Arg Phe Ile Leu Lys Cys
    290                 295                 300

Lys Ile Lys Gly Cys Asn Lys Asn Thr Pro Lys Lys Glu Lys Val Arg
305                 310                 315                 320

Asp Phe Glu Leu Lys Met Val Leu Asn Asn Ala Arg Ser Asp Tyr Gln
                325                 330                 335

Ile Ser Asp Glu Asp Leu Asn Ser Phe Arg Asn Glu Val Ile Asn Ile
            340                 345                 350

Phe Gln Lys Lys Glu Asn Leu Lys Lys Gly Glu Leu Lys Gly Val Thr
        355                 360                 365

Ile Glu Asp Leu Arg Lys Gln Leu Asn Lys Thr Phe Asn Lys Ala Lys
    370                 375                 380

Ile Lys Lys Gly Ile Arg Glu Gln Ile Arg Ser Ile Val Phe Glu Lys
```

```
385                 390                 395                 400

Ile Ser Gly Arg Ser Lys Phe Cys Lys Glu His Leu Lys Glu Phe Ser
                405                 410                 415

Glu Lys Pro Ala Pro Ser Asp Arg Ile Asn Tyr Gly Val Asn Ser Ala
            420                 425                 430

Arg Glu Gln His Asp Phe Arg Val Leu Asn Phe Ile Asp Lys Lys Ile
        435                 440                 445

Phe Lys Asp Lys Leu Ile Asp Pro Ser Lys Leu Arg Tyr Ile Thr Ile
    450                 455                 460

Glu Ser Pro Glu Pro Glu Thr Glu Lys Leu Glu Lys Gly Gln Ile Ser
465                 470                 475                 480

Glu Lys Ser Phe Glu Thr Leu Lys Glu Lys Leu Ala Lys Glu Thr Gly
                485                 490                 495

Gly Ile Asp Ile Tyr Thr Gly Glu Lys Leu Lys Lys Asp Phe Glu Ile
            500                 505                 510

Glu His Ile Phe Pro Arg Ala Arg Met Gly Pro Ser Ile Arg Glu Asn
        515                 520                 525

Glu Val Ala Ser Asn Leu Glu Thr Asn Lys Glu Lys Ala Asp Arg Thr
    530                 535                 540

Pro Trp Glu Trp Phe Gly Gln Asp Glu Lys Arg Trp Ser Glu Phe Glu
545                 550                 555                 560

Lys Arg Val Thr Ser Leu Tyr Ser Lys Lys Lys Ile Ser Glu Arg Lys
                565                 570                 575

Arg Glu Ile Leu Leu Asn Lys Ser Asn Glu Tyr Pro Gly Leu Asn Pro
            580                 585                 590
```

```
Thr Glu Leu Ser Arg Ile Pro Ser Thr Leu Ser Asp Phe Val Glu Ser
        595                 600                 605

Ile Arg Lys Met Phe Val Lys Tyr Gly Tyr Glu Glu Pro Gln Thr Leu
    610                 615                 620

Val Gln Lys Gly Lys Pro Ile Ile Gln Val Val Arg Gly Arg Asp Thr
625                 630                 635                 640

Gln Ala Leu Arg Trp Arg Trp His Ala Leu Asp Ser Asn Ile Ile Pro
                645                 650                 655

Glu Lys Asp Arg Lys Ser Ser Phe Asn His Ala Glu Asp Ala Val Ile
            660                 665                 670

Ala Ala Cys Met Pro Pro Tyr Tyr Leu Arg Gln Lys Ile Phe Arg Glu
        675                 680                 685

Glu Ala Lys Ile Lys Arg Lys Val Ser Asn Lys Glu Lys Glu Val Thr
    690                 695                 700

Arg Pro Asp Met Pro Thr Lys Lys Ile Ala Pro Asn Trp Ser Glu Phe
705                 710                 715                 720

Met Lys Thr Arg Asn Glu Pro Val Ile Glu Val Ile Gly Lys Val Lys
                725                 730                 735

Pro Ser Trp Lys Asn Ser Ile Met Asp Gln Thr Phe Tyr Lys Tyr Leu
            740                 745                 750

Leu Lys Pro Phe Lys Asp Asn Leu Ile Lys Ile Pro Asn Val Lys Asn
        755                 760                 765

Thr Tyr Lys Trp Ile Gly Val Asn Gly Gln Thr Asp Ser Leu Ser Leu
    770                 775                 780

Pro Ser Lys Val Leu Ser Ile Ser Asn Lys Lys Val Asp Ser Ser Thr
```

785 790 795 800

Val Leu Leu Val His Asp Lys Lys Gly Gly Lys Arg Asn Trp Val Pro
805 810 815

Lys Ser Ile Gly Gly Leu Leu Val Tyr Ile Thr Pro Lys Asp Gly Pro
820 825 830

Lys Arg Ile Val Gln Val Lys Pro Ala Thr Gln Gly Leu Leu Ile Tyr
835 840 845

Arg Asn Glu Asp Gly Arg Val Asp Ala Val Arg Glu Phe Ile Asn Pro
850 855 860

Val Ile Glu Met Tyr Asn Asn Gly
865 870

<210> 130
<211> 1229
<212> PRT
<213> Pediococcus acidilactici

<400> 130

Met Gly Asp Arg Lys Tyr Asn Leu Gly Leu Asp Ile Gly Thr Ser Ser
1 5 10 15

Ile Gly Phe Ala Ala Val Asp Glu Asn Asn Gln Pro Ile Arg Val Lys
20 25 30

Gly Lys Thr Ala Ile Gly Val Arg Leu Phe Glu Glu Gly Lys Thr Ala
35 40 45

Ala Asp Arg Arg Gly Phe Arg Thr Thr Arg Arg Arg Leu Ser Arg Arg
50 55 60

Arg Trp Arg Ile Asn Leu Leu Asn Glu Ile Phe Asp Ala His Leu Ala
65 70 75 80

```
Glu Val Asp Pro Thr Phe Leu Ala Arg Leu Lys Glu Ser Asn Arg Ser
                85                  90                  95

Asn Leu Asp Pro Lys Lys Ser Phe Gln Gly Ser Leu Leu Phe Pro Glu
            100                 105                 110

Arg Lys Asp Tyr Gln Phe Tyr Glu Glu Tyr Pro Thr Ile Tyr His Leu
        115                 120                 125

Arg Lys Ala Leu Met Glu Lys Asp Arg Lys Phe Asp Ile Arg Glu Ile
    130                 135                 140

Tyr Leu Ala Val His His Ile Ile Lys Tyr Arg Gly Asn Phe Leu Asn
145                 150                 155                 160

Gly Thr Pro Met Arg Ser Phe Lys Val Glu Asn Ile Glu Leu Asn Thr
                165                 170                 175

Leu Phe Asp Gln Leu Asn Gln Leu Tyr Ala Glu Ile Val Pro Asp Asn
            180                 185                 190

Glu Leu Ala Phe Asp Leu Ala Gln Val Ala Asp Val Lys Asp Val Leu
        195                 200                 205

Ser Ser Thr Thr Ile Tyr Lys Met Asp Lys Lys Lys Gln Leu Val Lys
    210                 215                 220

Met Met Leu Leu Pro Ala Ser Asn Lys Ala Leu Gln Ser Glu Asn Lys
225                 230                 235                 240

Lys Ile Val Thr Gln Phe Val Asn Ala Ile Leu Asn Tyr Lys Phe Lys
                245                 250                 255

Leu Asp Val Leu Leu Gln Val Glu Thr Asp Ala Asp Trp Ser Leu Lys
            260                 265                 270

Leu Asn Asp Glu Gly Ala Asp Asp Lys Leu Glu Glu Phe Thr Gly Asp
        275                 280                 285
```

```
Leu Asp Glu Asn Arg Leu Glu Ile Ile Asp Leu Leu Gln Arg Leu His
    290                 295                 300

Asn Trp Phe Ser Leu Asn Glu Ile Thr Lys Asp Gly Asn Ser Leu Ser
305                 310                 315                 320

Ala Ala Met Val Glu Lys Tyr Glu Asn His His His His Leu Gly Leu
                325                 330                 335

Leu Lys Lys Val Ile Glu Asn His Pro Asp Ala Lys Lys Ala Lys Ala
            340                 345                 350

Leu Lys Glu Thr Tyr Thr Ala Tyr Val Gly Lys Thr Asp Asp Lys Thr
        355                 360                 365

Gln Asn Gln Asp Asp Phe Tyr Lys Ala Val Glu Lys Asn Leu Asp Asp
    370                 375                 380

Ser Pro Asp Ala Lys Gly Ile Lys Arg Leu Ile Gln Leu Asp Gln Phe
385                 390                 395                 400

Met Pro Lys Gln Arg Thr Gly Gln Asn Gly Ala Ile Pro His Gln Leu
                405                 410                 415

His Gln Gln Glu Leu Asp Gln Ile Ile Glu Lys Gln Ser Lys Tyr Tyr
            420                 425                 430

Pro Phe Leu Ala Glu Pro Asn Pro Asn Val Lys Arg Arg Lys Asp Ala
        435                 440                 445

Pro Tyr Lys Leu Asp Glu Leu Ile Ala Phe Lys Ile Pro Tyr Tyr Val
    450                 455                 460

Gly Pro Leu Val Thr Pro Glu Glu Gln Ala Gln Asn Lys Glu Asn Val
465                 470                 475                 480
```

```
Phe Ala Trp Met Lys Arg Lys Ala Ala Gly Pro Ile Thr Pro Trp Asn
                485                 490                 495

Phe Asp Glu Lys Val Asp Arg Met Glu Ser Ala Asn Arg Phe Ile Arg
            500                 505                 510

Arg Met Thr Thr Lys Asp Thr Tyr Leu Phe Gly Glu Asp Val Leu Pro
        515                 520                 525

Ala Glu Ser Met Ile Tyr Gln Lys Phe Val Val Leu Asn Glu Leu Asn
    530                 535                 540

Asn Leu Lys Ile Asn Gly Arg His Leu Ser Leu Lys Asp Lys Gln Asp
545                 550                 555                 560

Val Tyr Asn Asp Leu Phe Lys Gln Gln Lys Thr Val Ser Ile Lys Ala
                565                 570                 575

Leu Gln Asn Tyr Tyr Val Thr Lys Lys Lys Ala Ala Thr Ala Pro Thr
            580                 585                 590

Val Gly Gly Leu Ala Asp Pro Lys Lys Phe Leu Ser Ser Leu Ser Thr
        595                 600                 605

Tyr Ile Asp Phe Lys Asn Met Phe Gly Glu Arg Val Asn Asp Pro Gln
    610                 615                 620

Phe Gln Glu Asp Leu Glu Gln Ile Val Glu Trp Ser Thr Ile Phe Glu
625                 630                 635                 640

Asp Arg Gly Ile Phe Lys Ala Lys Leu Gln Ala Leu Gly Trp Leu Ser
                645                 650                 655

Glu Lys Gln Ile Gln Gln Leu Val Ala Lys Arg Tyr Lys Gly Trp Gly
            660                 665                 670

Arg Leu Ser Lys Lys Leu Leu Thr Gly Leu Lys Asn Ala Glu Gly Tyr
        675                 680                 685
```

```
Ser Ile Leu Asp Glu Met Trp Arg Ser Thr Glu Asn Phe Met Gln Ile
    690                 695                 700

Gln Ser Arg Pro Glu Phe Ala Ala Leu Ile Gln Gln Ala Asn Glu Lys
705                 710                 715                 720

Gln Phe Glu Gly Asn Asp Pro Asp Asn Val Trp Glu Asn Ile Glu Asn
                725                 730                 735

Ile Leu Gly Asp Ala Tyr Thr Ser Pro Gln Asn Lys Lys Ala Ile Arg
            740                 745                 750

Gln Val Val Lys Val Val Gln Asp Ile Glu Lys Ala Val Gly Asn Pro
        755                 760                 765

Pro Glu Lys Ile Ala Ile Glu Phe Thr Arg Glu Ala Ala Ala Asn Pro
    770                 775                 780

Gln Arg Thr Gln Ser Arg Leu Arg Thr Leu Glu Lys Leu Tyr Glu Ser
785                 790                 795                 800

Ala Glu Glu Val Val Asp Ala Gly Leu Thr Ala Glu Leu Ala Glu Phe
                805                 810                 815

Lys Glu Asn Lys His Val Leu Ser Asp Lys Tyr Tyr Leu Tyr Phe Thr
            820                 825                 830

Gln Leu Gly Arg Asp Val Tyr Thr Gly Asp Thr Ile Ser Leu Asp Lys
        835                 840                 845

Leu Asn Asp Tyr Asp Val Asp His Ile Leu Pro Gln Ser Phe Ile Lys
    850                 855                 860

Asp Asp Ser Leu Asp Asn Arg Val Leu Thr Ile Arg Ala Val Asn Asn
865                 870                 875                 880
```

```
Gly Lys Ser Asp Asn Val Pro Ala Lys Met Phe Gly Lys Lys Met Gly
               885                 890                 895

Ser Phe Trp Arg His Leu Leu Asp Asn Gly Met Ile Ser Lys Arg Lys
            900                 905                 910

Tyr Asn Asn Leu Ile Thr Asp Pro Asp Asn Ile Ser Lys Tyr Ala Gln
        915                 920                 925

Lys Gly Phe Ile Asn Arg Gln Leu Val Glu Thr Ser Gln Val Ile Lys
    930                 935                 940

Leu Thr Ala Asn Ile Leu Asn Gly Ile Tyr Asp Lys Asp Thr Glu Ile
945                 950                 955                 960

Ile Glu Val Pro Ala Lys Met Asn Ser Gln Met Arg Lys Met Phe Asp
               965                 970                 975

Leu Val Lys Val Arg Glu Val Asn Asp Tyr His His Ala Phe Asp Ala
            980                 985                 990

Tyr Leu Thr Ile Phe Ile Gly Asn  Tyr Leu Tyr Lys Cys  Tyr Pro Lys
        995                 1000                1005

Leu Arg  Pro Tyr Phe Val Tyr  Asp Asn Phe Lys Lys  Phe Gly Asn
    1010                1015                1020

Lys Glu  Asp Ile Gly His Lys  Arg Phe Asn Phe Leu  Gly Lys Ile
    1025                1030                1035

Glu Arg  Glu Lys Lys Val Val  Ala Pro Glu Thr Gly  Glu Ile Leu
    1040                1045                1050

Trp Ser  Asn Val Ala Pro Asn  Glu Thr Ile Lys Gln  Ile Lys Lys
    1055                1060                1065

Val Tyr  Asn Tyr Lys Phe Met  Ile Val Ser Arg Glu  Ile Thr Thr
    1070                1075                1080
```

```
Arg Arg  Ala Glu Leu Phe Asn  Gln Thr Val Tyr Pro  Lys Asn Tyr
    1085                1090                1095


Arg Gly  Lys Leu Ile Pro Ile  Lys Glu Asp Arg Pro  Thr Asp Leu
    1100                1105                1110


Tyr Gly  Gly Tyr Ser Gly Asn  Thr Asp Ala Tyr Leu  Ala Ile Val
    1115                1120                1125


Ala Leu  Glu Asp Lys Lys Lys  Gly Lys Tyr Phe Lys  Val Val Gly
    1130                1135                1140


Ile Pro  Thr Arg Ala Ala Ala  Lys Leu Glu Lys Leu  Lys Gln Gln
    1145                1150                1155


Asp Ser  Gln Gln Tyr Leu Gln  Ala Leu His Glu Val  Ile Ala Pro
    1160                1165                1170


Gln Phe  Thr Lys Ser Thr Lys  Lys Gly Ile Lys Lys  Thr Glu Phe
    1175                1180                1185


Glu Ile  Val Leu Asp Lys Val  His Tyr Arg Gln Leu  Val Gln Asp
    1190                1195                1200


Gly Pro  Val Lys Met Met Leu  Gly Ser Ser Thr Tyr  Lys Tyr Asn
    1205                1210                1215


Ala Lys  Gln Leu Val Leu Ser  Glu Lys Ala Leu
    1220                1225


<210>  131
<211>  1398
<212>  PRT
<213>  Veillonella parvula

<400>  131

Met Glu Thr Gln Ala Ser Asn Gln Leu Ile Ser Ser His Leu Lys Gly
```

```
1               5                   10                  15

Tyr Pro Ile Lys Asp Tyr Phe Val Gly Leu Asp Ile Gly Thr Ser Ser
            20                  25                  30

Val Gly Trp Ala Val Thr Asn Lys Ala Tyr Glu Leu Leu Lys Phe Arg
        35                  40                  45

Ser His Lys Met Trp Gly Ser Arg Leu Phe Asp Glu Gly Glu Ser Ala
    50                  55                  60

Val Ala Arg Arg Gly Phe Arg Ser Met Arg Arg Arg Leu Glu Arg Arg
65                  70                  75                  80

Lys Leu Arg Leu Lys Leu Leu Glu Glu Leu Phe Ala Asp Ala Met Ala
                85                  90                  95

Gln Val Asp Pro Thr Phe Phe Met Arg Leu Arg Glu Ser Lys Tyr His
            100                 105                 110

Tyr Glu Asp Lys Thr Thr Gly His Ser Ser Lys His Ile Leu Phe Ile
        115                 120                 125

Asp Lys Asn Tyr Asn Asp Gln Asp Tyr Phe Lys Glu Tyr Pro Thr Val
    130                 135                 140

Tyr His Leu Arg Ser Glu Leu Met Lys Ser Gly Thr Asp Asp Ile Arg
145                 150                 155                 160

Lys Leu Phe Leu Ala Val His His Ile Leu Lys Tyr Arg Gly Asn Phe
                165                 170                 175

Leu Tyr Glu Gly Ala Thr Phe Asp Ser Asn Ala Ser Thr Leu Asp Asp
            180                 185                 190

Val Ile Lys Gln Ala Leu Glu Asn Ile Thr Phe Asn Cys Phe Asp Cys
        195                 200                 205
```

```
Asn Ser Ala Ile Ser Ser Ile Gly Gln Ile Leu Met Glu Ala Gly Lys
    210                 215                 220

Thr Lys Ser Asp Lys Ala Lys Ala Ile Glu His Leu Val Asp Thr Tyr
225                 230                 235                 240

Ile Ala Thr Asp Thr Val Asp Thr Ser Ser Lys Thr Gln Lys Asp Gln
                245                 250                 255

Val Lys Glu Asp Lys Lys Arg Leu Lys Ala Phe Ala Asn Leu Val Leu
            260                 265                 270

Gly Leu Asn Ala Ser Leu Ile Asp Leu Phe Gly Ser Val Glu Glu Leu
        275                 280                 285

Glu Glu Asp Leu Lys Lys Leu Gln Ile Thr Gly Asp Thr Tyr Asp Asp
    290                 295                 300

Lys Arg Asp Glu Leu Ala Lys Ala Trp Ser Asp Glu Ile Tyr Ile Ile
305                 310                 315                 320

Asp Asp Cys Lys Ser Val Tyr Asp Ala Ile Ile Leu Leu Ser Ile Lys
                325                 330                 335

Glu Pro Gly Leu Thr Ile Ser Glu Ser Lys Val Lys Ala Phe Asn Lys
            340                 345                 350

His Lys Asp Asp Leu Ala Ile Leu Lys Ser Leu Leu Lys Ser Asp Arg
        355                 360                 365

Ser Ile Tyr Asn Thr Met Phe Lys Val Asp Glu Lys Gly Leu His Asn
    370                 375                 380

Tyr Val His Tyr Ile Lys Gln Gly Arg Thr Glu Glu Thr Ser Cys Asn
385                 390                 395                 400

Arg Glu Asp Phe Tyr Lys Tyr Thr Lys Lys Ile Val Glu Gly Leu Ser
```

```
                405                 410                 415

Asp Ser Lys Asp Lys Glu Tyr Ile Leu Ser Gln Ile Glu Leu Gln Ile
            420                 425                 430

Leu Leu Pro Leu Gln Arg Ile Lys Asp Asn Gly Val Ile Pro Tyr Gln
        435                 440                 445

Leu His Leu Glu Glu Leu Lys Ala Ile Leu Ala Lys Cys Gly Pro Lys
    450                 455                 460

Phe Pro Phe Leu Asn Glu Val Ala Asp Gly Phe Ser Val Ala Glu Lys
465                 470                 475                 480

Leu Ile Lys Met Leu Glu Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu
                485                 490                 495

Asn Thr His His Asn Val Asp Asn Gly Gly Phe Ala Trp Ala Val Arg
            500                 505                 510

Lys Ala Ser Gly Arg Val Thr Pro Trp Asn Phe Asp Asp Lys Ile Asp
        515                 520                 525

Arg Glu Lys Ser Ala Ala Ala Phe Ile Lys Asn Leu Thr Asn Lys Cys
    530                 535                 540

Thr Tyr Leu Leu Gly Glu Asp Val Leu Pro Lys Ser Ser Leu Leu Tyr
545                 550                 555                 560

Ser Glu Phe Met Leu Leu Asn Glu Leu Asn Asn Val Arg Ile Asp Gly
                565                 570                 575

Lys Pro Leu Glu Lys Val Val Lys Glu His Leu Ile Glu Ala Val Phe
            580                 585                 590

Lys Gln Asp His Lys Lys Met Thr Lys Asn Arg Ile Glu Gln Phe Leu
        595                 600                 605
```

```
Lys Asp Asn Gly Tyr Ile Ser Glu Thr His Lys His Glu Ile Thr Gly
    610                 615                 620

Leu Asp Gly Glu Ile Lys Asn Asp Leu Ala Ser Tyr Arg Asp Met Val
625                 630                 635                 640

Arg Ile Leu Gly Asp Gly Phe Asp Arg Ser Met Ala Glu Glu Ile Ile
                645                 650                 655

Thr Asp Ile Thr Ile Phe Gly Glu Ser Lys Lys Met Leu Arg Glu Thr
            660                 665                 670

Leu Arg Lys Lys Phe Ala Ser Cys Leu Asp Asp Glu Ala Ile Lys Lys
        675                 680                 685

Leu Thr Lys Leu Arg Tyr Arg Asp Trp Gly Arg Leu Ser Gln Lys Leu
    690                 695                 700

Leu Asn Gly Ile Glu Gly Cys Asp Lys Ala Gly Asp Gly Thr Pro Glu
705                 710                 715                 720

Thr Ile Ile Ile Leu Met Arg Asn Phe Ser Tyr Asn Leu Met Glu Leu
                725                 730                 735

Leu Gly Asp Lys Phe Ser Phe Met Glu Arg Ile Gln Glu Ile Asn Ala
            740                 745                 750

Lys Leu Thr Glu Gly Gln Ile Val Asn Pro His Asp Ile Ile Asp Asp
        755                 760                 765

Leu Ala Leu Ser Pro Ala Val Lys Arg Ala Val Trp Gln Ala Leu Arg
    770                 775                 780

Ile Val Asp Glu Val Ala His Ile Lys Lys Ala Leu Pro Ala Arg Ile
785                 790                 795                 800

Phe Val Glu Val Thr Arg Ser Asn Lys Asn Glu Lys Lys Lys Lys Asp
```

```
                805                 810                 815

Ser Arg Gln Lys Arg Leu Ser Asp Leu Tyr Ala Ala Ile Lys Lys Asp
            820                 825                 830

Asp Val Leu Leu Asn Gly Leu Asn Asn Glu Ile Phe Gly Glu Leu Lys
        835                 840                 845

Ser Ser Leu Ala Lys Tyr Asp Asp Ala Ala Leu Arg Ser Lys Lys Leu
    850                 855                 860

Tyr Leu Tyr Tyr Thr Gln Met Gly Arg Cys Ala Tyr Thr Gly Glu Ile
865                 870                 875                 880

Ile Glu Leu Ser Leu Leu Asn Thr Asp Asn Tyr Asp Ile Asp His Ile
                885                 890                 895

Tyr Pro Arg Ser Leu Thr Lys Asp Asp Ser Phe Asp Asn Leu Val Leu
            900                 905                 910

Cys Lys Arg Thr Ala Asn Ala Gln Lys Ser Asp Ala Tyr Pro Ile Ser
        915                 920                 925

Glu Glu Ile Gln Lys Thr Gln Lys Pro Phe Trp Thr Phe Leu Lys Gln
    930                 935                 940

Gln Gly Leu Ile Ser Glu Arg Lys Tyr Glu Arg Leu Thr Arg Ile Thr
945                 950                 955                 960

Pro Leu Thr Ala Asp Asp Leu Ser Gly Phe Ile Ala Arg Gln Leu Val
                965                 970                 975

Glu Thr Asn Gln Ser Val Lys Ala Ala Thr Thr Leu Leu Arg Arg Leu
            980                 985                 990

Tyr Pro Gly Val Asp Val Val Phe  Val Lys Ala Glu Asn  Val Thr Asp
        995                 1000                1005
```

```
Phe Arg  His Asp Asn Asn Phe  Ile Lys Val Arg Ser  Leu Asn His
    1010                1015                1020

His His  His Ala Lys Asp Ala  Tyr Leu Asn Ile Val  Val Gly Asn
    1025                1030                1035

Val Tyr  His Glu Arg Phe Thr  Arg Asn Phe Arg Ala  Phe Phe Lys
    1040                1045                1050

Lys Asn  Gly Ala Asn Arg Thr  Tyr Asn Leu Ala Lys  Met Phe Asn
    1055                1060                1065

Tyr Asp  Val Asn Cys Thr Asn  Ala Lys Asp Gly Lys  Ala Trp Asp
    1070                1075                1080

Val Lys  Thr Ser Met Asp Thr  Val Lys Lys Met Met  Asp Ser Asn
    1085                1090                1095

Asp Val  Arg Val Thr Lys Arg  Leu Leu Glu Gln Thr  Gly Ala Leu
    1100                1105                1110

Ala Asp  Ala Thr Ile Tyr Lys  Ala Thr Val Ala Gly  Lys Ala Lys
    1115                1120                1125

Asp Gly  Ala Tyr Ile Gly Met  Lys Thr Lys Ser Ser  Val Phe Ala
    1130                1135                1140

Asp Val  Ser Lys Tyr Gly Gly  Met Thr Lys Ile Lys  Asn Ala Tyr
    1145                1150                1155

Ser Ile  Ile Val Gln Tyr Thr  Gly Lys Lys Gly Glu  Val Ile Lys
    1160                1165                1170

Glu Ile  Val Pro Leu Pro Ile  Tyr Leu Thr Asn Arg  Asn Thr Thr
    1175                1180                1185

Asp Gln  Asp Leu Ile Asn Tyr  Val Ala Ser Ile Ile  Pro Gln Ala
```

```
    1190                1195                1200

Lys Asp  Ile Ser Ile Ile Tyr  Gly Lys Leu Cys Ile  Asn Gln Leu
    1205                1210                1215

Val Lys  Val Asn Gly Phe Tyr  Tyr Tyr Leu Gly Gly  Lys Thr Asn
    1220                1225                1230

Ser Lys  Phe Cys Ile Asp Asn  Ala Ile Gln Val Ile  Val Ser Asn
    1235                1240                1245

Glu Trp  Ile Pro Tyr Leu Lys  Val Leu Glu Lys Phe  Asn Asn Met
    1250                1255                1260

Arg Lys  Asp Asn Lys Asp Leu  Lys Ala Asn Val Val  Ser Thr Arg
    1265                1270                1275

Ala Leu  Asp Asn Lys His Thr  Ile Glu Val Arg Ile  Val Glu Glu
    1280                1285                1290

Lys Asn  Ile Glu Phe Phe Asp  Tyr Leu Val Ser Lys  Leu Lys Met
    1295                1300                1305

Pro Ile  Tyr Gln Lys Met Lys  Gly Asn Lys Ala Ala  Glu Leu Ser
    1310                1315                1320

Glu Lys  Gly Tyr Gly Leu Phe  Lys Lys Met Ser Leu  Glu Glu Gln
    1325                1330                1335

Ser Ile  His Leu Ile Glu Leu  Leu Asn Leu Leu Thr  Asn Gln Lys
    1340                1345                1350

Thr Thr  Phe Glu Val Lys Pro  Leu Gly Ile Thr Ala  Ser Arg Ser
    1355                1360                1365

Thr Val  Gly Ser Lys Ile Ser  Asn Gln Asp Glu Phe  Lys Val Ile
    1370                1375                1380
```

```
Asn Glu  Ser Ile Thr Gly Leu  Tyr Ser Asn Glu Val  Thr Ile Val
    1385                1390                1395


<210>  132
<211>  1485
<212>  PRT
<213>  Prevotella bivia

<400>  132

Met Lys Asn Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Lys Ile Ser Ile Asp Asp Asn Gly Lys Tyr Ile Lys Asp Ser Ile
            20                  25                  30


Lys Leu Gly Ser Arg Ile Ile Pro Met Ser Gln Asp Val Leu Ser Asn
        35                  40                  45


Phe Ser Lys Gly Val Thr Leu Ser Gln Thr Ser Glu Arg Thr Ser Phe
    50                  55                  60


Arg Gly Ala Arg Arg Leu Arg Glu Arg Thr Leu Leu Arg Arg Glu Arg
65                  70                  75                  80


Leu His Arg Ile Leu His Leu Leu Gly Phe Leu Pro Lys His Tyr Glu
                85                  90                  95


Lys Ala Ile Gly Trp Asp Arg Asn Asp Asn Lys Thr Tyr Gly Lys Phe
            100                 105                 110


Ile Asn His Ala Glu Pro Lys Leu Ala Trp Cys Lys Asp Asn Asn Gly
        115                 120                 125


Lys Met Arg Phe Leu Phe Met Asp Ser Phe His Asp Met Leu Ser Glu
    130                 135                 140


Phe Ser Glu Lys His Pro Glu Leu Leu Ala Asn Gly Lys Lys Ile Pro
145                 150                 155                 160
```

```
Leu Asp Trp Thr Ile Tyr Tyr Leu Arg Lys Lys Ala Leu Tyr Lys Ala
                165                 170                 175

Ile Thr Lys Glu Glu Leu Ala Trp Ile Leu Leu Asn Phe Asn Gln Lys
            180                 185                 190

Arg Gly Tyr Tyr Gln Leu Arg Gly Glu Glu Asp Arg Asp Ser Glu Ala
        195                 200                 205

Asn Lys Lys Glu Tyr Leu Glu Leu Lys Val Ile Gly Val Glu Ala Thr
    210                 215                 220

Gly Glu Lys Lys Gly Asn Asp Ile Trp Tyr Asn Ile His Leu Glu Asn
225                 230                 235                 240

Gly Trp Ile Tyr Arg Arg Ser Ser Lys Asn Pro Leu Asn Asp Trp Leu
                245                 250                 255

Gly Lys Val Lys Ser Phe Ile Val Thr Thr Asp Leu Asp Ala Asp Gly
            260                 265                 270

Asn Pro Lys Lys Asp Lys Asp Gly Asn Ile Lys Arg Ser Phe Arg Ala
        275                 280                 285

Pro Ser Glu Gly Asp Trp Thr Leu Ile Lys Lys Arg Thr Glu Ser Leu
    290                 295                 300

Leu Glu Asn Ser Gly Gln Thr Val Gly Gln Phe Ile Tyr Asn His Ile
305                 310                 315                 320

Leu Glu Glu Pro Ser Ala Lys Ile Arg Gly Asn Phe Ile Arg Thr Ile
                325                 330                 335

Glu Arg Lys Tyr Tyr Lys Asp Glu Leu Lys Ala Ile Leu Glu Lys Gln
            340                 345                 350
```

```
Lys Glu Phe His His Glu Leu Ser Ser Glu Ser Leu Leu Thr Glu Cys
        355                 360                 365

Ala Lys Glu Leu Tyr Lys Arg Asn Ile Ala His Gln Glu Val Leu Leu
    370                 375                 380

Lys Lys Gly Ile Ile His Leu Leu Leu Asn Asp Ile Leu Phe Tyr Gln
385                 390                 395                 400

Arg Pro Leu Lys Ile Lys Lys Ser Leu Ile Asp Asn Cys Pro Tyr Glu
                405                 410                 415

Asn Tyr Lys Tyr Val Asp Lys Lys Ser Gly Asp Ile Lys Val Lys Ser
            420                 425                 430

Ile Lys Cys Ile Ala Lys Ser Asn Pro Phe Phe Gln Glu Phe Arg Leu
        435                 440                 445

Trp Gln Phe Val Ser Asn Leu Arg Leu Tyr Arg Lys Ser Asp Asp Lys
    450                 455                 460

Asp Val Thr Ser Glu His Leu Val Thr Thr Asp Asp Tyr Ala Asn Leu
465                 470                 475                 480

Phe Thr Tyr Leu Asn Asn Arg Lys Asp Ile Lys Gln Ser Val Leu Leu
                485                 490                 495

Lys Glu Tyr Phe Lys Ile Lys Lys Val Lys Thr Ile Asn Gly Ala Glu
            500                 505                 510

Tyr Pro Val Arg Trp Asn Tyr Ile Asp Asp Asp Asn Lys Thr Tyr Pro
        515                 520                 525

Cys Asn Glu Thr Arg Tyr Asp Ile Leu His Ala Leu Ser Lys Thr Glu
    530                 535                 540

Leu Lys Ser Glu Trp Leu Thr Pro Glu Arg Thr Tyr Arg Leu Trp His
545                 550                 555                 560
```

```
Leu Leu Tyr Ser Ile Glu Ser Lys Glu Glu Thr Lys Lys Ala Leu Asn
               565                 570                 575

Lys Leu Asn Leu Ser Asp Asp Phe Thr Glu Ala Phe Leu Thr Ile Lys
            580                 585                 590

Pro Phe Lys Lys Glu Tyr Gly Ser Tyr Ser Glu Lys Ala Ile Lys Lys
        595                 600                 605

Leu Leu Ser Leu Met Arg Met Gly Tyr Leu Trp Ser Glu Asp Glu Ala
    610                 615                 620

Ile Lys Gln Val Gly Ala Glu Ile Glu Lys Thr Ile Glu Gly Glu Leu
625                 630                 635                 640

Pro Asp Tyr Val Leu Gln Arg Leu Glu Lys Ser Gln His Asn Tyr Asn
               645                 650                 655

Lys Ile Ser Asp Phe Ser Gly Leu Pro Leu Trp Leu Ala Ser Tyr Ile
            660                 665                 670

Ile Tyr Gly Arg His Ser Glu Ala Lys Glu Ile Ile His Trp Asp Asn
        675                 680                 685

Pro Glu Ser Met Met Ala Tyr Ile Lys Asp Phe Arg Gln His Ser Met
    690                 695                 700

Arg Asn Pro Ile Val Glu Gln Cys Val Leu Glu Thr Leu Arg Thr Val
705                 710                 715                 720

His Asp Ile Trp Lys Glu Ile Gly His Ile Asp Glu Ile His Ile Glu
               725                 730                 735

Leu Gly Arg Glu Met Lys Ser Thr Ser Glu Gln Arg Lys Ala Ile Thr
            740                 745                 750
```

```
Gln Asn Val Leu His Asn Gln Asn Thr Asn Ile Arg Ile Lys Leu Leu
        755                 760                 765

Leu Gln Glu Leu Lys Asn Asp Asn Asn Ile Thr Gly Val Arg Pro Tyr
    770                 775                 780

Ser Pro Met Gln Gln Glu Ile Leu Arg Ile Tyr Glu Glu Gly Ala Leu
785                 790                 795                 800

Gln Gly Leu Thr Lys Glu Asp Lys Asp Tyr Asn Asp Ile Leu Lys Ile
                805                 810                 815

Ser Gln Thr Ala Gln Pro Thr Ser Asn Glu Leu Thr Arg Tyr Lys Leu
            820                 825                 830

Trp Leu Glu Gln Lys Tyr Arg Ser Pro Tyr Thr Gly Lys Ala Ile Ser
        835                 840                 845

Leu Ser Lys Leu Phe Thr Ser Ala Tyr Gln Ile Glu His Val Ile Pro
    850                 855                 860

Gln Ser Arg Tyr Phe Asp Asp Ser Leu Ser Asn Lys Val Ile Cys Glu
865                 870                 875                 880

Ser Glu Val Asn Thr Leu Lys Lys Ala Met Leu Gly Met Glu Phe Ile
                885                 890                 895

Lys Thr Cys Gly Gly Gln Lys Val His Cys Thr Leu Leu Gly Asp Val
            900                 905                 910

Glu Ile Tyr Asn Glu Glu Asp Tyr Lys Ala Phe Val Asn Glu His Tyr
        915                 920                 925

Ser Asn Asn Arg Thr Lys Arg Asn Lys Leu Leu Met Glu Asp Ile Pro
    930                 935                 940

Gln Glu Phe Ile Asn Arg Gln Leu Asn Asp Ser Arg Tyr Ile Ser Lys
945                 950                 955                 960
```

```
Met Val Lys Gln Leu Leu Ser Ala Ile Val Arg Gly Gln Glu Glu Val
               965                 970                 975

Glu Ala Thr Ser Lys Phe Val Ile Pro Cys Thr Gly Gly Ile Thr Asp
           980                 985                 990

Arg Leu Lys Lys Asp Trp Gly Leu  Asn Asp Ile Trp Asn  Asn Leu Val
        995                 1000                1005

Ser Pro  Arg Phe Gln Arg Met  Asn Ala Leu Thr Gly  Ser Glu Tyr
    1010                1015                1020

Phe Gly  His Trp Glu Asn Lys  Glu Gly Lys Arg Val  Phe Gln Thr
    1025                1030                1035

Thr Met  Pro Ile Gln Leu Gln  Gln Gly Phe Ser Lys  Lys Arg Ile
    1040                1045                1050

Asp His  Arg His His Ala Met  Asp Ala Leu Val Ile  Ala Cys Ala
    1055                1060                1065

Ser Arg  Asn Ile Ile Ser Tyr  Leu Asn Asn Glu Thr  Ala Gln Asp
    1070                1075                1080

Thr Glu  Arg Arg Arg Asp Leu  Arg Gln Lys Leu Cys  Asp Lys Gly
    1085                1090                1095

Gly Ser  Val Arg Lys Pro Trp  Asp Ser Phe Thr Gln  Asp Thr Gln
    1100                1105                1110

Tyr Ala  Leu Lys Asp Ile Ile  Val Thr Phe Lys Asn  Tyr Val Arg
    1115                1120                1125

Ile Ile  Asn Lys Ala Thr Asn  Tyr Tyr Glu His Tyr  Lys Thr Asp
    1130                1135                1140
```

```
Gly Lys  Lys Gly Met Ile Ser  Gln Lys Gly Asp Glu  Leu Trp Ala
    1145                1150                1155

Ile Arg  Lys Pro Met His Lys  Glu Thr Val Phe Gly  Lys Val Asn
    1160                1165                1170

Leu Arg  Arg Pro Lys Arg Val  Ser Leu Ser Lys Ala  Ile Asp Ser
    1175                1180                1185

Val Asp  Ile Ile Cys Asn Arg  Lys Leu Lys Lys Tyr  Ile Lys Ala
    1190                1195                1200

Arg Leu  Asn Glu Gly Leu Gln  Lys Lys Gln Ile Leu  Asn Ile Phe
    1205                1210                1215

Lys Glu  Leu Asn Asn Val Trp  Glu Gly Ile Asp Val  Asn Lys Ile
    1220                1225                1230

Asp Ile  Trp Glu Met Ser Asn  Asp Lys Glu Pro Met  Val Ala Thr
    1235                1240                1245

Arg Lys  Gln Leu Asp Thr Ser  Phe Asp Glu Lys Lys  Ile Arg Ser
    1250                1255                1260

Ile Ser  Asp Thr Gly Ile Gln  Lys Ile Leu Leu Asn  Tyr Leu Ile
    1265                1270                1275

Thr Lys  Asn Asn Asn Pro Glu  Leu Ala Phe Thr Pro  Glu Gly Ile
    1280                1285                1290

Gln Glu  Met Asn Ser Asn Ile  Ser Glu Tyr Asn Asp  His Lys Lys
    1295                1300                1305

His Gln  Pro Ile Tyr Lys Val  Arg Val Thr Glu Pro  Leu Gly Ala
    1310                1315                1320

Lys Tyr  Pro Ile Gly Thr Met  Gly Asn Asn Pro Lys  Lys Phe Val
    1325                1330                1335
```

```
Glu Ala  Gln Ala Gly Thr Asn  Leu Tyr Phe Ala Ile  Tyr Glu Asp
    1340                1345                1350

Lys Glu  Gly Lys Arg Asn Tyr  Asp Thr Ile Pro Leu  Asn Ile Ala
    1355                1360                1365

Ala Glu  Arg Leu Asn Gln Gln  Leu Ser Pro Val Pro  Glu Thr Asn
    1370                1375                1380

Glu Asn  Asn Thr Pro Leu Lys  Phe Tyr Leu Ser Pro  Asn Asp Leu
    1385                1390                1395

Val Tyr  Val Pro Ser Glu Glu  Glu Arg His Ser Gly  Asn Asn Ile
    1400                1405                1410

Gln Leu  Asp Lys Asn Arg Ile  Tyr Lys Met Val Ser  Ser Thr Ser
    1415                1420                1425

Lys Arg  Cys Phe Phe Ile His  His Arg Val Ala Ile  Ser Leu Val
    1430                1435                1440

Asp Lys  Lys Glu Phe Ser Ala  Gln Asn Lys Met Glu  Arg Ser Ile
    1445                1450                1455

Asp Asn  Glu Gln Val Met Ile  Lys Ser Val Cys Trp  Lys Leu Ile
    1460                1465                1470

Thr Asp  Arg Leu Gly Asn Ile  Ile Lys Val Ile Lys
    1475                1480                1485
```

<210> 133
<211> 1218
<212> PRT
<213> Prevotella buccalis

<400> 133

```
Met Asn Lys Arg Ile Leu Gly Leu Asp Thr Gly Thr Asn Ser Leu Gly
```

```
1               5                   10                  15

Trp Ala Val Val Asp Trp Asp Glu His Ala Gln Ser Tyr Glu Leu Ile
            20                  25                  30

Lys Tyr Gly Asp Val Ile Phe Gln Glu Gly Val Lys Ile Glu Lys Gly
        35                  40                  45

Ile Glu Ser Ser Lys Ala Ala Glu Arg Ser Gly Tyr Lys Ala Ile Arg
    50                  55                  60

Lys Gln Tyr Phe Arg Arg Arg Leu Arg Lys Ile Gln Val Leu Lys Val
65                  70                  75                  80

Leu Val Lys Tyr His Leu Cys Pro Tyr Leu Ser Asp Asp Asp Leu Arg
                85                  90                  95

Gln Trp His Leu Gln Lys Gln Tyr Pro Lys Ser Asp Glu Leu Met Leu
            100                 105                 110

Trp Gln Arg Thr Ser Asp Glu Glu Gly Lys Asn Pro Tyr Tyr Asp Arg
        115                 120                 125

His Arg Cys Leu His Glu Lys Leu Asp Leu Thr Val Glu Ala Asp Arg
    130                 135                 140

Tyr Thr Leu Gly Arg Ala Leu Tyr His Leu Thr Gln Arg Arg Gly Phe
145                 150                 155                 160

Leu Ser Asn Arg Leu Asp Thr Ser Ala Asp Asn Lys Glu Asp Gly Val
                165                 170                 175

Val Lys Ser Gly Ile Ser Gln Leu Ser Thr Glu Met Glu Glu Ala Gly
            180                 185                 190

Cys Glu Tyr Leu Gly Asp Tyr Phe Tyr Lys Leu Tyr His Glu Gln Gly
        195                 200                 205
```

```
Asn Lys Val Arg Ile Arg Gln Arg Tyr Thr Asp Arg Lys Lys His Tyr
    210                 215                 220

Gln His Glu Phe Asp Ala Ile Cys Glu Lys Gln Glu Leu Ser Ser Glu
225                 230                 235                 240

Leu Ile Glu Asp Leu Gln Arg Ala Ile Phe Phe Gln Leu Pro Leu Lys
                245                 250                 255

Ser Gln Arg His Gly Val Gly Arg Cys Thr Phe Glu Arg Gly Lys Pro
            260                 265                 270

Arg Cys Ala Asp Ser His Pro Asp Tyr Glu Glu Phe Arg Met Leu Cys
        275                 280                 285

Phe Val Asn Asn Ile Gln Val Lys Gly Pro His Asp Leu Glu Leu Arg
    290                 295                 300

Pro Leu Thr Tyr Glu Glu Arg Glu Lys Ile Glu His Leu Phe Phe Arg
305                 310                 315                 320

Lys Ser Lys Pro Asn Phe Asp Phe Glu Asp Ile Ala Lys Glu Leu Ala
                325                 330                 335

Gly Lys Lys Asn Tyr Ala Trp Ile His Asp Lys Glu Glu Arg Ala Tyr
            340                 345                 350

Lys Phe Asn Tyr Arg Met Thr Gln Gly Val Pro Gly Cys Pro Thr Thr
        355                 360                 365

Ala Gln Leu Lys Ser Ile Phe Gly Asp Asp Trp Lys Thr Gly Ile Ala
    370                 375                 380

Glu Thr Tyr Thr Leu Ile Gln Lys Lys Asn Gly Ser Lys Ser Leu Gln
385                 390                 395                 400

Glu Met Val Asp Asp Val Trp Asn Val Leu Tyr Ser Phe Ser Ser Val
```

```
                405                 410                 415

Glu Lys Leu Lys Glu Phe Ala His His Lys Leu Gln Leu Asp Glu Glu
            420                 425                 430

Asn Ala Glu Lys Phe Ala Lys Ile Lys Leu Ser His Ser Phe Ala Ala
        435                 440                 445

Leu Ser Leu Lys Ala Ile Arg Lys Phe Leu Pro Phe Leu Arg Lys Gly
    450                 455                 460

Met Tyr Tyr Thr His Ala Ser Phe Phe Ala Asn Ile Pro Thr Ile Val
465                 470                 475                 480

Gly Lys Glu Ile Trp Asn Asn Glu Gln Ser Arg Lys Tyr Ile Met Glu
                485                 490                 495

Asn Val Gly Glu Leu Val Phe Asn Tyr Gln Pro Lys His Arg Asp Val
            500                 505                 510

Gln Gly Thr Ile Glu Met Leu Ile Lys Asp Phe Leu Ala Asn Asn Phe
        515                 520                 525

Glu Leu Pro Ala Gly Ala Thr Asp Lys Leu Tyr His Pro Ser Met Ile
    530                 535                 540

Glu Thr Tyr Pro His Ala Leu Arg Asn Glu Phe Gly Ile Leu Gln Leu
545                 550                 555                 560

Gly Ser Pro Arg Thr Asn Ala Ile Arg Asn Pro Met Ala Met Arg Ser
                565                 570                 575

Leu His Val Leu Arg Arg Val Val Asn Gln Leu Leu Lys Glu Ser Ile
            580                 585                 590

Ile Asp Glu Asn Thr Glu Val His Val Glu Tyr Ala Arg Glu Leu Asn
        595                 600                 605
```

```
Asp Ala Asn Lys Arg Arg Ala Ile Ala Asp Arg Gln Lys Glu Gln Asp
    610                 615                 620

Lys Gln His Lys Lys Tyr Gly Asp Glu Ile Arg Lys Leu Tyr Lys Glu
625                 630                 635                 640

Glu Thr Gly Lys Asp Ile Glu Pro Thr Gln Thr Asp Val Leu Lys Phe
                645                 650                 655

Gln Leu Trp Glu Glu Gln Asn His Tyr Cys Leu Tyr Thr Gly Glu Gln
            660                 665                 670

Ile Gly Ile Thr Asp Phe Ile Gly Ser Asn Pro Lys Phe Asp Ile Glu
        675                 680                 685

His Thr Ile Pro Gln Ser Val Gly Gly Asp Ser Thr Gln Met Asn Leu
    690                 695                 700

Thr Leu Cys Asp Asn Arg Phe Asn Arg Glu Val Lys Lys Ala Lys Leu
705                 710                 715                 720

Pro Thr Glu Leu Ala Asn His Glu Glu Ile Leu Thr Arg Ile Glu Pro
                725                 730                 735

Trp Lys Asn Lys Tyr Glu Gln Leu Val Lys Glu Arg Asp Lys Gln Arg
            740                 745                 750

Thr Phe Ala Gly Met Asp Lys Ala Val Lys Asp Ile Arg Ile Gln Lys
        755                 760                 765

Arg His Lys Leu Gln Met Glu Ile Asp Tyr Trp Arg Gly Lys Tyr Glu
    770                 775                 780

Arg Phe Thr Met Thr Glu Val Pro Glu Gly Phe Ser Arg Arg Gln Gly
785                 790                 795                 800

Thr Gly Ile Gly Leu Ile Ser Arg Tyr Ala Gly Leu Tyr Leu Lys Ser
```

```
                805                 810                 815

Leu Phe His Gln Ala Asp Ser Arg Asn Lys Ser Asn Val Tyr Val Val
            820                 825                 830

Lys Gly Val Ala Thr Ala Glu Phe Arg Lys Met Trp Gly Leu Gln Ser
        835                 840                 845

Glu Tyr Glu Lys Lys Cys Arg Asp Asn His Ser His His Cys Met Asp
    850                 855                 860

Ala Ile Thr Ile Ala Cys Ile Gly Lys Arg Glu Tyr Asp Leu Met Ala
865                 870                 875                 880

Glu Tyr Tyr His Met Glu Glu Thr Phe Arg Gln Gly Arg Gly Ser Lys
                885                 890                 895

Pro Lys Phe Ser Lys Pro Trp Ala Thr Phe Thr Glu Asp Val Leu Asn
            900                 905                 910

Ile Tyr Lys Asn Leu Leu Val Val His Asp Thr Pro Asn Asn Met Pro
        915                 920                 925

Lys His Thr Lys Lys Tyr Val Gln Thr Ser Lys Gly Lys Val Leu Ala
    930                 935                 940

Gln Gly Asp Thr Ala Arg Gly Ser Leu His Leu Asp Thr Tyr Tyr Gly
945                 950                 955                 960

Ala Ile Glu Arg Asp Gly Glu Ile Arg Tyr Val Val Arg Arg Pro Leu
                965                 970                 975

Ser Ser Phe Thr Asn Pro Lys Glu Leu Glu Asn Ile Val Asp Glu Thr
            980                 985                 990

Val Lys Arg Thr Ile Lys Glu Ala  Ile Ala Asp Lys Asn  Phe Lys Gln
        995                 1000                1005
```

```
Ala Ile  Ala Glu Pro Ile Tyr  Met Asn Glu Asp Lys  Gly Ile Leu
    1010                1015                1020

Ile Lys  Lys Val Arg Cys Phe  Ala Asn Ser Val Lys  Gln Pro Ile
    1025                1030                1035

Asn Ile  Arg Gln His Arg Asp  Leu Ser Lys Lys Glu  Tyr Lys Gln
    1040                1045                1050

Gln Tyr  His Val Met Asn Glu  Asn Asn Tyr Leu Leu  Ala Ile Tyr
    1055                1060                1065

Glu Gly  Leu Val Lys Asn Lys  Val Val Arg Glu Phe  Glu Ile Val
    1070                1075                1080

Ser Tyr  Ile Glu Ala Ala Lys  Tyr Tyr Lys Arg Ser  Gln Asp Arg
    1085                1090                1095

Asn Ile  Phe Ser Ser Ile Val  Pro Thr His Ser Thr  Lys Tyr Gly
    1100                1105                1110

Leu Pro  Leu Lys Thr Lys Leu  Leu Met Gly Gln Gln  Val Leu Met
    1115                1120                1125

Phe Glu  Glu Asn Pro Asp Glu  Ile Gln Val Asp Asn  Thr Lys Asp
    1130                1135                1140

Leu Val  Lys Arg Leu Tyr Lys  Val Val Gly Ile Glu  Lys Asp Gly
    1145                1150                1155

Arg Ile  Lys Phe Lys His His  Gln Glu Ala Arg Lys  Glu Gly Leu
    1160                1165                1170

Thr Ile  Tyr Ser Thr Pro Tyr  Lys Asn Asn Asp Asp  Tyr Val Pro
    1175                1180                1185

Ile Phe  Arg Gln Ser Ile Lys  Asn Ile Asn Ile Leu  Val Asp Gly
```

1190 1195 1200

Ile Asp Phe Asn Ile Asp Ile Leu Gly Lys Val Thr Leu Lys Glu
1205 1210 1215

<210> 134
<211> 1218
<212> PRT
<213> Prevotella timonensis

<400> 134

Met Asn Lys Arg Ile Leu Gly Leu Asp Thr Gly Thr Asn Ser Leu Gly
1 5 10 15

Trp Ala Val Val Asp Trp Asp Glu His Ala Gln Ser Tyr Glu Leu Ile
20 25 30

Lys Tyr Gly Asp Val Ile Phe Gln Glu Gly Val Lys Ile Glu Lys Gly
35 40 45

Ile Glu Ser Ser Lys Ala Ala Glu Arg Ser Gly Tyr Lys Ala Ile Arg
50 55 60

Lys Gln Tyr Phe Arg Arg Arg Leu Arg Lys Ile Gln Val Leu Lys Val
65 70 75 80

Leu Val Lys Tyr His Leu Cys Pro Tyr Leu Ser Asp Asp Asp Leu Arg
85 90 95

Gln Trp His Leu Gln Lys Gln Tyr Pro Lys Ser Asp Glu Leu Met Leu
100 105 110

Trp Gln Arg Thr Ser Asp Glu Glu Gly Lys Asn Pro Tyr Tyr Asp Arg
115 120 125

His Arg Cys Leu His Glu Lys Leu Asp Leu Thr Val Glu Ala Asp Arg
130 135 140

```
Tyr Thr Leu Gly Arg Ala Leu Tyr His Leu Thr Gln Arg Arg Gly Phe
145                 150                 155                 160

Leu Ser Asn Arg Leu Asp Thr Ser Ala Asp Asn Lys Glu Asp Gly Val
                165                 170                 175

Val Lys Ser Gly Ile Ser Gln Leu Ser Thr Glu Met Glu Glu Ala Gly
            180                 185                 190

Cys Glu Tyr Leu Gly Asp Tyr Phe Tyr Lys Leu Tyr Asp Ala Gln Gly
        195                 200                 205

Asn Lys Val Arg Ile Arg Gln Arg Tyr Thr Asp Arg Asn Lys His Tyr
    210                 215                 220

Gln His Glu Phe Asp Ala Ile Cys Glu Lys Gln Glu Leu Ser Ser Glu
225                 230                 235                 240

Leu Ile Glu Asp Leu Gln Arg Ala Ile Phe Phe Gln Leu Pro Leu Lys
                245                 250                 255

Ser Gln Arg His Gly Val Gly Arg Cys Thr Phe Glu Arg Gly Lys Pro
            260                 265                 270

Arg Cys Ala Asp Ser His Pro Asp Tyr Glu Glu Phe Arg Met Leu Cys
        275                 280                 285

Phe Val Asn Asn Ile Gln Val Lys Gly Pro His Asp Leu Glu Leu Arg
    290                 295                 300

Pro Leu Thr Tyr Glu Glu Arg Glu Lys Ile Glu Pro Leu Phe Phe Arg
305                 310                 315                 320

Lys Ser Lys Pro Asn Phe Asp Phe Glu Asp Ile Ala Lys Ala Leu Ala
                325                 330                 335

Gly Lys Lys Asn Tyr Ala Trp Ile His Asp Lys Glu Glu Arg Ala Tyr
            340                 345                 350
```

```
Lys Phe Asn Tyr Arg Met Thr Gln Gly Val Pro Gly Cys Pro Thr Ile
        355                 360                 365

Ala Gln Leu Lys Ser Ile Phe Gly Asp Asp Trp Lys Thr Gly Ile Ala
    370                 375                 380

Glu Thr Tyr Thr Leu Ile Gln Lys Lys Asn Gly Ser Lys Ser Leu Gln
385                 390                 395                 400

Glu Met Val Asp Asp Val Trp Asn Val Leu Tyr Ser Phe Ser Ser Val
                405                 410                 415

Glu Lys Leu Lys Glu Phe Ala His His Lys Leu Gln Leu Asp Glu Glu
            420                 425                 430

Ser Ala Glu Lys Phe Ala Lys Ile Lys Leu Ser His Ser Phe Ala Ala
        435                 440                 445

Leu Ser Leu Lys Ala Ile Arg Lys Phe Leu Pro Phe Leu Arg Lys Gly
    450                 455                 460

Met Tyr Tyr Thr His Ala Ser Phe Phe Ala Asn Ile Pro Thr Ile Val
465                 470                 475                 480

Gly Lys Glu Ile Trp Asn Lys Glu Gln Asn Arg Lys Tyr Ile Met Glu
                485                 490                 495

Asn Val Gly Glu Leu Val Phe Asn Tyr Gln Pro Lys His Arg Glu Val
            500                 505                 510

Gln Gly Thr Ile Glu Met Leu Ile Lys Asp Phe Leu Ala Asn Asn Phe
        515                 520                 525

Glu Leu Pro Ala Gly Ala Thr Asp Lys Leu Tyr His Pro Ser Met Ile
    530                 535                 540
```

```
Glu Thr Tyr Pro Asn Ala Gln Arg Asn Glu Phe Gly Ile Leu Gln Leu
545                 550                 555                 560

Gly Ser Pro Arg Thr Asn Ala Ile Arg Asn Pro Met Ala Met Arg Ser
                565                 570                 575

Leu His Ile Leu Arg Arg Val Val Asn Gln Leu Leu Lys Glu Ser Ile
            580                 585                 590

Ile Asp Glu Asn Thr Glu Val His Val Glu Tyr Ala Arg Glu Leu Asn
        595                 600                 605

Asp Ala Asn Lys Arg Arg Ala Ile Ala Asp Arg Gln Lys Glu Gln Asp
    610                 615                 620

Lys Gln His Lys Lys Tyr Gly Asp Glu Ile Arg Lys Leu Tyr Lys Glu
625                 630                 635                 640

Glu Thr Gly Lys Asp Ile Glu Pro Thr Gln Thr Asp Val Leu Lys Phe
                645                 650                 655

Gln Leu Trp Glu Glu Gln Asn His His Cys Leu Tyr Thr Gly Glu Gln
            660                 665                 670

Ile Gly Ile Thr Asp Phe Ile Gly Ser Asn Pro Lys Phe Asp Ile Glu
        675                 680                 685

His Thr Ile Pro Gln Ser Val Gly Gly Asp Ser Thr Gln Met Asn Leu
    690                 695                 700

Thr Leu Cys Asp Asn Arg Phe Asn Arg Glu Val Lys Lys Ala Lys Leu
705                 710                 715                 720

Pro Thr Glu Leu Ala Asn His Glu Glu Ile Leu Thr Arg Ile Glu Pro
                725                 730                 735

Trp Lys Asn Lys Tyr Glu Gln Leu Val Lys Glu Arg Asp Lys Gln Arg
            740                 745                 750
```

```
Thr Phe Ala Gly Met Asp Lys Ala Val Lys Asp Ile Arg Ile Gln Lys
        755                 760                 765

Arg His Lys Leu Gln Met Glu Ile Asp Tyr Trp Arg Gly Lys Tyr Glu
    770                 775                 780

Arg Phe Thr Met Thr Glu Val Pro Glu Gly Phe Ser Arg Arg Gln Gly
785                 790                 795                 800

Thr Gly Ile Gly Leu Ile Ser Arg Tyr Ala Gly Leu Tyr Leu Lys Ser
                805                 810                 815

Leu Phe His Gln Ala Asp Ser Arg Asn Lys Ser Asn Val Tyr Val Val
            820                 825                 830

Lys Gly Val Ala Thr Ala Glu Phe Arg Lys Met Trp Gly Leu Gln Ser
        835                 840                 845

Glu Tyr Glu Lys Lys Cys Arg Asp Asn His Ser His His Cys Met Asp
    850                 855                 860

Ala Ile Thr Ile Ala Cys Ile Gly Lys Arg Glu Tyr Asp Leu Met Ala
865                 870                 875                 880

Glu Tyr Tyr Arg Met Glu Glu Thr Phe Lys Gln Gly Arg Gly Ser Lys
                885                 890                 895

Pro Lys Phe Ser Lys Pro Trp Ala Thr Phe Thr Glu Asp Val Leu Asn
            900                 905                 910

Ile Tyr Lys Asn Leu Leu Val Val His Asp Thr Pro Asn Asn Met Pro
        915                 920                 925

Lys His Thr Lys Lys Tyr Val Gln Thr Ser Ile Gly Lys Val Leu Ala
    930                 935                 940
```

```
Gln Gly Asp Thr Ala Arg Gly Ser Leu His Leu Asp Thr Tyr Tyr Gly
945                 950                 955                 960


Ala Ile Glu Arg Asp Gly Glu Ile Arg Tyr Val Val Arg Arg Pro Leu
                965                 970                 975


Ser Ser Phe Thr Lys Pro Glu Glu Leu Glu Asn Ile Val Asp Glu Thr
            980                 985                 990


Val Lys Arg Thr Ile Lys Glu Ala  Ile Ala Asp Lys Asn  Phe Lys Gln
        995                 1000                1005


Ala Ile  Ala Glu Pro Ile Tyr  Met Asn Glu Glu Lys  Gly Ile Leu
    1010                1015                1020


Ile Lys  Lys Val Arg Cys Phe  Ala Lys Ser Val Lys  Gln Pro Ile
    1025                1030                1035


Asn Ile  Arg Gln His Arg Asp  Leu Ser Lys Lys Glu  Tyr Lys Gln
    1040                1045                1050


Gln Tyr  His Val Met Asn Glu  Asn Asn Tyr Leu Leu  Ala Ile Tyr
    1055                1060                1065


Glu Gly  Leu Val Lys Asn Lys  Val Val Arg Glu Phe  Glu Ile Val
    1070                1075                1080


Ser Tyr  Ile Glu Ala Ala Lys  Tyr Tyr Lys Arg Ser  Gln Asp Arg
    1085                1090                1095


Asn Ile  Phe Ser Ser Ile Val  Pro Thr His Ser Thr  Lys Tyr Gly
    1100                1105                1110


Leu Pro  Leu Lys Thr Lys Leu  Leu Met Gly Gln Leu  Val Leu Met
    1115                1120                1125


Phe Glu  Glu Asn Pro Asp Glu  Ile Gln Val Asp Asn  Thr Lys Asp
    1130                1135                1140
```

```
Leu Val  Lys Arg Leu Tyr Lys  Val Val Gly Ile Glu  Lys Asp Gly
    1145                1150                1155


Arg Ile  Lys Phe Lys Tyr His  Gln Glu Ala Arg Lys  Glu Gly Leu
    1160                1165                1170


Pro Ile  Phe Ser Thr Pro Tyr  Lys Asn Asn Asp Asp  Tyr Ala Pro
    1175                1180                1185


Ile Phe  Arg Gln Ser Ile Asn  Asn Ile Asn Ile Leu  Val Asp Gly
    1190                1195                1200


Ile Asp  Phe Thr Ile Asp Ile  Leu Gly Lys Val Thr  Leu Lys Glu
    1205                1210                1215


<210>  135
<211>  1487
<212>  PRT
<213>  Prevotella timonensis

<400>  135

Met Lys Asn Ile Leu Gly Leu Asp Leu Gly Ser Asn Ser Val Gly Trp
1               5                   10                  15


Ala Leu Val Lys Val Glu Glu Asn Gly Asn Pro Ile Gly Ser Ile Lys
            20                  25                  30


Met Gly Ser Arg Ile Ile Pro Met Ser Gln Asp Ile Leu Gly Ser Phe
        35                  40                  45


Glu Lys Gly Asp Thr Val Ser Gln Thr Ala Gln Arg Thr Leu Tyr Arg
    50                  55                  60


Gly Lys Arg Arg Leu Ile Glu Arg His Val Leu Arg Arg Glu Arg Leu
65                  70                  75                  80


Cys Arg Val Leu His Ile Met Asn Phe Leu Pro Ala His Phe Asp Arg
```

```
                85                  90                  95

Leu Leu Gly Trp Asp Lys Thr Asp Asn Lys Thr Tyr Gly Lys Phe Ile
            100                 105                 110

Asp Asp Ser Glu Pro Lys Leu Ala Trp Arg Gln Asn Lys Asn Glu Met
        115                 120                 125

Gly Lys Met Glu Phe Val Phe Met Asp Ser Phe His Glu Met Leu Ser
    130                 135                 140

Asp Phe Ala Lys His Gln Pro Gln Leu Ile Ala Asn Gly Lys Lys Val
145                 150                 155                 160

Pro Leu Asp Trp Thr Ile Tyr Tyr Leu Arg Lys Lys Ala Leu Thr Gln
                165                 170                 175

Leu Ile Ser Lys Glu Glu Leu Ala Trp Ile Leu Leu Asn Phe Asn Lys
            180                 185                 190

Lys Arg Gly Tyr Tyr Gln Leu Arg Gly Glu Glu Glu Glu Glu Gln Pro
        195                 200                 205

Thr Lys Lys Glu Glu Tyr Lys Val Leu Lys Val Ile Ser Val Asp Ala
    210                 215                 220

Asp Glu Gly Gln Lys Gly Asn Gly Ile Trp Tyr Asn Ile His Leu Glu
225                 230                 235                 240

Asp Gly Gly Ile Tyr Lys Lys Lys Ser Asp Ile Pro Leu Tyr Asp Trp
                245                 250                 255

Val Gly Lys Thr Leu Gln Leu Ile Val Val Thr Thr Tyr Glu Lys Asp
            260                 265                 270

Gly Lys Thr Pro Lys Ile Phe Asp Ser Gly Lys Gln Asn Pro Ser Tyr
        275                 280                 285
```

```
Arg Leu Pro Lys Glu Asp Asp Trp Gly Leu Val Lys Lys Arg Thr Glu
    290                 295                 300

Ser Gln Leu Gln Ser Ser Gly Lys Thr Val Gly Ala Phe Ile Tyr Asp
305                 310                 315                 320

Asn Ile Leu Ser Lys Pro Asp Asp Lys Ile Arg Gly Asn Leu Val Arg
                325                 330                 335

Thr Ile Glu Arg Lys Tyr Tyr Lys Lys Glu Leu Ile Glu Ile Leu Gln
            340                 345                 350

Gln Gln Ala Lys Tyr His Asp Glu Leu His Asn Gln Asn Leu Leu Glu
        355                 360                 365

Ser Cys Ala Lys Glu Leu Tyr Ala His Asn Asp Val His Tyr Asn Glu
    370                 375                 380

Val Ile Lys Ser Asn Met Ile Asn Leu Leu Val Asn Asp Ile Ile Phe
385                 390                 395                 400

Tyr Gln Arg Pro Leu Lys Ser Lys Lys Ser Leu Ile Ala Asn Cys Lys
                405                 410                 415

Tyr Glu Ser Tyr Glu Tyr Val Asp Lys Glu Thr Gly Glu Ile Lys Glu
            420                 425                 430

Met Pro Ile Lys Cys Ile Ala Lys Ser Asn Pro Tyr Tyr Gln Glu Phe
        435                 440                 445

Arg Leu Trp Gln Phe Ile His Asn Leu Arg Leu Ser Asp Val Val Thr
    450                 455                 460

Arg Glu Asp Val Thr Ala Gln Tyr Leu Ser Thr Pro Gln Asp Tyr Cys
465                 470                 475                 480

Asn Leu Phe Thr Tyr Leu Asn Asp Arg Lys Glu Ile Lys Gln Asp Ile
```

```
                485                 490                 495

Leu Leu Lys Asp Phe Phe Lys Ile Lys Lys Val Gln Ile Asp Lys Glu
            500                 505                 510

Lys Val Phe Pro Ile Glu Trp Asn Tyr Ile Lys Asp Ala Thr Lys Ser
        515                 520                 525

Tyr Pro Cys Asn Glu Thr Arg Tyr Glu Leu Leu Ser Ala Leu Lys Arg
    530                 535                 540

Ala Gly Met Asp Lys Gln Trp Leu Asp Asp Thr Pro Asn Met Gln Tyr
545                 550                 555                 560

Arg Leu Trp His Leu Leu Tyr Ser Val Glu Glu Lys Glu Glu Ser Ala
                565                 570                 575

Lys Ala Leu Arg Lys Leu Tyr Asp Asp Asp Lys Phe Val Thr Ser Phe
            580                 585                 590

Leu Lys Ile Lys Pro Phe Asn Lys Cys Tyr Gly Ala Tyr Ser Glu Lys
        595                 600                 605

Ala Ile Lys Arg Leu Leu Thr Leu Met Arg Met Gly Lys Ala Trp Asn
    610                 615                 620

Glu Gln Ala Ile Asp Ala Lys Thr Leu Lys Cys Ile Gln Gln Ile Ile
625                 630                 635                 640

Thr Asp Asn Val Asp Ser Lys Leu Lys Glu Lys Ile Asp Asp Ser Arg
                645                 650                 655

Tyr Val Leu His His Val Ser Asp Phe Gln Gly Leu Pro Thr Tyr Leu
            660                 665                 670

Ala Ser Tyr Val Ile Tyr Gly Arg His Ser Glu Val Thr Asp Ile Gln
        675                 680                 685
```

```
Cys Trp Asp Ser Pro Glu Asp Leu Leu Lys Phe Ile Arg Asp Phe Lys
    690                 695                 700

Gln His Ser Leu Arg Asn Pro Ile Val Glu Gln Val Ile Leu Glu Thr
705                 710                 715                 720

Leu Arg Val Val Tyr Asp Ile Trp Lys Ala Glu Lys His Ile Asp Glu
                725                 730                 735

Ile His Val Glu Val Ala Arg Glu Met Lys Leu Thr Ala Gln Gln Arg
            740                 745                 750

Asn Glu Ala Asn Leu Arg Asn Leu Asn Asn Glu Ala Thr Asn Leu Arg
        755                 760                 765

Ile Lys Tyr Leu Leu Glu Glu Leu Lys Asn Asp Thr Phe Ile Lys Asp
    770                 775                 780

Val Arg Pro Leu Ser Pro Ile His Gln Glu Lys Met Arg Ile Tyr Glu
785                 790                 795                 800

Gln Ala Val Leu Gly Asn Leu Asn Lys Gln Asp Lys Asp Tyr Asp Asp
                805                 810                 815

Ile Ile Lys Ile Ser Lys Lys Glu His Pro Thr Asn Ala Glu Leu Ile
            820                 825                 830

Arg Tyr Lys Leu Trp Leu Glu Gln Arg Tyr Cys Ser Pro Tyr Thr Gly
        835                 840                 845

Lys Ala Ile Ser Leu Ser Lys Leu Phe Thr Thr Ala Tyr Glu Ile Glu
    850                 855                 860

His Ile Ile Pro Gln Ser Arg Tyr Phe Asp Asn Ser Phe Asn Asn Lys
865                 870                 875                 880

Val Ile Cys Glu Ala Glu Val Asn Lys Ala Lys Gly Asn Met Leu Gly
```

```
               885                 890                 895

Tyr Glu Phe Ile Lys Lys Gln Gly Gly Gln Lys Ile Tyr Cys Thr Gln
            900                 905                 910

Leu Gly Lys Ala Val Thr Ile Leu Lys Glu Glu Ala Tyr Lys Gln Phe
        915                 920                 925

Val Asn Glu His Tyr Ala His Asn Lys Arg Lys Arg Asp Asn Leu Leu
    930                 935                 940

Ala Glu Asn Ile Pro Glu Ser Phe Ser Ser Arg Gln Leu Asn Asp Thr
945                 950                 955                 960

Arg Tyr Ile Thr Lys Thr Ile Met Ser Leu Leu Ser Asn Val Val Arg
                965                 970                 975

Gln Gln Ser Glu Glu Glu Ala Thr Ala Lys Asn Leu Leu Pro Ser Ser
            980                 985                 990

Gly Ser Val Thr Asp Arg Leu Lys  Asn Asp Trp Gly Leu  Lys Asp Val
        995                 1000                1005

Trp Asn  Thr Ile Val Thr Pro  Arg Phe Glu Arg Leu  Asn Lys Leu
    1010                1015                1020

Ser Gly  Thr Asn Asp Phe Gly  Glu Met Lys Glu Glu  Asn Gly Asn
    1025                1030                1035

Arg Tyr  Phe Gln Thr Asn Val  Pro Leu Glu Tyr Glu  Lys Gly Phe
    1040                1045                1050

Lys Lys  Lys Arg Ile Asp His  Arg His His Ala Met  Asp Ala Leu
    1055                1060                1065

Val Ile  Ala Cys Thr Thr Arg  Asn Met Val Asn Tyr  Ile Ser Asn
    1070                1075                1080
```

```
Ala Asn  Ala Asn Ser Pro Lys  Gln Arg Glu Asp Leu  Arg Gln Leu
    1085                1090                1095

Leu Cys  Asp Lys Asn Arg Ile  Ile Asn Lys Pro Trp  Asp Thr Phe
    1100                1105                1110

Thr Gln  Asp Ala Leu Lys Ala  Leu Asn Asp Ile Val  Val Ser Phe
    1115                1120                1125

Lys Asn  Asn Val Arg Ile Ile  Asn Arg Ala Thr Asn  Arg Tyr Gln
    1130                1135                1140

Arg Tyr  Asp Lys Asn Gly Lys  Lys Ile Ile Phe Ser  Gln Lys Gly
    1145                1150                1155

Asp Asp  Met Trp Ala Ile Arg  Lys Ser Met His Lys  Glu Thr Val
    1160                1165                1170

Phe Gly  Arg Val Asn Leu Ile  Arg Lys Glu Val Leu  Pro Ile Ala
    1175                1180                1185

Lys Ala  Leu Asp Asn Ile Ser  Ala Ile Cys Asn Ala  Gln Leu Arg
    1190                1195                1200

Ala Tyr  Val Asn Asp Leu Val  Asp Lys His Phe Asn  Lys Lys Gln
    1205                1210                1215

Leu Val  Ala His Phe Lys Ser  Leu Asn Tyr Lys Trp  Asn Arg Gln
    1220                1225                1230

Asp Val  Ser Lys Val Glu Val  Trp Ile Ser Ser Asp  Asn Lys Thr
    1235                1240                1245

Pro Met  Val Ala Val Arg Lys  Pro Leu Asp Thr Ser  Phe Asp Lys
    1250                1255                1260

Lys Lys  Ile Ala Ser Ile Thr  Asp Thr Gly Ile Gln  Thr Ile Leu
```

```
    1265                1270                1275

Leu Asn  Tyr Leu Glu Ser Lys  Gly Gly Asp Ala Ser  Val Ala Phe
    1280                1285                1290

Ala Pro  Glu Gly Ile Gln Glu  Met Asn Ser Asn Ile  Glu Leu Tyr
    1295                1300                1305

Asn Asn  Gly Lys Ala His Lys  Pro Ile Lys Asn Val  Arg Leu Ser
    1310                1315                1320

Glu Pro  Leu Gly Ala Lys Tyr  Gln Val Gly Glu Arg  Gly Ala Lys
    1325                1330                1335

Thr Lys  Lys Tyr Val Glu Ala  Asp Lys Gly Thr Asn  Leu Phe Phe
    1340                1345                1350

Ala Ile  Tyr Glu Asp Glu Glu  Gly Lys Arg Tyr Tyr  Tyr Ser Val
    1355                1360                1365

Pro Leu  Arg Glu Ala Ile Glu  Arg Gln Lys Gln Lys  Leu Ser Pro
    1370                1375                1380

Val Pro  Glu Tyr Asn Glu Lys  Gly Val Ala Leu Lys  Phe Tyr Leu
    1385                1390                1395

Ser Pro  Asn Asp Leu Val Tyr  Val Pro Thr Glu Glu  Glu Arg Thr
    1400                1405                1410

Met Gly  Thr Cys His Ile Asp  Lys Ala Arg Ile Tyr  Lys Met Val
    1415                1420                1425

Ser Ser  Thr Gly Cys Ser Cys  Tyr Phe Val Pro Ser  Thr Phe Ala
    1430                1435                1440

Lys Val  Ile Val Asp Lys Val  Glu Leu Gln Ser Leu  Asn Lys Met
    1445                1450                1455
```

```
Glu Lys  Ala Ile Thr Asp Glu  Cys Ile Lys Glu Val  Cys Trp Lys
    1460                1465                1470


Leu Lys  Val Asp Arg Leu Gly  Asn Ile Ile Asn Val  Ile Lys
    1475                1480                1485


<210>  136
<211>  1138
<212>  PRT
<213>  Bifidobacterium dentium

<400>  136

Met Leu Cys Arg Cys His Arg Arg Tyr Arg Ile Gly Ile Asp Val Gly
1               5                   10                  15


Leu Met Ser Val Gly Leu Ala Ala Ile Glu Val Asp Glu Thr Gly Phe
            20                  25                  30


Pro Ile Arg Ile Leu Asn Ile Gln Ser Val Ile His Asp Gly Gly Ile
        35                  40                  45


Asp Pro Gln Leu Gly Lys Lys Lys Ser Ile Ser Arg Lys Ala Ile Ser
    50                  55                  60


Gly Val Ala Arg Arg Thr Arg Arg Met Arg Arg Arg Lys Val Val Arg
65                  70                  75                  80


Leu Arg Gln Leu Asp Ala Thr Leu Glu Ser Leu Gly Phe Pro Ile Val
                85                  90                  95


Glu Pro Asp Ser Leu Asp Thr Trp Glu Ile Trp Leu Thr Arg Ala Lys
            100                 105                 110


Leu Ala Ser Ser Tyr Ile Gln Asp Asp Glu Thr Arg Lys Glu Asp Val
        115                 120                 125


Ser Ile Ala Leu Arg His Ile Ala Arg His Arg Gly Trp Arg Asn Pro
    130                 135                 140
```

```
Tyr Ser Asn Val Glu Ser Leu Phe Val Asp Val Ala Pro Ser Glu Gln
145                 150                 155                 160

Tyr Glu Glu Leu Arg Arg Lys Ala Glu Glu Lys Leu Gly Thr Ser Leu
                165                 170                 175

Ser Gly Asn Pro Thr Ser Ala Glu Ile Val Glu Cys Ile Leu Lys Arg
            180                 185                 190

Gln Val Gly Glu Val Gln Leu Arg Thr Arg Ser Arg Lys Gly Val Asn
        195                 200                 205

Gly Asn Ala Val Glu Lys Glu Gly Leu Leu Pro Thr Lys Leu Met Gln
    210                 215                 220

Ser Asp Asn Ala Ala Glu Ile Arg Arg Ile Phe Lys Val Gln Arg Ile
225                 230                 235                 240

Asp Asp Glu Thr Gly Arg Lys Leu Leu Arg Ala Val Phe Lys Ala Cys
                245                 250                 255

Ser Pro Lys Gly Ser Val Glu Arg Arg Val Gly Arg Asp Ala Leu Ala
            260                 265                 270

Pro Gly Leu Pro Arg Ala Leu Lys Ala Ser Leu Ala Phe Gln Glu Tyr
        275                 280                 285

Arg Ile Ala Asn Val Leu Thr Asn Leu Val Ile Ser Glu Asp Gly Thr
    290                 295                 300

Lys Arg Lys Leu Thr Ile Ala Glu Lys Gln Arg Val Phe Gly Phe Leu
305                 310                 315                 320

Ser Ser Asn Glu Thr Asp Asp Ile Thr Trp Ile Asp Val Ala Glu Lys
                325                 330                 335
```

```
Leu Gly Leu Glu Arg Arg Gln Ile Gln Gly Val Gly Cys Leu Thr Ala
            340                 345                 350

Asp Gly Glu Glu Arg Ile Ser Ser Thr Pro Pro Arg Asn Ile Thr Ala
        355                 360                 365

Leu His Ile His Ser Ala Lys Pro Val Ile Arg Glu Lys Leu Val Ala
    370                 375                 380

Trp Trp Lys Ala Ala Ser Pro Thr Val Arg Glu Thr Met Val Glu Leu
385                 390                 395                 400

Leu Ser Asn Thr Val Asp Ile Asp Arg Val Arg Glu Asp Met Asp Tyr
                405                 410                 415

Ser Ser Ala Val Ala Phe Ile Asp Ser Leu Gly Asp Glu Glu Leu Thr
            420                 425                 430

Ala Leu Asp Ser Val Asp Leu Leu Ser Gly Arg Ala Ala Tyr Ser Arg
        435                 440                 445

Gln Thr Leu Lys Gln Leu Thr Glu Arg Met Leu Asn Thr Asp Asp Asp
    450                 455                 460

Leu His Glu Ala Arg Lys Ala Val Phe Gly Val Asp Asp Asn Trp Lys
465                 470                 475                 480

Pro Pro Val Asp Ala Ile Ser Thr Ser Val Gly Asn Pro Ala Val Asp
                485                 490                 495

Arg Val Leu Lys Ile Val Asn Arg Tyr Leu Leu Ala Cys Gln Lys Arg
            500                 505                 510

Trp Arg Asn Pro Gln Ser Val Gln Ile Glu His Val Arg Glu Ser Phe
        515                 520                 525

Ser Ser Val Ala Lys Ala Lys Glu Thr Glu Arg Val Gln Gly Glu Arg
    530                 535                 540
```

```
Ala Arg Tyr Arg Asn Asp Leu Arg Arg Glu Leu Cys Glu Gln Glu Gly
545                 550                 555                 560

Leu Asn Lys Ile Arg Glu Ser Asp Ile Arg Arg Trp Glu Ser Val Gln
                565                 570                 575

Arg Gln Asn Gly Thr Cys Leu Tyr Cys Gly Ser Pro Ile Thr Phe Arg
            580                 585                 590

Thr Cys Glu Met Asp His Ile Val Pro Arg Lys Gly Val Gly Ser Thr
        595                 600                 605

Asn Thr Arg Val Asn Leu Ala Ala Ala Cys Ala Ala Cys Asn Lys Leu
    610                 615                 620

Lys Ser Asn Thr Ala Phe Ser Val Trp Ala Arg Thr Glu Gly Ala Ala
625                 630                 635                 640

Asn Arg Lys Val Ser Gln Arg Asp Ala Ile Glu Arg Val Lys Thr Phe
                645                 650                 655

Ile Phe Asn Lys Ser Val Pro Pro Arg Glu Gln Arg Ala Phe Lys Gln
            660                 665                 670

Ala Val Ile Ser Arg Leu Arg Gln Ala Glu Ser Asp Pro Ala Ile Asp
        675                 680                 685

Asn Arg Ser Ile Glu Ser Val Ala Trp Met Ala Asp Glu Leu His Arg
    690                 695                 700

Arg Ile Glu Ala Tyr Phe Asn Gln Asp Ala Asp Val Ser Gly Asn Thr
705                 710                 715                 720

Pro Ala Thr Gln Val Trp Val Phe Gln Gly Arg Val Thr Ala Leu Ala
                725                 730                 735
```

```
Arg Lys Ala Ser Gly Ile Glu Gly Arg Ile His Phe Ala Gly Glu Trp
            740                 745                 750

Lys Lys Thr Arg Leu Asp Arg Arg His His Ala Val Asp Ala Ala Val
        755                 760                 765

Ile Ala Met Met Asn His Ser Ala Ala Gln Thr Leu Val Glu Arg Asp
    770                 775                 780

Ser Leu Arg Leu Ser Gln Trp Ile Thr Arg Lys Pro Glu Thr Trp Lys
785                 790                 795                 800

Asn Tyr Pro Phe Ser Glu Gly Gln Lys Lys Thr Arg Phe Lys Glu Trp
                805                 810                 815

Leu Asp Cys Met Asn Ala Leu Leu Asp Leu Leu Asn Asp Ala Leu Asp
            820                 825                 830

Ser Asp Arg Val Pro Val Thr Arg Cys Gln Arg Met Ser Leu Gly Asn
        835                 840                 845

Ser Gln Ala His Ala Ala Thr Ile Arg Lys Met Lys Arg Val Glu Leu
    850                 855                 860

Phe Ser Pro Met Asp Ala Asp Leu Ile Arg Arg Ala Ser Thr Pro Ala
865                 870                 875                 880

Leu Tyr Cys Ala Leu Thr Arg Leu Pro Glu Tyr Ser Pro Glu Lys Gly
                885                 890                 895

Leu Pro Glu Asn Arg Gly Arg Glu Ile Val Leu Asn Gly Arg His Ile
            900                 905                 910

Arg Ser Thr Glu Thr Val Asp Phe Phe Ala Ser Gly Ala Ala Gln Leu
        915                 920                 925

Met Val Arg Asn Gly Ser Ala Glu Ile Gly Asp Ser Ile His His Met
    930                 935                 940
```

```
Arg Ile Tyr Arg Tyr Arg Lys Thr Gly Ala Lys Ser Gln Glu Tyr Val
945                 950                 955                 960


Tyr Gly Met Ile Arg Val Phe Gln Ile Asp Leu Leu His Ala Ser Ser
                965                 970                 975


Glu Asn Leu Phe Ala Val Gln Leu Pro Ser Gln Ser Val Ser Val Arg
            980                 985                 990


Tyr Gly Asp Lys Asn Val Val Gln  Ala Ile Gln Glu Gly  Arg Ala Glu
        995                 1000                1005


Tyr Leu  Gly His Ile Val Pro  Asn Asp Glu Ile Leu  Ile Ser Tyr
    1010                1015                1020


Glu Gly  Val Arg Met Lys Asp  Ser Glu Lys Ile Gly  Ala Tyr Ala
    1025                1030                1035


Asn Asp  Phe Ser Gly Thr Ala  Ser Glu Leu Ala Gln  Arg Arg His
    1040                1045                1050


Trp Val  Val Val Gly Ser Asp  Val Ser Lys Leu Ala  Leu Arg Pro
    1055                1060                1065


Ser Tyr  Leu Ser Glu Glu Gly  Leu Glu Asn Ser Gly  Ser Glu Ser
    1070                1075                1080


Glu Arg  Leu Ser Lys Gln Thr  Arg Lys Val Ile Glu  Gly Lys Gly
    1085                1090                1095


Trp Val  Val Ala Val Asn Ile  Leu Ala Lys Tyr His  Pro Val Val
    1100                1105                1110


Ile Arg  Arg Asn Ala Leu Gly  Glu Pro Arg Phe Arg  Thr Asn Ser
    1115                1120                1125
```

```
Gly Met  Pro Val Ser Trp Arg  Trp Asp Arg
    1130                1135


<210>  137
<211>  587
<212>  PRT
<213>  Neisseria subflava

<400>  137

Met Ala Thr Ser Arg Ser Arg Ile Arg Ser Gln Thr Asp Ala Phe Gly
1               5                   10                  15


Val Val Gly Ser Leu Val Ala Phe Asn Gln Thr Ser Arg Leu Phe Val
            20                  25                  30


Ala Lys Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu
        35                  40                  45


Leu Lys Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asn Phe
    50                  55                  60


Arg Thr Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly
65                  70                  75                  80


His Ile Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Asn Arg Lys
                85                  90                  95


Asp Leu Gln Ala Glu Leu Asn Leu Leu Phe Glu Lys Gln Lys Glu Phe
            100                 105                 110


Gly Asn Pro His Val Ser Asp Gly Leu Lys Glu Gly Ile Glu Thr Leu
        115                 120                 125


Leu Met Ala Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met
    130                 135                 140


Leu Gly Tyr Cys Thr Phe Glu Pro Thr Glu Pro Lys Ala Ala Lys Asn
145                 150                 155                 160
```

```
Thr Tyr Thr Ala Gly Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu
                165                 170                 175

Arg Ile Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Thr Thr Glu Arg
            180                 185                 190

Ala Thr Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala
        195                 200                 205

Gln Ala Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly
    210                 215                 220

Leu Arg Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met
225                 230                 235                 240

Lys Ala Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys
                245                 250                 255

Asp Lys Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile
            260                 265                 270

Gly Thr Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg
        275                 280                 285

Leu Lys Asp Arg Val Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His
    290                 295                 300

Ile Ser Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg
305                 310                 315                 320

Ile Val Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala
                325                 330                 335

Glu Ile Tyr Gly Asp His Tyr Gly Lys Lys Asn Ala Glu Glu Lys Ile
            340                 345                 350

Tyr Leu Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu
```

```
        355                 360                 365

Arg Ala Leu Ser Gln Ala Arg Lys Val Ile Asn Ala Val Val Arg Arg
    370                 375                 380

Tyr Gly Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly
385                 390                 395                 400

Lys Ser Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn
                405                 410                 415

Arg Lys Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro
            420                 425                 430

Asn Phe Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu
        435                 440                 445

Tyr Glu Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn
    450                 455                 460

Leu Gly Arg Leu Asn Glu Lys Gly Tyr Ile Glu Ile Asp His Ala Leu
465                 470                 475                 480

Pro Phe Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val
                485                 490                 495

Leu Gly Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr
            500                 505                 510

Phe Asn Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg
        515                 520                 525

Val Glu Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu
    530                 535                 540

Gln Lys Phe Asp Glu Asp Gly Ile Tyr Arg Ile Gly Val Lys Thr Ala
545                 550                 555                 560
```

```
Leu Ser Phe Pro Lys Tyr Gln Ile Asp Glu Leu Gly Lys Glu Ile Arg
                565                 570                 575


Pro Cys Arg Leu Lys Lys Arg Pro Pro Val Arg
            580                 585


<210>  138
<211>  1269
<212>  PRT
<213>  Mycoplasma gallisepticum

<400>  138

Met Asn Asn Ser Ile Lys Ser Lys Pro Glu Val Thr Ile Gly Leu Asp
1               5                   10                  15


Leu Gly Val Gly Ser Val Gly Trp Ala Ile Val Asp Asn Glu Thr Asn
            20                  25                  30


Ile Ile His His Leu Gly Ser Arg Leu Phe Ser Gln Ala Lys Thr Ala
        35                  40                  45


Glu Asp Arg Arg Ser Phe Arg Gly Val Arg Arg Leu Ile Arg Arg Arg
    50                  55                  60


Lys Tyr Lys Leu Lys Arg Phe Val Asn Leu Ile Trp Lys Tyr Asn Ser
65                  70                  75                  80


Tyr Phe Gly Phe Lys Asn Lys Glu Asp Ile Leu Asn Asn Tyr Gln Glu
                85                  90                  95


Gln Gln Lys Leu His Asn Thr Val Leu Asn Leu Lys Ser Glu Ala Leu
            100                 105                 110


Asn Ala Lys Ile Asp Pro Lys Ala Leu Ser Trp Ile Leu His Asp Tyr
        115                 120                 125


Leu Lys Asn Arg Gly His Phe Tyr Glu Asp Asn Arg Asp Phe Asn Val
    130                 135                 140
```

```
Tyr Pro Thr Lys Glu Leu Ala Lys Tyr Phe Asp Lys Tyr Gly Tyr Tyr
145                 150                 155                 160

Lys Gly Ile Ile Asp Ser Lys Glu Asp Asn Asp Asn Lys Leu Glu Glu
                165                 170                 175

Glu Leu Thr Lys Tyr Lys Phe Ser Asn Lys His Trp Leu Glu Glu Val
            180                 185                 190

Lys Lys Val Leu Ser Asn Gln Thr Gly Leu Pro Glu Lys Phe Lys Glu
        195                 200                 205

Glu Tyr Glu Ser Leu Phe Ser Tyr Val Arg Asn Tyr Ser Glu Gly Pro
    210                 215                 220

Gly Ser Ile Asn Ser Val Ser Pro Tyr Gly Ile Tyr His Leu Asp Glu
225                 230                 235                 240

Lys Glu Gly Lys Val Val Gln Lys Tyr Asn Asn Ile Trp Asp Lys Thr
                245                 250                 255

Ile Gly Lys Cys Asn Ile Phe Pro Asp Glu Tyr Arg Ala Pro Lys Asn
            260                 265                 270

Ser Pro Ile Ala Met Ile Phe Asn Glu Ile Asn Glu Leu Ser Thr Ile
        275                 280                 285

Arg Ser Tyr Ser Ile Tyr Leu Thr Gly Trp Phe Ile Asn Gln Glu Phe
    290                 295                 300

Lys Lys Ala Tyr Leu Asn Lys Leu Leu Asp Leu Leu Ile Lys Thr Asn
305                 310                 315                 320

Gly Glu Lys Pro Ile Asp Ala Arg Gln Phe Lys Lys Leu Arg Glu Glu
                325                 330                 335
```

```
Thr Ile Ala Glu Ser Ile Gly Lys Glu Thr Leu Lys Asp Val Glu Asn
            340                 345                 350

Glu Glu Lys Leu Glu Lys Glu Asp His Lys Trp Lys Leu Lys Gly Leu
        355                 360                 365

Lys Leu Asn Thr Asn Gly Lys Ile Gln Tyr Asn Asp Leu Ser Ser Leu
    370                 375                 380

Ala Lys Phe Val His Lys Leu Lys Gln His Leu Lys Leu Asp Phe Leu
385                 390                 395                 400

Leu Glu Asp Gln Tyr Ala Thr Leu Asp Lys Ile Asn Phe Leu Gln Ser
                405                 410                 415

Leu Phe Val Tyr Leu Gly Lys His Leu Arg Tyr Ser Asn Arg Val Asp
            420                 425                 430

Ser Ala Asn Leu Lys Glu Phe Ser Asp Ser Asn Lys Leu Phe Glu Arg
        435                 440                 445

Ile Leu Gln Lys Gln Lys Asp Gly Leu Phe Lys Leu Phe Glu Gln Thr
    450                 455                 460

Asp Lys Asp Asp Glu Lys Ile Leu Ala Gln Thr His Ser Leu Ser Thr
465                 470                 475                 480

Lys Ala Met Leu Leu Ala Ile Thr Arg Met Thr Asn Leu Asp Asn Asp
                485                 490                 495

Glu Asp Asn Gln Lys Asn Asn Asp Lys Gly Trp Asn Phe Glu Ala Ile
            500                 505                 510

Lys Asn Phe Asp Gln Lys Phe Ile Asp Ile Thr Lys Lys Asn Asn Asn
        515                 520                 525

Leu Ser Leu Lys Gln Asn Lys Arg Tyr Leu Asp Asp Arg Phe Ile Asn
    530                 535                 540
```

```
Asp Ala Ile Leu Ser Pro Gly Val Lys Arg Ile Leu Arg Glu Ala Thr
545                 550                 555                 560

Lys Val Phe Asn Ala Ile Leu Lys Gln Phe Ser Glu Glu Tyr Asp Val
                565                 570                 575

Thr Lys Val Val Ile Glu Leu Ala Arg Glu Leu Ser Glu Glu Lys Glu
            580                 585                 590

Leu Glu Asn Thr Lys Asn Tyr Lys Lys Leu Ile Lys Lys Asn Gly Asp
        595                 600                 605

Lys Ile Ser Glu Gly Leu Lys Ala Leu Gly Ile Ser Glu Asp Glu Ile
    610                 615                 620

Lys Asp Ile Leu Lys Ser Pro Thr Lys Ser Tyr Lys Phe Leu Leu Trp
625                 630                 635                 640

Leu Gln Gln Asp His Ile Asp Pro Tyr Ser Leu Lys Glu Ile Ala Phe
                645                 650                 655

Asp Asp Ile Phe Thr Lys Thr Glu Lys Phe Glu Ile Asp His Ile Ile
            660                 665                 670

Pro Tyr Ser Ile Ser Phe Asp Asp Ser Ser Ser Asn Lys Leu Leu Val
        675                 680                 685

Leu Ala Glu Ser Asn Gln Ala Lys Ser Asn Gln Thr Pro Tyr Glu Phe
    690                 695                 700

Ile Ser Ser Gly Asn Ala Gly Ile Lys Trp Glu Asp Tyr Glu Ala Tyr
705                 710                 715                 720

Cys Arg Lys Phe Lys Asp Gly Asp Ser Ser Leu Leu Asp Ser Thr Gln
                725                 730                 735
```

```
Arg Ser Lys Lys Phe Ala Lys Met Met Lys Thr Asp Thr Ser Ser Lys
            740                 745                 750

Tyr Asp Ile Gly Phe Leu Ala Arg Asn Leu Asn Asp Thr Arg Tyr Ala
        755                 760                 765

Thr Ile Val Phe Arg Asp Ala Leu Glu Asp Tyr Ala Asn Asn His Leu
    770                 775                 780

Val Glu Asp Lys Pro Met Phe Lys Val Val Cys Ile Asn Gly Ser Val
785                 790                 795                 800

Thr Ser Phe Leu Arg Lys Asn Phe Asp Asp Ser Ser Tyr Ala Lys Lys
                805                 810                 815

Asp Arg Asp Lys Asn Ile His His Ala Val Asp Ala Ser Ile Ile Ser
            820                 825                 830

Ile Phe Ser Asn Glu Thr Lys Thr Leu Phe Asn Gln Leu Thr Gln Phe
        835                 840                 845

Ala Asp Tyr Lys Leu Phe Lys Asn Thr Asp Gly Ser Trp Lys Lys Ile
    850                 855                 860

Asp Pro Lys Thr Gly Val Val Thr Glu Val Thr Asp Glu Asn Trp Lys
865                 870                 875                 880

Gln Ile Arg Val Arg Asn Gln Val Ser Glu Ile Ala Lys Val Ile Glu
                885                 890                 895

Lys Tyr Ile Gln Asp Ser Asn Ile Glu Arg Lys Ala Arg Tyr Ser Arg
            900                 905                 910

Lys Ile Glu Asn Lys Thr Asn Ile Ser Leu Phe Asn Asp Thr Val Tyr
        915                 920                 925

Ser Ala Lys Lys Val Gly Tyr Glu Asp Gln Ile Lys Arg Lys Asn Leu
    930                 935                 940
```

```
Lys Thr Leu Asp Ile His Glu Ser Ala Lys Glu Asn Lys Asn Ser Lys
945                 950                 955                 960


Val Lys Arg Gln Phe Val Tyr Arg Lys Leu Val Asn Val Ser Leu Leu
                965                 970                 975


Asn Asn Asp Lys Leu Ala Asp Leu Phe Ala Glu Lys Glu Asp Ile Leu
            980                 985                 990


Met Tyr Arg Ala Asn Pro Trp Val  Ile Asn Leu Ala Glu  Gln Ile Phe
        995                 1000                1005


Asn Glu  Tyr Thr Glu Asn Lys  Lys Ile Lys Ser Gln  Asn Val Phe
    1010                1015                1020


Glu Lys  Tyr Met Leu Asp Leu  Thr Lys Glu Phe Pro  Glu Lys Phe
    1025                1030                1035


Ser Glu  Phe Leu Val Lys Ser  Met Leu Arg Asn Lys  Thr Ala Ile
    1040                1045                1050


Ile Tyr  Asp Asp Lys Lys Asn  Ile Val His Arg Ile  Lys Arg Leu
    1055                1060                1065


Lys Met  Leu Ser Ser Glu Leu  Lys Glu Asn Lys Leu  Ser Asn Val
    1070                1075                1080


Ile Ile  Arg Ser Lys Asn Gln  Ser Gly Thr Lys Leu  Ser Tyr Gln
    1085                1090                1095


Asp Thr  Ile Asn Ser Leu Ala  Leu Met Ile Met Arg  Ser Ile Asp
    1100                1105                1110


Pro Thr  Ala Lys Lys Gln Tyr  Ile Arg Val Pro Leu  Asn Thr Leu
    1115                1120                1125
```

```
Asn Leu  His Leu Gly Asp His  Asp Phe Asp Leu His  Asn Met Asp
    1130                1135                1140


Ala Tyr  Leu Lys Lys Pro Lys  Phe Val Lys Tyr Leu  Lys Ala Asn
    1145                1150                1155


Glu Ile  Gly Asp Glu Tyr Lys  Pro Trp Arg Val Leu  Thr Ser Gly
    1160                1165                1170


Thr Leu  Leu Ile His Lys Lys  Asp Lys Lys Leu Met  Tyr Ile Ser
    1175                1180                1185


Ser Phe  Gln Asn Leu Asn Asp  Val Ile Glu Ile Lys  Asn Leu Ile
    1190                1195                1200


Glu Thr  Glu Tyr Lys Glu Asn  Asp Asp Ser Asp Ser  Lys Lys Lys
    1205                1210                1215


Lys Lys  Ala Asn Arg Phe Leu  Met Thr Leu Ser Thr  Ile Leu Asn
    1220                1225                1230


Asp Tyr  Ile Leu Leu Asp Ala  Lys Asp Asn Phe Asp  Ile Leu Gly
    1235                1240                1245


Leu Ser  Lys Asn Arg Ile Asp  Glu Ile Leu Asn Ser  Lys Leu Gly
    1250                1255                1260


Leu Asp  Lys Ile Val Lys
    1265


<210>  139
<211>  1354
<212>  PRT
<213>  Prevotella melaninogenica

<400>  139

Met Ala Asp Phe Ala Lys Tyr Gln Pro Gly Met Val Ala Asp Gly Arg
1               5                  10                  15
```

```
Lys Ile Pro Leu Asp Trp Thr Leu Tyr Tyr Leu Arg Lys Lys Ala Leu
            20                  25                  30

Thr Gln Ala Ile Arg Lys Glu Glu Leu Ala Trp Ile Leu Leu Asn Phe
        35                  40                  45

Asn Gln Lys Arg Gly Tyr Tyr Gln Leu Arg Gly Glu Glu Glu Glu Glu
    50                  55                  60

Asn Ser Thr Lys His Glu Glu Tyr Tyr Glu Leu Lys Val Val Ser Val
65                  70                  75                  80

Glu Ala Ala Glu Glu Gly Lys Gly Gly Asn Thr Trp Tyr Asn Val Thr
                85                  90                  95

Leu Glu Asn Gly Trp Ile Tyr Arg Arg Gln Ser Lys Ile Glu Leu Asn
            100                 105                 110

Asp Trp Val Gly Lys Val Arg Pro Phe Ile Val Thr Thr Glu Tyr Glu
        115                 120                 125

Ile Asp Gly Val Thr Ile Lys Lys Asp Lys Asn Gly Glu Val Lys Arg
    130                 135                 140

Ser Phe Arg Ala Pro Ser Glu Asn Asp Trp Gly Leu Arg Lys Lys Arg
145                 150                 155                 160

Thr Glu Ser Leu Leu Glu Glu Ser Gly Lys Thr Val Gly Ala Phe Ile
                165                 170                 175

Tyr Asn His Ile Leu Ser Glu Pro Ala Asp Lys Ile Arg Gly Asn Phe
            180                 185                 190

Ile Arg Thr Ile Glu Arg Lys Phe Tyr Lys Lys Glu Leu Glu Ala Ile
        195                 200                 205

Leu Arg Glu Gln Ser Lys His Gln Lys Glu Leu Lys Asp Ile Asp Thr
```

```
    210                 215                 220

Leu Ile Ala Cys Ile Lys Glu Leu Tyr Pro Asn Asn Lys Pro His Gln
225                 230                 235                 240

Asp Ser Leu Ile Lys Lys Asp Met Thr Tyr Leu Leu Ile Thr Asp Leu
                245                 250                 255

Ile Phe Tyr Gln Arg Pro Leu Lys Ser Lys Lys Ser Leu Ile Ala Asp
            260                 265                 270

Cys Pro Tyr Glu Tyr Tyr Glu Tyr Val Ile Lys Glu Thr Gly Glu Asn
        275                 280                 285

Lys Arg Gln Ser Ile Lys Cys Ile Ala Lys Ser Asn Pro Tyr Tyr Gln
    290                 295                 300

Glu Phe Arg Leu Trp Gln Phe Ile Ile Asn Leu Arg Leu Phe Asp Arg
305                 310                 315                 320

Asn Asn Asp Lys Glu Val Thr Ser Glu Tyr Leu Ser Ser Met Glu Asp
                325                 330                 335

Tyr Thr Arg Leu Phe Thr Tyr Leu Asn Asp Arg Lys Asp Ile Asn Gln
            340                 345                 350

Glu Thr Leu Leu Lys Asp Phe Phe Lys Gln Lys Lys Val Lys Arg Gly
        355                 360                 365

Met Glu Lys Glu Phe Pro Ile Arg Trp Asn Tyr Ile Glu Asp Lys Glu
    370                 375                 380

Lys Lys Tyr Pro Cys Asn Glu Thr Arg His Glu Leu Leu Thr Ala Leu
385                 390                 395                 400

Gly Lys Val Gly Ile Asp His Ser Trp Leu Asp Asp Lys Glu Leu Phe
                405                 410                 415
```

```
Tyr Arg Leu Trp His Leu Leu Tyr Ser Val Glu Ser Lys Glu Glu Ala
            420                 425                 430

Glu Gly Ala Leu Arg Lys Leu Val Asp Asn Asp Asp Phe Val Asn Ala
        435                 440                 445

Phe Leu Lys Ile Lys Pro Phe Lys Lys Glu Tyr Gly Ala Tyr Ser Glu
    450                 455                 460

Lys Ala Ile Lys Lys Leu Leu Ala Val Met Arg Met Gly Asn Leu Trp
465                 470                 475                 480

Asn Glu Val Asp Ile Cys Glu Gln Thr Arg Asp Arg Ile Gln Asn Ile
                485                 490                 495

Ile Lys Gly Asp Ile Asp Glu Lys Ile Lys Asp Arg Met Gly Arg Thr
            500                 505                 510

Phe Ser Gln Leu Ser Asp Phe Gln Gly Leu Pro Glu Trp Leu Ala Cys
        515                 520                 525

Tyr Val Val Tyr Gly Gln His Ser Glu Ala Thr Asp Ile Gln Arg Trp
    530                 535                 540

Thr Lys Pro Glu Asn Leu Met Ala Tyr Ile Asn Gly Phe Lys Gln His
545                 550                 555                 560

Ser Leu Arg Asn Pro Ile Val Glu Gln Cys Ile Leu Glu Thr Leu Arg
                565                 570                 575

Thr Val His Asp Ile Trp Lys Glu Ala Gly His Ile Asp Glu Ile His
            580                 585                 590

Ile Glu Leu Gly Arg Gly Met Lys Ser Thr Ala Asp Gln Arg Ala Arg
        595                 600                 605

Met Ser Lys Ser Ile Met Gln Asn Glu Asn Thr Asn Leu Arg Ile Lys
```

```
    610                 615                 620

Ser Leu Leu Met Glu Leu Lys Asn Ala Lys Glu Phe Glu Asn Val Arg
625                 630                 635                 640

Pro Tyr Ser Pro Met Gln Gln Glu Ile Leu Arg Ile Tyr Glu Glu Gly
                645                 650                 655

Ala Leu Gln Glu Leu Thr Lys Glu Asp Ala Gln Tyr Asn Glu Ile Ser
            660                 665                 670

Lys Ile Ser Gln Met Ala Gln Pro Ser Ala Asn Glu Leu Leu Lys Tyr
        675                 680                 685

Arg Leu Trp Leu Glu Gln Lys Tyr Cys Ser Pro Tyr Thr Gly Lys Pro
    690                 695                 700

Ile Ser Leu Ser Lys Leu Phe Thr Ser Ala Tyr Gln Ile Glu His Ile
705                 710                 715                 720

Ile Pro Gln Ser Arg Tyr Phe Asp Asp Ser Phe Thr Asn Lys Val Ile
                725                 730                 735

Cys Glu Ala Glu Val Asn Gln Leu Lys Ser Asn Met Leu Gly Tyr Glu
            740                 745                 750

Phe Ile Lys Lys His Gly Gly Glu Ile Val Arg Cys Thr Met Ile Gly
        755                 760                 765

Asp Val Lys Leu Leu Asp Ala Lys Glu Tyr Tyr Asn Phe Val Thr Glu
    770                 775                 780

His Tyr Thr Asn Asn Arg Arg Lys Lys Glu Lys Leu Leu Met Glu Asp
785                 790                 795                 800

Ile Pro Gln Glu Phe Leu Asn Arg Gln Met Asn Asp Ser Arg Tyr Ile
                805                 810                 815
```

```
Ser Lys Lys Val Met Ala Ile Leu Ser Asn Ile Val Arg Glu Glu Asp
            820                 825                 830

Glu Gln Glu Ala Lys Ser Lys Phe Val Ile Ala Cys Ser Gly Gly Ile
        835                 840                 845

Thr Asp Arg Leu Lys Gln Asp Trp Gly Leu Asn Asp Val Trp Asn Ser
    850                 855                 860

Ile Val Tyr Pro Arg Phe Glu Arg Leu Asn Lys Leu Thr Asn Thr Glu
865                 870                 875                 880

Asn Phe Gly Arg Trp Glu Asn Lys Lys Gly Lys Gln Val Phe Gln Thr
                885                 890                 895

Ser Val Pro Leu Glu Leu Gln Lys Asp Phe Ser Lys Lys Arg Ile Asp
            900                 905                 910

His Arg His His Ala Met Asp Ala Leu Val Ile Ala Cys Ala Ser Asn
        915                 920                 925

Asn Ile Ile Asn Tyr Leu Asn Asn Glu Ser Ala Lys Ser Gln Glu Lys
    930                 935                 940

Arg Glu Asp Leu Arg Lys Lys Leu Cys Asp Lys Asn Arg Ile Ile Arg
945                 950                 955                 960

Lys Pro Trp Glu Thr Phe Thr Gln Asp Ala His Thr Ala Leu Glu Asn
                965                 970                 975

Val Val Val Ser Phe Lys Asn Tyr Ile Arg Val Ile Asn Lys Ala Thr
            980                 985                 990

Asn Tyr Tyr Glu Lys Tyr Asp Lys  Asn Gly Lys Lys Glu  Ile Ala Glu
        995                 1000                1005

Gln Lys  Gly Gln Asp Met Trp  Ala Ile Arg Lys Pro  Met His Lys
```

```
    1010                1015                1020

Glu Thr  Val Phe Gly Gln Val  Asn Leu Arg Arg Lys  Ile Thr Ile
    1025                1030                1035

Lys Leu  Lys Asp Ala Leu Glu  Lys Ile Pro Ala Ile  Cys Asp Lys
    1040                1045                1050

Glu Leu  Arg Asp Tyr Ile Asn  Ile Leu Val Ala Lys  Gln Phe Asn
    1055                1060                1065

Lys Lys  Gln Ile Leu Ala His  Phe Lys Ser Ile Asn  Tyr Arg Leu
    1070                1075                1080

Asn Met  Lys Ser Val Asp Lys  Val Asp Val Trp Gln  Phe Ser Asn
    1085                1090                1095

Glu Lys  Glu Pro Met Val Ala  Thr Arg Lys Ser Val  Asp Thr Ser
    1100                1105                1110

Phe Asp  Thr Lys Arg Ile Ala  Thr Ile Thr Asp Thr  Gly Ile Gln
    1115                1120                1125

Lys Ile  Leu Leu Asn Tyr Leu  Lys Ala Lys Asn Asn  Asp Pro Asn
    1130                1135                1140

Ile Ala  Phe Thr Pro Glu Gly  Ile Ala Glu Met Asn  Lys His Ile
    1145                1150                1155

Thr Glu  Tyr Asn Asn Gly Lys  Gln His Gln Pro Ile  Leu Lys Val
    1160                1165                1170

Arg Val  Ser Glu Pro Lys Gly  Ala Lys Tyr Gln Val  Gly Glu Thr
    1175                1180                1185

Gly Asn  Lys Arg Ser Lys Phe  Val Glu Ala Gln Lys  Gly Thr Asn
    1190                1195                1200
```

```
Leu Tyr  Phe Ala Ile Tyr Glu  Asp Lys Glu Gly Asn  Arg Ser Tyr
    1205                1210                1215

Asn Thr  Ile Pro Leu Asn Glu  Val Ile Glu Arg Leu  Lys Gln Gly
    1220                1225                1230

Leu Ser  Pro Val Pro Asp Ala  Asn Glu Lys Ser Ile  Pro Leu Lys
    1235                1240                1245

Phe His  Leu Ser Pro Asn Asp  Leu Val Tyr Val Pro  Lys Thr Asp
    1250                1255                1260

Glu Glu  Asn Glu Ile Lys Met  Gly Gln Ile Tyr Lys  Phe Val Asp
    1265                1270                1275

Ser Ser  Gly Thr Thr Ala Asn  Phe Val Pro His Arg  Val Ser Asn
    1280                1285                1290

Leu Ile  Tyr Asn Val Asp Lys  Lys Ile Ala Glu Asn  Phe Cys Asn
    1295                1300                1305

His Glu  Ile Ile Gln Asn Glu  Tyr Gly Ile Gly Ser  Pro Gln Ser
    1310                1315                1320

Lys Asn  Gln Lys Ser Ile Thr  Gly Glu Met Ile Lys  Ala Val Cys
    1325                1330                1335

Trp Lys  Leu Glu Val Asp Arg  Leu Gly Asn Ile His  Lys Ile Ile
    1340                1345                1350

Lys
```

<210> 140
<211> 1130
<212> PRT
<213> Streptococcus gallolyticus

<400> 140

```
Met Thr Asn Gly Lys Ile Leu Gly Leu Asp Ile Gly Ile Ala Ser Val
1               5                  10                  15

Gly Val Gly Ile Ile Glu Ala Lys Thr Gly Lys Val Val His Ala Asn
            20                  25                  30

Ser Arg Leu Phe Ser Ala Ala Asn Ala Glu Asn Asn Ala Glu Arg Arg
        35                  40                  45

Gly Phe Arg Gly Ser Arg Arg Leu Asn Arg Arg Lys Lys His Arg Val
    50                  55                  60

Lys Arg Val Arg Asp Leu Phe Glu Lys Tyr Glu Ile Val Thr Asp Phe
65                  70                  75                  80

Arg Asn Leu Asn Leu Asn Pro Tyr Glu Leu Arg Val Lys Gly Leu Thr
                85                  90                  95

Glu Gln Leu Thr Asn Glu Glu Leu Phe Ala Ala Leu Arg Thr Ile Ser
            100                 105                 110

Lys Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Glu Asp Asp Ser Thr
        115                 120                 125

Gly Ser Thr Asp Tyr Ala Lys Ser Ile Asp Glu Asn Arg Arg Leu Leu
    130                 135                 140

Lys Thr Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Leu Glu Lys Tyr
145                 150                 155                 160

Gly Gln Leu Arg Gly Asn Phe Thr Val Tyr Asp Glu Asn Gly Glu Ala
                165                 170                 175

His Arg Leu Ile Asn Val Phe Ser Thr Ser Asp Tyr Glu Lys Glu Ala
            180                 185                 190
```

```
Arg Lys Ile Leu Glu Thr Gln Ala Asp Tyr Asn Lys Lys Ile Thr Ala
        195                 200                 205

Glu Phe Ile Asp Asp Tyr Val Glu Ile Leu Thr Gln Lys Arg Lys Tyr
    210                 215                 220

Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg Phe
225                 230                 235                 240

Arg Thr Asp Gly Thr Thr Leu Glu Asn Ile Phe Gly Ile Leu Ile Gly
                245                 250                 255

Lys Cys Ser Phe Tyr Pro Asp Glu Tyr Arg Ala Ser Lys Ala Ser Tyr
            260                 265                 270

Thr Ala Gln Glu Tyr Asn Phe Leu Asn Asp Leu Asn Asn Leu Lys Val
        275                 280                 285

Pro Thr Glu Thr Gly Lys Leu Ser Thr Glu Gln Lys Glu Ala Leu Val
    290                 295                 300

Glu Phe Ala Lys Ser Thr Ala Thr Leu Gly Pro Ala Lys Leu Leu Lys
305                 310                 315                 320

Glu Ile Ala Lys Ile Leu Asp Cys Lys Val Asp Glu Ile Lys Gly Tyr
                325                 330                 335

Arg Glu Asp Asp Lys Gly Lys Pro Asp Leu His Thr Phe Glu Pro Tyr
            340                 345                 350

Arg Lys Leu Lys Phe Asn Leu Asp Ser Val Asn Ile Asp Asp Leu Ser
        355                 360                 365

Arg Glu Val Leu Asp Lys Leu Ala Asp Ile Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Glu Asp Ala Ile Arg His Asn Leu Pro Asn Gln Phe
385                 390                 395                 400
```

```
Thr Glu Gly Gln Ile Ser Glu Ile Ile Lys Val Arg Lys Ser Gln Ser
                405                 410                 415

Thr Ala Phe Asn Lys Gly Trp His Ser Phe Ser Ala Lys Leu Met Asn
            420                 425                 430

Glu Leu Ile Pro Glu Leu Tyr Ala Thr Ser Asp Glu Gln Met Thr Ile
        435                 440                 445

Leu Thr Arg Leu Glu Lys Phe Lys Val Asn Lys Lys Ser Ser Lys Asn
    450                 455                 460

Thr Lys Thr Ile Asp Glu Lys Glu Val Thr Asp Glu Ile Tyr Asn Pro
465                 470                 475                 480

Val Val Ala Lys Ser Val Arg Gln Thr Ile Lys Ile Ile Asn Ala Ala
                485                 490                 495

Val Lys Lys Tyr Gly Asp Phe Asp Lys Ile Val Ile Glu Met Pro Arg
            500                 505                 510

Asp Lys Asn Ala Asp Asp Glu Lys Lys Phe Ile Asp Lys Arg Asn Lys
        515                 520                 525

Glu Asn Lys Lys Glu Lys Asp Asp Ala Leu Lys Arg Ala Ala Tyr Leu
    530                 535                 540

Tyr Asn Gly Thr Asp Lys Leu Pro Asp Glu Val Phe His Gly Asn Lys
545                 550                 555                 560

Gln Leu Glu Thr Lys Ile Arg Leu Trp Tyr Gln Gln Gly Glu Arg Cys
                565                 570                 575

Leu Tyr Ser Gly Lys Pro Ile Pro Ile Gln Glu Leu Val His Asn Ser
            580                 585                 590
```

```
Asn Asn Phe Glu Ile Asp His Ile Leu Pro Leu Ser Leu Ser Phe Asp
        595                 600                 605

Asp Ser Leu Ala Asn Lys Val Leu Val Tyr Ala Trp Thr Asn Gln Glu
    610                 615                 620

Lys Gly Gln Lys Thr Pro Tyr Gln Val Ile Asp Ser Met Asp Ala Ala
625                 630                 635                 640

Trp Ser Phe Arg Glu Met Lys Asp Tyr Val Leu Lys Gln Lys Gly Leu
                645                 650                 655

Gly Lys Lys Lys Arg Asp Tyr Leu Leu Thr Thr Glu Asn Ile Asp Lys
            660                 665                 670

Ile Glu Val Lys Lys Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Ala Ser Arg Val Val Leu Asn Ser Leu Gln Ser Ala Leu Arg Glu
    690                 695                 700

Leu Gly Lys Asp Thr Lys Ile Ser Val Ile Arg Gly Gln Phe Thr Ser
705                 710                 715                 720

Gln Leu Arg Arg Lys Trp Lys Ile Asp Lys Ser Arg Glu Thr Tyr His
                725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Lys
            740                 745                 750

Leu Trp Glu Lys Gln Asp Asn Pro Met Phe Val Asp Tyr Gly Asn Asn
        755                 760                 765

Gln Val Val Asp Lys Gln Thr Gly Glu Ile Leu Ser Val Ser Asp Asp
    770                 775                 780

Glu Tyr Lys Glu Leu Val Phe Gln Pro Pro Tyr Gln Gly Phe Val Asn
785                 790                 795                 800
```

```
Met Ile Ser Ser Lys Gly Phe Glu Asp Glu Ile Leu Phe Ser Tyr Gln
                805                 810                 815

Val Asp Ser Lys Tyr Asn Arg Lys Val Ser Asp Ala Thr Ile Tyr Ser
            820                 825                 830

Thr Arg Lys Ala Lys Ile Gly Lys Asp Lys Lys Glu Glu Thr Tyr Val
        835                 840                 845

Leu Gly Lys Ile Lys Asp Ile Tyr Ser Gln Asn Gly Phe Asp Thr Phe
    850                 855                 860

Ile Lys Lys Tyr Asn Lys Asp Lys Thr Gln Phe Leu Met Tyr Gln Lys
865                 870                 875                 880

Asp Pro Leu Thr Trp Glu Asn Val Ile Glu Val Ile Leu Arg Asp Tyr
                885                 890                 895

Pro Thr Thr Lys Lys Ser Glu Asp Gly Lys Asn Asp Val Lys Cys Asn
            900                 905                 910

Pro Phe Glu Glu Tyr Arg Arg Glu Asn Gly Leu Val Cys Lys Tyr Ser
        915                 920                 925

Lys Lys Gly Lys Gly Thr Pro Ile Lys Ser Leu Lys Tyr Tyr Asp Lys
    930                 935                 940

Lys Leu Gly Asn Cys Ile Asp Ile Thr Pro Glu Gly Ser Lys Asn Glu
945                 950                 955                 960

Val Val Leu Gln Ser Leu Asn Pro Trp Arg Ala Asp Val Tyr Phe Asn
                965                 970                 975

Pro Glu Thr Leu Lys Tyr Glu Leu Leu Gly Leu Lys Tyr Ser Asp Leu
            980                 985                 990
```

```
Ser Phe Glu Lys Gly Thr Gly Lys  Tyr His Ile Ser Gln  Glu Lys Tyr
        995                 1000                1005


Asp Val  Ile Lys Glu Lys Glu  Gly Ile Gly Lys Lys  Ser Glu Phe
    1010                1015                1020


Lys Phe  Thr Leu Tyr Arg Asn  Asp Leu Ile Leu Ile  Lys Asp Thr
    1025                1030                1035


Ala Ser  Gly Glu Gln Glu Ile  Tyr Arg Phe Leu Ser  Arg Thr Met
    1040                1045                1050


Pro Asn  Val Lys His Tyr Ala  Glu Leu Lys Pro Tyr  Asp Lys Glu
    1055                1060                1065


Lys Phe  Asp Asn Val Gln Glu  Leu Val Glu Ala Leu  Gly Glu Ala
    1070                1075                1080


Asp Lys  Val Gly Arg Cys Ile  Lys Gly Leu Asn Lys  Ser Asn Leu
    1085                1090                1095


Ser Ile  Tyr Lys Val Arg Thr  Asp Val Leu Gly Asn  Lys Tyr Phe
    1100                1105                1110


Val Lys  Lys Glu Gly Asp Lys  Pro Lys Leu Asp Phe  Lys Asn Asn
    1115                1120                1125


Lys Lys
    1130


<210>  141
<211>  1371
<212>  PRT
<213>  Streptococcus gallolyticus

<400>  141

Met Thr Glu Lys Asn Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser
1               5                   10                  15
```

```
Val Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys
            20                  25                  30

Met Lys Val Leu Gly Asn Thr Asp Lys Lys Tyr Ile Lys Lys Asn Leu
        35                  40                  45

Leu Gly Ala Leu Leu Phe Asp Asn Gly Glu Thr Ala Glu Ala Thr Arg
    50                  55                  60

Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu
65                  70                  75                  80

Arg Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ala Lys Val Asp Glu
                85                  90                  95

Ser Phe Phe Tyr Arg Leu Asp Glu Ser Phe Leu Thr Thr Asp Asp Lys
            100                 105                 110

Asp Phe Glu Arg His Pro Ile Phe Gly Asn Lys Ala Asp Glu Ile Lys
        115                 120                 125

Tyr His Gln Glu Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala
    130                 135                 140

Asp Ser His Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala
145                 150                 155                 160

His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn
                165                 170                 175

Ala Glu Asn Thr Asp Val Gln Lys Leu Phe Glu Ala Phe Val Glu Val
            180                 185                 190

Tyr Asp Arg Thr Phe Asp Asp Ser Asn Leu Ser Glu Ile Thr Val Asp
        195                 200                 205

Ala Ser Ser Ile Leu Thr Glu Lys Phe Ser Lys Ser Arg Arg Leu Glu
```

```
    210                 215                 220

Asn Leu Ile Lys His Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly
225                 230                 235                 240

Asn Leu Val Ala Leu Ala Leu Gly Leu Gln Pro Asn Phe Lys Thr Ser
                245                 250                 255

Phe Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Glu Leu Ile Gly Lys Ile Gly Asp Glu Tyr Ala
        275                 280                 285

Asp Leu Phe Thr Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ala Asp Asn Thr Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Lys Arg Tyr Asn Glu His Gln Val Asp Leu Lys Lys Leu
                325                 330                 335

Lys Glu Phe Ile Lys Asn Asn Ala Ser Asp Lys Tyr Asp Glu Ile Phe
            340                 345                 350

Asn Asp Lys Asp Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val
        355                 360                 365

Lys Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Thr Thr Leu Ser Lys Ile
    370                 375                 380

Asp Gly Ser Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His
                405                 410                 415
```

```
Leu Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Ala
            420                 425                 430

Phe Leu Lys Glu Asn Gln Ala Lys Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Asn Ser Arg Phe Ala
    450                 455                 460

Trp Ala Glu Tyr His Ser Asp Glu Lys Ile Thr Pro Trp Asn Phe Asp
465                 470                 475                 480

Glu Ile Ile Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met
                485                 490                 495

Thr Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Val Tyr Glu Thr Tyr Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Lys Tyr Val Asn Glu Gln Gly Lys Ser Asn Phe Phe Asp Ala Asn Met
    530                 535                 540

Lys Gln Glu Ile Phe Glu His Val Phe Lys Glu Asn Arg Lys Val Thr
545                 550                 555                 560

Lys Asp Lys Phe Leu Asn Tyr Leu Asn Lys Glu Phe Pro Glu Tyr Arg
                565                 570                 575

Ile Gln Asp Leu Ile Gly Leu Asp Lys Glu Asn Lys Ser Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Ser Phe
        595                 600                 605

Leu Asp Asp Lys Thr Asn Glu Thr Ile Ile Glu Asp Ile Ile Gln Thr
```

```
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Asp Met Ile Arg Gln Arg Leu Gln Lys
625                 630                 635                 640

Tyr Ser Asp Ile Phe Thr Pro Gln Gln Leu Lys Lys Leu Glu Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asn Lys Glu Asn Gly Lys Ser Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Tyr Ala Asn Arg Asn Phe Met Gln Leu Ile Ser Asp Asp Thr Leu
    690                 695                 700

Pro Phe Lys Gln Ile Ile Lys Asp Ala Gln Ile Ile Gly Asp Ile Asp
705                 710                 715                 720

Asp Val Thr Ser Val Val Arg Glu Leu Pro Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly His Asn Pro Asp Asn Ile Val Ile Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Arg Gly Arg Asn Gln Ser Gln Gln Arg Leu Lys Lys
    770                 775                 780

Leu Gln Asp Ser Leu Lys Glu Leu Gly Ser Asn Ile Leu Asn Glu Glu
785                 790                 795                 800

Lys Pro Ser Tyr Ile Glu Gly Lys Val Glu Asn Asn His Leu Gln Asp
                805                 810                 815
```

```
Asp Arg Leu Phe Leu Tyr Tyr Ile Gln Asn Gly Lys Asp Met Tyr Thr
            820                 825                 830

Gly Asp Glu Leu Asp Ile Asp His Leu Ser Asp Tyr Asp Ile Asp His
        835                 840                 845

Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp Ser Ile Asp Asn Arg Val
    850                 855                 860

Leu Thr Ser Ser Ala Lys Asn Arg Gly Lys Ser Asp Asp Val Pro Ser
865                 870                 875                 880

Leu Asp Ile Val His Asp Arg Lys Ala Asp Trp Ile Arg Leu Tyr Lys
                885                 890                 895

Ser Gly Leu Ile Ser Lys Arg Lys Phe Asp Asn Leu Thr Lys Ala Glu
            900                 905                 910

Arg Gly Gly Leu Thr Glu Asn Asp Lys Ala Gly Phe Ile Lys Arg Gln
        915                 920                 925

Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln Ile Leu Asp
    930                 935                 940

Ser Arg Phe Asn Thr Glu Arg Asp Glu Asn Asp Lys Val Ile Arg Asn
945                 950                 955                 960

Val Lys Val Ile Thr Leu Lys Ser Asn Leu Val Ser Gln Phe Arg Lys
                965                 970                 975

Asp Phe Lys Phe Tyr Lys Val Arg Glu Ile Asn Asp Tyr His His Ala
            980                 985                 990

His Asp Ala Tyr Leu Asn Ala Val  Val Gly Thr Ala Leu  Leu Lys Lys
        995                 1000                1005

Tyr Pro  Lys Leu Ala Pro Glu  Phe Val Tyr Gly Glu  Tyr Lys Lys
```

```
    1010                1015                1020

Tyr Asp  Ile Arg Lys Phe Ile  Thr Ser Ser Gly Asp  Lys Ala Thr
    1025                1030                1035

Ala Lys  Tyr Phe Phe Tyr Ser  Asn Leu Met Asn Phe  Phe Lys Arg
    1040                1045                1050

Val Ile  Arg Tyr Ser Asn Gly  Lys Val Val Val Arg  Pro Val Ile
    1055                1060                1065

Glu Cys  Ser Lys Asp Thr Gly  Glu Ile Ala Trp Asn  Lys Gln Thr
    1070                1075                1080

Asp Phe  Glu Lys Val Arg Arg  Val Leu Ser Tyr Pro  Gln Val Asn
    1085                1090                1095

Ile Val  Lys Lys Val Glu Thr  Gln Thr Gly Gly Phe  Ser Lys Glu
    1100                1105                1110

Ser Ile  Leu Pro Lys Gly Asn  Ser Asp Lys Leu Ile  Pro Arg Lys
    1115                1120                1125

Thr Lys  Lys Phe Arg Trp Asp  Thr Pro Lys Tyr Gly  Gly Phe Asp
    1130                1135                1140

Ser Pro  Asn Ile Ala Tyr Ser  Val Phe Val Ile Ala  Asp Val Glu
    1145                1150                1155

Lys Gly  Lys Ala Lys Lys Leu  Lys Thr Val Lys Glu  Leu Val Gly
    1160                1165                1170

Ile Ser  Ile Met Glu Arg Ser  Ser Phe Glu Glu Asn  Pro Val Val
    1175                1180                1185

Phe Leu  Glu Lys Lys Gly Tyr  Gln Asn Val Gln Glu  Asp Asn Leu
    1190                1195                1200
```

```
Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu Phe Glu  Gly Gly Arg
    1205                1210                1215

Arg Arg  Leu Leu Ala Ser Ala  Ser Glu Leu Gln Lys  Gly Asn Glu
    1220                1225                1230

Val Val  Leu Ser Arg His Leu  Val Glu Leu Leu Tyr  His Ala His
    1235                1240                1245

Arg Val  Asn Ser Phe Asn Asn  Ser Glu His Leu Lys  Tyr Val Ser
    1250                1255                1260

Glu His  Lys Lys Glu Phe Gly  Glu Val Leu Ser Cys  Val Glu Asn
    1265                1270                1275

Phe Ala  Lys Ser Tyr Val Asp  Val Glu Lys Asn Leu  Gly Lys Ile
    1280                1285                1290

Arg Ala  Val Ala Asp Lys Ile  Asp Thr Phe Ser Ile  Glu Asp Ile
    1295                1300                1305

Ser Ile  Ser Phe Val Asn Leu  Leu Thr Leu Thr Ala  Leu Gly Ala
    1310                1315                1320

Pro Ala  Asp Phe Asn Phe Leu  Gly Glu Lys Ile Pro  Arg Lys Arg
    1325                1330                1335

Tyr Thr  Ser Thr Lys Glu Cys  Leu Asn Ala Thr Leu  Ile His Gln
    1340                1345                1350

Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile Asp Leu  Ser Lys Leu
    1355                1360                1365

Gly Glu  Glu
    1370
```

<210> 142

<211> 1168
<212> PRT
<213> Azospirillum sp.

<400> 142

```
Met Ala Arg Pro Ala Phe Arg Ala Pro Arg Arg Glu His Val Asn Gly
1               5                   10                  15


Trp Thr Pro Asp Pro His Arg Ile Ser Lys Pro Phe Phe Ile Leu Val
            20                  25                  30


Ser Trp His Leu Leu Ser Arg Val Val Ile Asp Ser Ser Ser Gly Cys
        35                  40                  45


Phe Pro Gly Thr Ser Arg Asp His Thr Asp Lys Phe Ala Glu Trp Glu
    50                  55                  60


Cys Ala Val Gln Pro Tyr Arg Leu Ser Phe Asp Leu Gly Thr Asn Ser
65                  70                  75                  80


Ile Gly Trp Gly Leu Leu Asn Leu Asp Arg Gln Gly Lys Pro Arg Glu
                85                  90                  95


Ile Arg Ala Leu Gly Ser Arg Ile Phe Ser Asp Gly Arg Asp Pro Gln
            100                 105                 110


Asp Lys Ala Ser Leu Ala Val Ala Arg Arg Leu Ala Arg Gln Met Arg
        115                 120                 125


Arg Arg Arg Asp Arg Tyr Leu Thr Arg Arg Thr Arg Leu Met Gly Ala
    130                 135                 140


Leu Val Arg Phe Gly Leu Met Pro Ala Asp Pro Ala Ala Arg Lys Arg
145                 150                 155                 160


Leu Glu Val Ala Val Asp Pro Tyr Leu Ala Arg Glu Arg Ala Thr Arg
                165                 170                 175
```

```
Glu Arg Leu Glu Pro Phe Glu Ile Gly Arg Ala Leu Phe His Leu Asn
            180                 185                 190

Gln Arg Arg Gly Tyr Lys Pro Val Arg Thr Ala Thr Lys Pro Asp Glu
        195                 200                 205

Glu Ala Gly Lys Val Lys Glu Ala Val Glu Arg Leu Glu Ala Ala Ile
    210                 215                 220

Ala Ala Ala Gly Ala Pro Thr Leu Gly Ala Trp Phe Ala Trp Arg Lys
225                 230                 235                 240

Thr Arg Gly Glu Thr Leu Arg Ala Arg Leu Ala Gly Lys Gly Lys Glu
                245                 250                 255

Ala Ala Tyr Pro Phe Tyr Pro Ala Arg Arg Met Leu Glu Ala Glu Phe
            260                 265                 270

Asp Thr Leu Trp Ala Glu Gln Ala Arg His His Pro Asp Leu Leu Thr
        275                 280                 285

Ala Glu Ala Arg Glu Ile Leu Arg His Arg Ile Phe His Gln Arg Pro
    290                 295                 300

Leu Lys Pro Pro Pro Val Gly Arg Cys Thr Leu Tyr Pro Asp Asp Gly
305                 310                 315                 320

Arg Ala Pro Arg Ala Leu Pro Ser Ala Gln Arg Leu Arg Leu Phe Gln
                325                 330                 335

Glu Leu Ala Ser Leu Arg Val Ile His Leu Asp Leu Ser Glu Arg Pro
            340                 345                 350

Leu Thr Pro Ala Glu Arg Asp Arg Ile Val Ala Phe Val Gln Gly Arg
        355                 360                 365

Pro Pro Lys Ala Gly Arg Lys Pro Gly Lys Val Gln Lys Ser Val Pro
    370                 375                 380
```

```
Phe Glu Lys Leu Arg Gly Leu Leu Glu Leu Pro Pro Gly Thr Gly Phe
385                 390                 395                 400

Ser Leu Glu Ser Asp Lys Arg Pro Glu Leu Leu Gly Asp Glu Thr Gly
                405                 410                 415

Ala Arg Ile Ala Pro Ala Phe Gly Pro Gly Trp Thr Ala Leu Pro Leu
            420                 425                 430

Glu Glu Gln Asp Ala Leu Val Glu Leu Leu Leu Thr Glu Ala Glu Pro
        435                 440                 445

Glu Arg Ala Ile Ala Ala Leu Thr Ala Arg Trp Ala Leu Asp Glu Ala
    450                 455                 460

Thr Ala Ala Lys Leu Ala Gly Ala Thr Leu Pro Asp Phe His Gly Arg
465                 470                 475                 480

Tyr Gly Arg Arg Ala Val Ala Glu Leu Leu Pro Val Leu Glu Arg Glu
                485                 490                 495

Thr Arg Gly Asp Pro Asp Gly Arg Val Arg Pro Ile Arg Leu Asp Glu
            500                 505                 510

Ala Val Lys Leu Leu Arg Gly Gly Lys Asp His Ser Asp Phe Ser Arg
        515                 520                 525

Glu Gly Ala Leu Leu Asp Ala Leu Pro Tyr Tyr Gly Ala Val Leu Glu
    530                 535                 540

Arg His Val Ala Phe Gly Thr Gly Asn Pro Ala Asp Pro Glu Glu Lys
545                 550                 555                 560

Arg Val Gly Arg Val Ala Asn Pro Thr Val His Ile Ala Leu Asn Gln
                565                 570                 575
```

```
Leu Arg His Leu Val Asn Ala Ile Leu Ala Arg His Gly Arg Pro Glu
            580                 585                 590

Glu Ile Val Ile Glu Leu Ala Arg Asp Leu Lys Arg Ser Ala Glu Asp
        595                 600                 605

Arg Arg Arg Glu Asp Lys Arg Gln Ala Asp Asn Gln Lys Arg Asn Glu
    610                 615                 620

Glu Arg Lys Arg Leu Ile Leu Ser Leu Gly Glu Arg Pro Thr Pro Arg
625                 630                 635                 640

Asn Leu Leu Lys Leu Arg Leu Trp Glu Glu Gln Gly Pro Val Glu Asn
                645                 650                 655

Arg Arg Cys Pro Tyr Ser Gly Glu Thr Ile Ser Met Arg Met Leu Leu
            660                 665                 670

Ser Glu Gln Val Asp Ile Asp His Ile Leu Pro Phe Ser Val Ser Leu
        675                 680                 685

Asp Asp Ser Ala Ala Asn Lys Val Val Cys Leu Arg Glu Ala Asn Arg
    690                 695                 700

Ile Lys Arg Asn Arg Ser Pro Trp Glu Ala Phe Gly His Asp Ser Glu
705                 710                 715                 720

Arg Trp Ala Gly Ile Leu Ala Arg Ala Glu Ala Leu Pro Lys Asn Lys
                725                 730                 735

Arg Trp Arg Phe Ala Pro Asp Ala Leu Glu Lys Leu Glu Gly Glu Gly
            740                 745                 750

Gly Leu Arg Ala Arg His Leu Asn Asp Thr Arg His Leu Ser Arg Leu
        755                 760                 765

Ala Val Glu Tyr Leu Arg Cys Val Cys Pro Lys Val Arg Val Ser Pro
    770                 775                 780
```

```
Gly Arg Leu Thr Ala Leu Leu Arg Arg Arg Trp Gly Ile Asp Ala Ile
785                 790                 795                 800

Leu Ala Glu Ala Asp Gly Pro Pro Pro Glu Val Pro Ala Glu Thr Leu
                805                 810                 815

Asp Pro Ser Pro Ala Glu Lys Asn Arg Ala Asp His Arg His His Ala
            820                 825                 830

Leu Asp Ala Val Val Ile Gly Cys Ile Asp Arg Ser Met Val Gln Arg
        835                 840                 845

Val Gln Leu Ala Ala Ala Ser Ala Glu Arg Glu Ala Ala Ala Arg Glu
    850                 855                 860

Asp Asn Ile Arg Arg Val Leu Glu Gly Phe Lys Glu Glu Pro Trp Asp
865                 870                 875                 880

Gly Phe Arg Ala Glu Leu Glu Arg Arg Ala Arg Thr Ile Val Val Ser
                885                 890                 895

His Arg Pro Glu His Gly Ile Gly Gly Ala Leu His Lys Glu Thr Ala
            900                 905                 910

Tyr Gly Pro Val Asp Pro Pro Glu Glu Gly Phe Asn Leu Val Val Arg
        915                 920                 925

Lys Pro Ile Asp Gly Leu Ser Lys Asp Glu Ile Asn Ser Val Arg Asp
    930                 935                 940

Pro Arg Leu Arg Arg Ala Leu Ile Asp Arg Leu Ala Ile Arg Arg Arg
945                 950                 955                 960

Asp Ala Asn Asp Pro Ala Thr Ala Leu Ala Lys Ala Ala Glu Asp Leu
                965                 970                 975
```

```
Ala Ala Gln Pro Ala Ser Arg Gly Ile Arg Arg Val Arg Val Leu Lys
            980                 985                 990

Lys Glu Ser Asn Pro Ile Arg Val  Glu His Gly Gly Asn  Pro Ser Gly
        995                 1000                1005

Pro Arg  Ser Gly Gly Pro Phe  His Lys Leu Leu Leu  Ala Gly Glu
    1010                1015                1020

Val His  His Val Asp Val Ala  Leu Arg Ala Asp Gly  Arg Arg Trp
    1025                1030                1035

Val Gly  His Trp Val Thr Leu  Phe Glu Ala His Gly  Gly Arg Gly
    1040                1045                1050

Ala Asp  Gly Ala Ala Ala Pro  Pro Arg Leu Gly Asp  Gly Glu Arg
    1055                1060                1065

Phe Leu  Met Arg Leu His Lys  Gly Asp Cys Leu Lys  Leu Glu His
    1070                1075                1080

Lys Gly  Arg Val Arg Val Met  Gln Val Val Lys Leu  Glu Pro Ser
    1085                1090                1095

Ser Asn  Ser Val Val Val Val  Glu Pro His Gln Val  Lys Thr Asp
    1100                1105                1110

Arg Ser  Lys His Val Lys Ile  Ser Cys Asp Gln Leu  Arg Ala Arg
    1115                1120                1125

Gly Ala  Arg Arg Val Thr Val  Asp Pro Leu Gly Arg  Val Arg Val
    1130                1135                1140

His Ala  Pro Gly Ala Arg Val  Gly Ile Gly Gly Asp  Ala Gly Arg
    1145                1150                1155

Thr Ala  Met Glu Pro Ala Glu  Asp Ile Ser
    1160                1165
```

<210> 143
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 143

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140


Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
```

```
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365
```

```
Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
```

```
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765
```

```
Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Lys His Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
```

```
               965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155
```

```
Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
```

1340 1345

<210> 144
<211> 1024
<212> PRT
<213> Helicobacter mustelae

<400> 144

Met Ile Arg Thr Leu Gly Ile Asp Ile Gly Ile Ala Ser Ile Gly Trp
1 5 10 15

Ala Val Ile Glu Gly Glu Tyr Thr Asp Lys Gly Leu Glu Asn Lys Glu
20 25 30

Ile Val Ala Ser Gly Val Arg Val Phe Thr Lys Ala Glu Asn Pro Lys
35 40 45

Asn Lys Glu Ser Leu Ala Leu Pro Arg Thr Leu Ala Arg Ser Ala Arg
50 55 60

Arg Arg Asn Ala Arg Lys Lys Gly Arg Ile Gln Gln Val Lys His Tyr
65 70 75 80

Leu Ser Lys Ala Leu Gly Leu Asp Leu Glu Cys Phe Val Gln Gly Glu
85 90 95

Lys Leu Ala Thr Leu Phe Gln Thr Ser Lys Asp Phe Leu Ser Pro Trp
100 105 110

Glu Leu Arg Glu Arg Ala Leu Tyr Arg Val Leu Asp Lys Glu Glu Leu
115 120 125

Ala Arg Val Ile Leu His Ile Ala Lys Arg Arg Gly Tyr Asp Asp Ile
130 135 140

Thr Tyr Gly Val Glu Asp Asn Asp Ser Gly Lys Ile Lys Lys Ala Ile
145 150 155 160

```
Ala Glu Asn Ser Lys Arg Ile Lys Glu Glu Gln Cys Lys Thr Ile Gly
                165                 170                 175

Glu Met Met Tyr Lys Leu Tyr Phe Gln Lys Ser Leu Asn Val Arg Asn
            180                 185                 190

Lys Lys Glu Ser Tyr Asn Arg Cys Val Gly Arg Ser Glu Leu Arg Glu
        195                 200                 205

Glu Leu Lys Thr Ile Phe Gln Ile Gln Gln Glu Leu Lys Ser Pro Trp
    210                 215                 220

Val Asn Glu Glu Leu Ile Tyr Lys Leu Leu Gly Asn Pro Asp Ala Gln
225                 230                 235                 240

Ser Lys Gln Glu Arg Glu Gly Leu Ile Phe Tyr Gln Arg Pro Leu Lys
                245                 250                 255

Gly Phe Gly Asp Lys Ile Gly Lys Cys Ser His Ile Lys Lys Gly Glu
            260                 265                 270

Asn Ser Pro Tyr Arg Ala Cys Lys His Ala Pro Ser Ala Glu Glu Phe
        275                 280                 285

Val Ala Leu Thr Lys Ser Ile Asn Phe Leu Lys Asn Leu Thr Asn Arg
    290                 295                 300

His Gly Leu Cys Phe Ser Gln Glu Asp Met Cys Val Tyr Leu Gly Lys
305                 310                 315                 320

Ile Leu Gln Glu Ala Gln Lys Asn Glu Lys Gly Leu Thr Tyr Ser Lys
                325                 330                 335

Leu Lys Leu Leu Leu Asp Leu Pro Ser Asp Phe Glu Phe Leu Gly Leu
            340                 345                 350

Asp Tyr Ser Gly Lys Asn Pro Glu Lys Ala Val Phe Leu Ser Leu Pro
        355                 360                 365
```

```
Ser Thr Phe Lys Leu Asn Lys Ile Thr Gln Asp Arg Lys Thr Gln Asp
    370                 375                 380

Lys Ile Ala Asn Ile Leu Gly Ala Asn Lys Asp Trp Glu Ala Ile Leu
385                 390                 395                 400

Lys Glu Leu Glu Ser Leu Gln Leu Ser Lys Glu Gln Ile Gln Thr Ile
                405                 410                 415

Lys Asp Ala Lys Leu Asn Phe Ser Lys His Ile Asn Leu Ser Leu Glu
            420                 425                 430

Ala Leu Tyr His Leu Leu Pro Leu Met Arg Glu Gly Lys Arg Tyr Asp
        435                 440                 445

Glu Gly Val Glu Ile Leu Gln Glu Arg Gly Ile Phe Ser Lys Pro Gln
    450                 455                 460

Pro Lys Asn Arg Gln Leu Leu Pro Pro Leu Ser Glu Leu Ala Lys Glu
465                 470                 475                 480

Glu Ser Tyr Phe Asp Ile Pro Asn Pro Val Leu Arg Arg Ala Leu Ser
                485                 490                 495

Glu Phe Arg Lys Val Val Asn Ala Leu Leu Glu Lys Tyr Gly Gly Phe
            500                 505                 510

His Tyr Phe His Ile Glu Leu Thr Arg Asp Val Cys Lys Ala Lys Ser
        515                 520                 525

Ala Arg Met Gln Leu Glu Lys Ile Asn Lys Lys Asn Lys Ser Glu Asn
    530                 535                 540

Asp Ala Ala Ser Gln Leu Leu Glu Val Leu Gly Leu Pro Asn Thr Tyr
545                 550                 555                 560
```

```
Asn Asn Arg Leu Lys Cys Lys Leu Trp Lys Gln Gln Glu Glu Tyr Cys
                565                 570                 575

Leu Tyr Ser Gly Glu Lys Ile Thr Ile Asp His Leu Lys Asp Gln Arg
            580                 585                 590

Ala Leu Gln Ile Asp His Ala Phe Pro Leu Ser Arg Ser Leu Asp Asp
        595                 600                 605

Ser Gln Ser Asn Lys Val Leu Cys Leu Thr Ser Ser Asn Gln Glu Lys
    610                 615                 620

Ser Asn Lys Thr Pro Tyr Glu Trp Leu Gly Ser Asp Glu Lys Lys Trp
625                 630                 635                 640

Asp Met Tyr Val Gly Arg Val Tyr Ser Ser Asn Phe Ser Pro Ser Lys
                645                 650                 655

Lys Arg Lys Leu Thr Gln Lys Asn Phe Lys Glu Arg Asn Glu Glu Asp
            660                 665                 670

Phe Leu Ala Arg Asn Leu Val Asp Thr Gly Tyr Ile Gly Arg Val Thr
        675                 680                 685

Lys Glu Tyr Ile Lys His Ser Leu Ser Phe Leu Pro Leu Pro Asp Gly
    690                 695                 700

Lys Lys Glu His Ile Arg Ile Ile Ser Gly Ser Met Thr Ser Thr Met
705                 710                 715                 720

Arg Ser Phe Trp Gly Val Gln Glu Lys Asn Arg Asp His His Leu His
                725                 730                 735

His Ala Gln Asp Ala Ile Ile Ile Ala Cys Ile Glu Pro Ser Met Ile
            740                 745                 750

Gln Lys Tyr Thr Thr Tyr Leu Lys Asp Lys Glu Thr His Arg Leu Lys
        755                 760                 765
```

```
Ser His Gln Lys Ala Gln Ile Leu Arg Glu Gly Asp His Lys Leu Ser
    770                 775                 780

Leu Arg Trp Pro Met Ser Asn Phe Lys Asp Lys Ile Gln Glu Ser Ile
785                 790                 795                 800

Gln Asn Ile Ile Pro Ser His His Val Ser His Lys Val Thr Gly Glu
                805                 810                 815

Leu His Gln Glu Thr Val Arg Thr Lys Glu Phe Tyr Tyr Gln Ala Phe
            820                 825                 830

Gly Gly Glu Glu Gly Val Lys Lys Ala Leu Lys Phe Gly Lys Ile Arg
        835                 840                 845

Glu Ile Asn Gln Gly Ile Val Asp Asn Gly Ala Met Val Arg Val Asp
    850                 855                 860

Ile Phe Lys Ser Lys Asp Lys Gly Lys Phe Tyr Ala Val Pro Ile Tyr
865                 870                 875                 880

Thr Tyr Asp Phe Ala Ile Gly Lys Leu Pro Asn Lys Ala Ile Val Gln
                885                 890                 895

Gly Lys Lys Asn Gly Ile Ile Lys Asp Trp Leu Glu Met Asp Glu Asn
            900                 905                 910

Tyr Glu Phe Cys Phe Ser Leu Phe Lys Asn Asp Cys Ile Lys Ile Gln
        915                 920                 925

Thr Lys Glu Met Gln Glu Ala Val Leu Ala Ile Tyr Lys Ser Thr Asn
    930                 935                 940

Ser Ala Lys Ala Thr Ile Glu Leu Glu His Leu Ser Lys Tyr Ala Leu
945                 950                 955                 960
```

Lys Asn Glu Asp Glu Glu Lys Met Phe Thr Asp Thr Asp Lys Glu Lys
965 970 975

Asn Lys Thr Met Thr Arg Glu Ser Cys Gly Ile Gln Gly Leu Lys Val
980 985 990

Phe Gln Lys Val Lys Leu Ser Val Leu Gly Glu Val Leu Glu His Lys
995 1000 1005

Pro Arg Asn Arg Gln Asn Ile Ala Leu Lys Thr Thr Pro Lys His
1010 1015 1020

Val

<210> 145
<211> 765
<212> PRT
<213> Butyrivibrio fibrisolvens

<400> 145

Met Gly Ile Thr Ile Gly Leu Asp Leu Gly Val Ala Ser Val Gly Trp
1 5 10 15

Ala Val Val Asn Asp Asp Tyr Glu Ile Leu Glu Ser Cys Ser Asn Ile
20 25 30

Phe Pro Ser Ala Asp Ala Ser Lys Asn Ser Glu Arg Arg Gly Phe Arg
35 40 45

Gln Gly Arg Arg Leu Thr Arg Arg Arg Lys Asn Arg Ile His Asp Phe
50 55 60

Gln Lys Leu Trp Glu Asp Lys Gly Phe Val Ile Pro Ser Gln Gly Thr
65 70 75 80

Glu Asp Val Leu Ala Ile Lys Ile Lys Gly Leu Ser Glu Lys Leu Ser
85 90 95

```
Val Asp Glu Val Tyr Trp Val Leu Leu Asn Ser Leu Lys His Arg Gly
            100                 105                 110

Ile Ser Tyr Leu Asp Asp Ala Asp Ser Gly Asp Asn Ser Ser Asp Tyr
        115                 120                 125

Ala Lys Ser Ile Ser Arg Asn Glu Glu Glu Leu Lys Glu Lys Leu Pro
    130                 135                 140

Cys Glu Ile Gln Trp Glu Arg Leu Gln Lys Tyr Gly Ala Tyr Arg Gly
145                 150                 155                 160

Asn Ile Ser Ile Val Glu Asp Gly Glu Pro Ile Thr Leu Arg Asn Val
                165                 170                 175

Phe Thr Thr Ser Ala Tyr Lys Lys Glu Val Glu Gln Phe Ile Asp Thr
            180                 185                 190

Gln Ala Lys Tyr Asn Ala Gln Tyr Ser Gly Asp Phe Lys Ala Asp Tyr
        195                 200                 205

Leu Glu Ile Phe Asn Arg Lys Arg Glu Tyr Tyr Glu Gly Pro Gly Asn
    210                 215                 220

Glu Leu Ser Arg Thr Asp Tyr Gly Lys Tyr Thr Thr Glu Ile Asn Ala
225                 230                 235                 240

Asp Gly Glu Tyr Ile Thr Val Asp Asn Ile Phe Asp Lys Leu Val Gly
                245                 250                 255

Lys Cys Ser Val Asn Pro Asp Glu Arg Arg Ala Ala Gly Ala Ser Tyr
            260                 265                 270

Thr Ala Gln Glu Phe Asn Val Leu Asn Asp Leu Asn Asn Leu Thr Ile
        275                 280                 285

Ser Ser Glu Ser Ser Phe Ile Glu Asp Gly Lys Leu Thr Glu Asp Ala
```

```
    290                 295                 300

Lys Arg Lys Ile Ile Glu Thr Ile Lys Asn Ala Lys Thr Val Asn Val
305                 310                 315                 320

Lys Lys Ile Ile Cys Asp Val Ile Gly Asp Lys Lys Cys Gln Ile Ser
                325                 330                 335

Gly Ala Arg Ile Asp Lys Asn Glu Lys Glu Ile Phe His Ser Phe Glu
            340                 345                 350

Ala Tyr Asn Lys Met Arg Arg Ala Leu Glu Glu Ile Gly Phe Asp Ile
        355                 360                 365

Ser Ser Leu Ser Arg Glu Asn Leu Asp Leu Ile Gly Asp Ile Leu Thr
    370                 375                 380

Leu Asn Thr Asp Arg Glu Ser Ile Leu Asn Ala Phe Asn Arg Lys Gly
385                 390                 395                 400

Ile Glu Leu Ala Asp Glu Ala Lys Asp Ile Leu Val Lys Val Arg Lys
                405                 410                 415

Thr Asn Gly Ser Leu Phe Asn Lys Trp Gln Ser Phe Gly Leu Ser Ile
            420                 425                 430

Met Asn Glu Leu Ile Pro Glu Leu Tyr Ala Gln Pro Lys Asn Gln Met
        435                 440                 445

Glu Leu Leu Thr Ala Met Gly Val Phe Lys Ser Arg Gly Asp Arg Phe
    450                 455                 460

Leu Glu Cys Lys Glu Ile Pro Gly Asp Leu Ile Val Asp Asp Ile Tyr
465                 470                 475                 480

Asn Pro Val Val Ser Lys Thr Val Arg Ile Thr Val Arg Ile Leu Asn
                485                 490                 495
```

```
Ala Leu Ile Lys Lys Tyr Gly Tyr Pro Asp Arg Val Val Ile Glu Met
            500                 505                 510

Pro Arg Asp Lys Asn Ser Asp Glu Glu Gln Gln Arg Leu Lys Lys Glu
        515                 520                 525

Gln Arg Asp Asn Glu Asn Glu Ile Lys Asp Ile Lys Ala Arg Val Lys
    530                 535                 540

Thr Glu Tyr Gly Arg Glu Ile Thr Glu Glu Asp Phe Arg Gln His Ser
545                 550                 555                 560

Lys Leu Ser Leu Lys Leu Lys Leu Trp Asn Glu Gln Gln Gly Ile Cys
                565                 570                 575

Pro Tyr Ser Gly Lys Ser Ile Lys Ile Asp Asp Leu Leu Asp Asn Pro
            580                 585                 590

Asn Leu Phe Glu Val Asp His Ile Ile Pro Leu Ser Ile Ser Phe Asp
        595                 600                 605

Asp Ser Arg Asn Asn Lys Val Leu Val Tyr Ser Ser Glu Asn Gln Asp
    610                 615                 620

Lys Gly Asn Arg Thr Pro Leu Ala Tyr Leu Ala Ser Val Asn Arg Gln
625                 630                 635                 640

Trp Asp Ile His Ser Phe Met Asp Tyr Val Leu Lys Thr Tyr Ala Gly
                645                 650                 655

Ala Gln Lys Arg Lys Lys Arg Asp Asn Leu Leu Asn Glu Gln Asp Ile
            660                 665                 670

Thr Lys Val Glu Val Leu Gln Gly Phe Val Asn Arg Asn Ile Asn Asp
        675                 680                 685

Thr Arg Tyr Ala Ser Lys Val Val Leu Asn Ser Leu Gln Glu Tyr Phe
```

```
    690                 695                 700

Ser Ser Lys Glu Cys Ser Thr Lys Val Lys Val Ile Arg Gly Ser Phe
705                 710                 715                 720

Thr His Gln Met Arg Val Asn Leu Lys Leu Lys Lys Thr Val Met Asn
                725                 730                 735

His Met Phe Ile Met Gln Leu Met Gln Cys Leu Leu Leu Phe His Arg
            740                 745                 750

Trp Asp Met Thr Leu Ile Met Asn Leu Gln Ile Ser Ile
        755                 760                 765
```

<210> 146
<211> 1338
<212> PRT
<213> Coprococcus catus

<400> 146

```
Met Lys Gln Glu Tyr Phe Leu Gly Leu Asp Met Gly Thr Gly Ser Leu
1               5                   10                  15

Gly Trp Ala Val Thr Asp Ser Thr Tyr Gln Val Met Arg Lys His Gly
            20                  25                  30

Lys Ala Leu Trp Gly Thr Arg Leu Phe Glu Ser Ala Ser Thr Ala Glu
        35                  40                  45

Glu Arg Arg Met Phe Arg Thr Ala Arg Arg Arg Leu Asp Arg Arg Asn
    50                  55                  60

Trp Arg Ile Gln Val Leu Gln Glu Ile Phe Ser Glu Glu Ile Ser Lys
65                  70                  75                  80

Val Asp Pro Gly Phe Phe Leu Arg Met Lys Glu Ser Lys Tyr Tyr Pro
                85                  90                  95
```

```
Glu Asp Lys Arg Asp Ala Glu Gly Asn Cys Pro Glu Leu Pro Tyr Ala
            100                 105                 110

Leu Phe Val Asp Asp Asn Tyr Thr Asp Lys Asn Tyr His Lys Asp Tyr
        115                 120                 125

Pro Thr Ile Tyr His Leu Arg Lys Met Leu Met Glu Thr Thr Glu Ile
    130                 135                 140

Pro Asp Ile Arg Leu Val Tyr Leu Val Leu His His Met Met Lys His
145                 150                 155                 160

Arg Gly His Phe Leu Leu Ser Gly Asp Ile Ser Gln Ile Lys Glu Phe
                165                 170                 175

Lys Ser Thr Phe Glu Gln Leu Ile Gln Asn Ile Gln Asp Glu Glu Leu
            180                 185                 190

Glu Trp His Ile Ser Leu Asp Asp Ala Ala Ile Gln Phe Val Glu His
        195                 200                 205

Val Leu Lys Asp Arg Asn Leu Thr Arg Ser Thr Lys Lys Ser Arg Leu
    210                 215                 220

Ile Lys Gln Leu Asn Ala Lys Ser Ala Cys Glu Lys Ala Ile Leu Asn
225                 230                 235                 240

Leu Leu Ser Gly Gly Thr Val Lys Leu Ser Asp Ile Phe Asn Asn Lys
                245                 250                 255

Glu Leu Asp Glu Ser Glu Arg Pro Lys Val Ser Phe Ala Asp Ser Gly
            260                 265                 270

Tyr Asp Asp Tyr Ile Gly Ile Val Glu Ala Glu Leu Ala Glu Gln Tyr
        275                 280                 285

Tyr Ile Ile Ala Ser Ala Lys Ala Val Tyr Asp Trp Ser Val Leu Val
    290                 295                 300
```

```
Glu Ile Leu Gly Asn Ser Val Ser Ile Ser Glu Ala Lys Ile Lys Val
305                 310                 315                 320

Tyr Gln Lys His Gln Ala Asp Leu Lys Thr Leu Lys Lys Ile Val Arg
                325                 330                 335

Gln Tyr Met Thr Lys Glu Asp Tyr Lys Arg Val Phe Val Asp Thr Glu
            340                 345                 350

Glu Lys Leu Asn Asn Tyr Ser Ala Tyr Ile Gly Met Thr Lys Lys Asn
        355                 360                 365

Gly Lys Lys Val Asp Leu Lys Ser Lys Gln Cys Thr Gln Ala Asp Phe
    370                 375                 380

Tyr Asp Phe Leu Lys Lys Asn Val Ile Lys Val Ile Asp His Lys Glu
385                 390                 395                 400

Ile Thr Gln Glu Ile Glu Ser Glu Ile Glu Lys Glu Asn Phe Leu Pro
                405                 410                 415

Lys Gln Val Thr Lys Asp Asn Gly Val Ile Pro Tyr Gln Val His Asp
            420                 425                 430

Tyr Glu Leu Lys Lys Ile Leu Asp Asn Leu Gly Thr Arg Met Pro Phe
        435                 440                 445

Ile Lys Glu Asn Ala Glu Lys Ile Gln Gln Leu Phe Glu Phe Arg Ile
    450                 455                 460

Pro Tyr Tyr Val Gly Pro Leu Asn Arg Val Asp Asp Gly Lys Asp Gly
465                 470                 475                 480

Lys Phe Thr Trp Ser Val Arg Lys Ser Asp Ala Arg Ile Tyr Pro Trp
                485                 490                 495
```

```
Asn Phe Thr Glu Val Ile Asp Val Glu Ala Ser Ala Glu Lys Phe Ile
            500                 505                 510

Arg Arg Met Thr Asn Lys Cys Thr Tyr Leu Val Gly Glu Asp Val Leu
        515                 520                 525

Pro Lys Asp Ser Leu Val Tyr Ser Lys Phe Met Val Leu Asn Glu Leu
    530                 535                 540

Asn Asn Leu Arg Leu Asn Gly Glu Lys Ile Ser Val Glu Leu Lys Gln
545                 550                 555                 560

Arg Ile Tyr Glu Glu Leu Phe Cys Lys Tyr Arg Lys Val Thr Arg Lys
                565                 570                 575

Lys Leu Glu Arg Tyr Leu Val Ile Glu Gly Ile Ala Lys Lys Gly Val
            580                 585                 590

Glu Ile Thr Gly Ile Asp Gly Asp Phe Lys Ala Ser Leu Thr Ala Tyr
        595                 600                 605

His Asp Phe Lys Glu Arg Leu Thr Asp Val Gln Leu Ser Gln Arg Ala
    610                 615                 620

Lys Glu Ala Ile Val Leu Asn Val Val Leu Phe Gly Asp Asp Lys Lys
625                 630                 635                 640

Leu Leu Lys Gln Arg Leu Ser Lys Met Tyr Pro Asn Leu Thr Thr Gly
                645                 650                 655

Gln Leu Lys Gly Ile Cys Ser Leu Ser Tyr Gln Gly Trp Gly Arg Leu
            660                 665                 670

Ser Lys Thr Phe Leu Glu Glu Ile Thr Val Pro Ala Pro Gly Thr Gly
        675                 680                 685

Glu Val Trp Asn Ile Met Thr Ala Leu Trp Gln Thr Asn Asp Asn Leu
    690                 695                 700
```

```
Met Gln Leu Leu Ser Arg Asn Tyr Gly Phe Thr Asn Glu Val Glu Glu
705                 710                 715                 720

Phe Asn Thr Leu Lys Lys Glu Thr Asp Leu Ser Tyr Lys Thr Val Asp
                725                 730                 735

Glu Leu Tyr Val Ser Pro Ala Val Lys Arg Gln Ile Trp Gln Thr Leu
            740                 745                 750

Lys Val Val Lys Glu Ile Gln Lys Val Met Gly Asn Ala Pro Lys Arg
        755                 760                 765

Val Phe Val Glu Met Ala Arg Glu Lys Gln Glu Gly Lys Arg Ser Asp
    770                 775                 780

Ser Arg Lys Lys Gln Leu Val Glu Leu Tyr Arg Ala Cys Lys Asn Glu
785                 790                 795                 800

Glu Arg Asp Trp Ile Thr Glu Leu Asn Ala Gln Ser Asp Gln Gln Leu
                805                 810                 815

Arg Ser Asp Lys Leu Phe Leu Tyr Tyr Ile Gln Lys Gly Arg Cys Met
            820                 825                 830

Tyr Ser Gly Glu Thr Ile Gln Leu Asp Glu Leu Trp Asp Asn Thr Lys
        835                 840                 845

Tyr Asp Ile Asp His Ile Tyr Pro Gln Ser Lys Thr Met Asp Asp Ser
    850                 855                 860

Leu Asn Asn Arg Val Leu Val Lys Lys Asn Tyr Asn Ala Ile Lys Ser
865                 870                 875                 880

Asp Thr Tyr Pro Leu Ser Leu Asp Ile Gln Lys Lys Met Met Ser Phe
                885                 890                 895
```

```
Trp Lys Met Leu Gln Gln Gln Gly Phe Ile Thr Lys Glu Lys Tyr Val
            900                 905                 910

Arg Leu Val Arg Ser Asp Glu Leu Ser Ala Asp Glu Leu Ala Gly Phe
        915                 920                 925

Ile Glu Arg Gln Ile Val Glu Thr Arg Gln Ser Thr Lys Ala Val Ala
    930                 935                 940

Thr Ile Leu Lys Glu Ala Leu Pro Asp Thr Glu Ile Val Tyr Val Lys
945                 950                 955                 960

Ala Gly Asn Val Ser Asn Phe Arg Gln Thr Tyr Glu Leu Leu Lys Val
                965                 970                 975

Arg Glu Met Asn Asp Leu His His Ala Lys Asp Ala Tyr Leu Asn Ile
            980                 985                 990

Val Val Gly Asn Ala Tyr Phe Val  Lys Phe Thr Lys Asn  Ala Ala Trp
        995                 1000                1005

Phe Ile  Arg Asn Asn Pro Gly  Arg Ser Tyr Asn Leu  Lys Arg Met
    1010                1015                1020

Phe Glu  Phe Asp Ile Glu Arg  Ser Gly Glu Ile Ala  Trp Lys Ala
    1025                1030                1035

Gly Asn  Lys Gly Ser Ile Val  Thr Val Lys Lys Val  Met Gln Lys
    1040                1045                1050

Asn Asn  Ile Leu Val Thr Arg  Lys Ala Tyr Glu Val  Lys Gly Gly
    1055                1060                1065

Leu Phe  Asp Gln Gln Ile Met  Lys Lys Gly Lys Gly  Gln Val Pro
    1070                1075                1080

Ile Lys  Gly Asn Asp Glu Arg  Leu Ala Asp Ile Glu  Lys Tyr Gly
    1085                1090                1095
```

```
Gly Tyr  Asn Lys Ala Ala Gly  Thr Tyr Phe Met Leu  Val Lys Ser
    1100                1105                1110

Leu Asp  Lys Lys Gly Lys Glu  Ile Arg Thr Ile Glu  Phe Val Pro
    1115                1120                1125

Leu Tyr  Leu Lys Asn Gln Ile  Glu Ile Asn His Glu  Ser Ala Ile
    1130                1135                1140

Gln Tyr  Leu Ala Gln Glu Arg  Gly Leu Asn Ser Pro  Glu Ile Leu
    1145                1150                1155

Leu Ser  Lys Ile Lys Ile Asp  Thr Leu Phe Lys Val  Asp Gly Phe
    1160                1165                1170

Lys Met  Trp Leu Ser Gly Arg  Thr Gly Asn Gln Leu  Ile Phe Lys
    1175                1180                1185

Gly Ala  Asn Gln Leu Ile Leu  Ser His Gln Glu Ala  Ala Ile Leu
    1190                1195                1200

Lys Gly  Val Val Lys Tyr Val  Asn Arg Lys Asn Glu  Asn Lys Asp
    1205                1210                1215

Ala Lys  Leu Ser Glu Arg Asp  Gly Met Thr Glu Glu  Lys Leu Leu
    1220                1225                1230

Gln Leu  Tyr Asp Thr Phe Leu  Asp Lys Leu Ser Asn  Thr Val Tyr
    1235                1240                1245

Ser Ile  Arg Leu Ser Ala Gln  Ile Lys Thr Leu Thr  Glu Lys Arg
    1250                1255                1260

Ala Lys  Phe Ile Gly Leu Ser  Asn Glu Asp Gln Cys  Ile Val Leu
    1265                1270                1275
```

```
Asn Glu  Ile Leu His Met Phe  Gln Cys Gln Ser Gly  Ser Ala Asn
    1280                1285                1290


Leu Lys  Leu Ile Gly Gly Pro  Gly Ser Ala Gly Ile  Leu Val Met
    1295                1300                1305


Asn Asn  Asn Ile Thr Ala Cys  Lys Gln Ile Ser Val  Ile Asn Gln
    1310                1315                1320


Ser Pro  Thr Gly Ile Tyr Glu  Lys Glu Ile Asp Leu  Ile Lys Leu
    1325                1330                1335
```

<210> 147
<211> 1035
<212> PRT
<213> Candidatus Puniceispirillum

<400> 147

```
Met Arg Arg Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp Cys
1               5                   10                  15


Leu Leu Asp Leu Gly Asp Asp Gly Glu Pro Val Ser Ile Phe Arg Thr
            20                  25                  30


Gly Ala Arg Ile Phe Ser Asp Gly Arg Asp Pro Lys Ser Leu Gly Ser
        35                  40                  45


Leu Lys Ala Thr Arg Arg Glu Ala Arg Leu Thr Arg Arg Arg Arg Asp
    50                  55                  60


Arg Phe Ile Gln Arg Gln Lys Asn Leu Ile Asn Ala Leu Val Lys Tyr
65                  70                  75                  80


Gly Leu Met Pro Ala Asp Glu Ile Gln Arg Gln Ala Leu Ala Tyr Lys
                85                  90                  95


Asp Pro Tyr Pro Ile Arg Lys Lys Ala Leu Asp Glu Ala Ile Asp Pro
            100                 105                 110
```

```
Tyr Glu Met Gly Arg Ala Ile Phe His Ile Asn Gln Arg Arg Gly Phe
        115                 120                 125

Lys Ser Asn Arg Lys Ser Ala Asp Asn Glu Ala Gly Val Val Lys Gln
    130                 135                 140

Ser Ile Ala Asp Leu Glu Met Lys Leu Gly Glu Ala Gly Ala Arg Thr
145                 150                 155                 160

Ile Gly Glu Phe Leu Ala Asp Arg Gln Ala Thr Asn Asp Thr Val Arg
                165                 170                 175

Ala Arg Arg Leu Ser Gly Thr Asn Ala Leu Tyr Glu Phe Tyr Pro Asp
            180                 185                 190

Arg Tyr Met Leu Glu Gln Glu Phe Asp Thr Leu Trp Ala Lys Gln Ala
        195                 200                 205

Ala Phe Asn Pro Ser Leu Tyr Ile Glu Ala Ala Arg Glu Arg Leu Lys
    210                 215                 220

Glu Ile Val Phe Phe Gln Arg Lys Leu Lys Pro Gln Glu Val Gly Arg
225                 230                 235                 240

Cys Ile Phe Leu Ser Asp Glu Asp Arg Ile Ser Lys Ala Leu Pro Ser
                245                 250                 255

Phe Gln Arg Phe Arg Ile Tyr Gln Glu Leu Ser Asn Leu Ala Trp Ile
            260                 265                 270

Asp His Asp Gly Val Ala His Arg Ile Thr Ala Ser Leu Ala Leu Arg
        275                 280                 285

Asp His Leu Phe Asp Glu Leu Glu His Lys Lys Lys Leu Thr Phe Lys
    290                 295                 300

Ala Met Arg Ala Ile Leu Arg Lys Gln Gly Val Val Asp Tyr Pro Val
```

```
305                 310                 315                 320

Gly Phe Asn Leu Glu Ser Asp Asn Arg Asp His Leu Ile Gly Asn Leu
                325                 330                 335

Thr Ser Cys Ile Met Arg Asp Ala Lys Lys Met Ile Gly Ser Ala Trp
            340                 345                 350

Asp Arg Leu Asp Glu Glu Glu Gln Asp Ser Phe Ile Leu Met Leu Gln
        355                 360                 365

Asp Asp Gln Lys Gly Asp Asp Glu Val Arg Ser Ile Leu Thr Gln Gln
    370                 375                 380

Tyr Gly Leu Ser Asp Asp Val Ala Glu Asp Cys Leu Asp Val Arg Leu
385                 390                 395                 400

Pro Asp Gly His Gly Ser Leu Ser Lys Lys Ala Ile Asp Arg Ile Leu
                405                 410                 415

Pro Val Leu Arg Asp Gln Gly Leu Ile Tyr Tyr Asp Ala Val Lys Glu
            420                 425                 430

Ala Gly Leu Gly Glu Ala Asn Leu Tyr Asp Pro Tyr Ala Ala Leu Ser
        435                 440                 445

Asp Lys Leu Asp Tyr Tyr Gly Lys Ala Leu Ala Gly His Val Met Gly
    450                 455                 460

Ala Ser Gly Lys Phe Glu Asp Ser Asp Glu Lys Arg Tyr Gly Thr Ile
465                 470                 475                 480

Ser Asn Pro Thr Val His Ile Ala Leu Asn Gln Val Arg Ala Val Val
                485                 490                 495

Asn Glu Leu Ile Arg Leu His Gly Lys Pro Asp Glu Val Val Ile Glu
            500                 505                 510
```

```
Ile Gly Arg Asp Leu Pro Met Gly Ala Asp Gly Lys Arg Glu Leu Glu
        515                 520                 525

Arg Phe Gln Lys Glu Gly Arg Ala Lys Asn Glu Arg Ala Arg Asp Glu
    530                 535                 540

Leu Lys Lys Leu Gly His Ile Asp Ser Arg Glu Ser Arg Gln Lys Phe
545                 550                 555                 560

Gln Leu Trp Glu Gln Leu Ala Lys Glu Pro Val Asp Arg Cys Cys Pro
                565                 570                 575

Phe Thr Gly Lys Met Met Ser Ile Ser Asp Leu Phe Ser Asp Lys Val
            580                 585                 590

Glu Ile Glu His Leu Leu Pro Phe Ser Leu Thr Leu Asp Asp Ser Met
        595                 600                 605

Ala Asn Lys Thr Val Cys Phe Arg Gln Ala Asn Arg Asp Lys Gly Asn
    610                 615                 620

Arg Ala Pro Phe Asp Ala Phe Gly Asn Ser Pro Ala Gly Tyr Asp Trp
625                 630                 635                 640

Gln Glu Ile Leu Gly Arg Ser Gln Asn Leu Pro Tyr Ala Lys Arg Trp
                645                 650                 655

Arg Phe Leu Pro Asp Ala Met Lys Arg Phe Glu Ala Asp Gly Gly Phe
            660                 665                 670

Leu Glu Arg Gln Leu Asn Asp Thr Arg Tyr Ile Ser Arg Tyr Thr Thr
        675                 680                 685

Glu Tyr Ile Ser Thr Ile Ile Pro Lys Asn Lys Ile Trp Val Val Thr
    690                 695                 700

Gly Arg Leu Thr Ser Leu Leu Arg Gly Phe Trp Gly Leu Asn Ser Ile
```

```
705                 710                 715                 720

Leu Arg Gly His Asn Thr Asp Asp Gly Thr Pro Ala Lys Lys Ser Arg
                725                 730                 735

Asp Asp His Arg His His Ala Ile Asp Ala Ile Val Val Gly Met Thr
            740                 745                 750

Ser Arg Gly Leu Leu Gln Lys Val Ser Lys Ala Ala Arg Arg Ser Glu
        755                 760                 765

Asp Leu Asp Leu Thr Arg Leu Phe Glu Gly Arg Ile Asp Pro Trp Asp
    770                 775                 780

Gly Phe Arg Asp Glu Val Lys Lys His Ile Asp Ala Ile Ile Val Ser
785                 790                 795                 800

His Arg Pro Arg Lys Lys Ser Gln Gly Ala Leu His Asn Asp Thr Ala
                805                 810                 815

Tyr Gly Ile Val Glu His Ala Glu Asn Gly Ala Ser Thr Val Val His
            820                 825                 830

Arg Val Pro Ile Thr Ser Leu Gly Lys Gln Ser Asp Ile Glu Lys Val
        835                 840                 845

Arg Asp Pro Leu Ile Lys Ser Ala Leu Leu Asn Glu Thr Ala Gly Leu
    850                 855                 860

Ser Gly Lys Ser Phe Glu Asn Ala Val Gln Lys Trp Cys Ala Asp Asn
865                 870                 875                 880

Ser Ile Lys Ser Leu Arg Ile Val Glu Thr Val Ser Ile Ile Pro Ile
                885                 890                 895

Thr Asp Lys Glu Gly Val Ala Tyr Lys Gly Tyr Lys Gly Asp Gly Asn
            900                 905                 910
```

```
Ala Tyr Met Asp Ile Tyr Gln Asp Pro Thr Ser Ser Lys Trp Lys Gly
        915                 920                 925


Glu Ile Val Ser Arg Phe Asp Ala Asn Gln Lys Gly Phe Ile Pro Ser
    930                 935                 940


Trp Gln Ser Gln Phe Pro Thr Ala Arg Leu Ile Met Arg Leu Arg Ile
945                 950                 955                 960


Asn Asp Leu Leu Lys Leu Gln Asp Gly Glu Ile Glu Glu Ile Tyr Arg
                965                 970                 975


Val Gln Arg Leu Ser Gly Ser Lys Ile Leu Met Ala Pro His Thr Glu
            980                 985                 990


Ala Asn Val Asp Ala Arg Asp Arg  Asp Lys Asn Asp Thr  Phe Lys Leu
        995                 1000                1005


Thr Ser  Lys Ser Pro Gly Lys  Leu Gln Ser Ala Ser  Ala Arg Lys
    1010                1015                1020


Val His  Ile Ser Pro Thr Gly  Leu Ile Arg Glu Gly
    1025                1030                1035


<210>  148
<211>  1270
<212>  PRT
<213>  Mycoplasma gallisepticum

<400>  148

Met Asn Asn Ser Ile Lys Ser Lys Pro Glu Val Thr Ile Gly Leu Asp
1               5                   10                  15


Leu Gly Val Gly Ser Val Gly Trp Ala Ile Val Asp Asn Glu Thr Asn
            20                  25                  30


Ile Ile His His Leu Gly Ser Arg Leu Phe Ser Gln Ala Lys Thr Ala
        35                  40                  45
```

```
Glu Asp Arg Arg Ser Phe Arg Gly Val Arg Arg Leu Ile Arg Arg Arg
    50                  55                  60

Lys Tyr Lys Leu Lys Arg Phe Val Asn Leu Ile Trp Lys Tyr Asn Ser
65                  70                  75                  80

Tyr Phe Gly Phe Lys Asn Lys Glu Asp Ile Leu Asn Asn Tyr Gln Glu
                85                  90                  95

Gln Gln Lys Leu His Asn Thr Val Leu Asn Leu Lys Leu Glu Ala Leu
            100                 105                 110

Asn Ala Lys Ile Asp Pro Lys Ala Leu Ser Trp Ile Leu His Asp Tyr
        115                 120                 125

Leu Lys Asn Arg Gly His Phe Tyr Glu Asp Asn Arg Asp Phe Asn Val
    130                 135                 140

Tyr Pro Thr Glu Glu Leu Ala Asn Tyr Phe Asp Glu Phe Gly Tyr Tyr
145                 150                 155                 160

Lys Gly Ile Ile Asp Ser Lys Asn Asp Asp Asp Asp Lys Leu Glu Glu
                165                 170                 175

Gly Leu Thr Lys Tyr Lys Phe Ser Asn Gln His Trp Leu Glu Glu Val
            180                 185                 190

Lys Lys Val Leu Ser Asn Gln Thr Gly Leu Pro Glu Lys Phe Lys Glu
        195                 200                 205

Glu Tyr Glu Ser Leu Phe Ser Tyr Val Arg Asn Tyr Ser Glu Gly Pro
    210                 215                 220

Gly Ser Ile Asn Ser Val Ser Pro Tyr Gly Ile Tyr His Leu Asp Glu
225                 230                 235                 240
```

```
Lys Glu Gly Lys Val Val Gln Lys Tyr Asn Asn Ile Trp Asp Lys Thr
                245                 250                 255

Ile Gly Lys Cys Ser Ile Phe Pro Asp Glu Tyr Arg Ala Pro Lys Asn
            260                 265                 270

Ser Pro Ile Ala Met Ile Phe Asn Glu Ile Asn Glu Leu Ser Thr Ile
        275                 280                 285

Arg Ser Tyr Ser Ile Tyr Leu Thr Gly Trp Phe Ile Asn Gln Glu Phe
    290                 295                 300

Lys Lys Ala Tyr Leu Asn Lys Leu Leu Asp Leu Leu Ile Lys Thr Asn
305                 310                 315                 320

Ser Glu Lys Pro Ile Asp Ala Arg Gln Phe Lys Lys Leu Arg Glu Glu
                325                 330                 335

Thr Ile Ala Glu Ser Ile Gly Lys Glu Thr Leu Lys Asp Val Glu Ser
            340                 345                 350

Glu Glu Lys Leu Glu Lys Asp Asp His Lys Trp Lys Leu Lys Gly Leu
        355                 360                 365

Lys Leu Asn Thr Asn Gly Lys Ile Gln Tyr Asn Asp Leu Ser Ser Leu
    370                 375                 380

Ala Lys Phe Val His Lys Leu Lys Gln His Leu Lys Leu Asp Phe Leu
385                 390                 395                 400

Leu Glu Asp Gln Tyr Thr Pro Leu Asp Lys Ile Asn Phe Leu Gln Ser
                405                 410                 415

Leu Tyr Val Tyr Leu Gly Lys His Leu Arg Tyr Ser Asn Arg Val Asp
            420                 425                 430

Ser Ala Asn Leu Lys Glu Phe Ser Asp Ser Ser Arg Leu Phe Glu Arg
        435                 440                 445
```

```
Val Leu Gln Glu Gln Lys Asp Gly Leu Phe Lys Leu Phe Glu Gln Thr
    450                 455                 460

Asp Lys Asp Asp Glu Lys Ile Leu Thr Gln Thr His Ser Leu Ser Thr
465                 470                 475                 480

Lys Ala Met Leu Leu Ala Ile Thr Arg Met Thr Asn Leu Asp Asn Asp
                485                 490                 495

Glu Asp Asn Gln Lys Asn Asn Asp Lys Gly Trp Asn Phe Glu Ala Ile
            500                 505                 510

Lys Asn Phe Asp Gln Lys Phe Ile Asp Ile Thr Lys Thr Asn Asn Asn
        515                 520                 525

Leu Ser Leu Lys Gln Asp Lys Arg Tyr Leu Asp Asp Gln Phe Ile Asn
    530                 535                 540

Asp Ala Ile Leu Ser Pro Gly Val Lys Arg Ile Leu Arg Glu Ala Thr
545                 550                 555                 560

Lys Val Phe Asn Ala Ile Leu Lys Gln Phe Ser Glu Glu Tyr Asp Val
                565                 570                 575

Thr Lys Val Val Ile Glu Leu Ala Arg Glu Leu Ser Glu Glu Lys Glu
            580                 585                 590

Leu Glu Asn Thr Lys Asn Tyr Lys Lys Leu Ile Lys Lys Asn Gly Asp
        595                 600                 605

Lys Ile Ser Glu Gly Leu Lys Ala Leu Gly Ile Ala Glu Asp Lys Ile
    610                 615                 620

Glu Glu Ile Leu Lys Ser Pro Thr Lys Ser Tyr Lys Val Leu Leu Trp
625                 630                 635                 640
```

```
Leu Gln Gln Asp His Ile Asp Pro Tyr Ser Gln Lys Glu Ile Ala Phe
                645                 650                 655

Asp Asp Ile Leu Thr Lys Thr Glu Lys Thr Glu Ile Asp His Ile Ile
            660                 665                 670

Pro Tyr Ser Ile Ser Phe Asp Asp Ser Ser Ser Asn Lys Leu Leu Val
        675                 680                 685

Leu Ala Glu Ser Asn Gln Ala Lys Ser Asn Gln Thr Pro Tyr Glu Phe
    690                 695                 700

Ile Asn Ser Gly Lys Ala Glu Ile Thr Trp Glu Val Tyr Glu Ala Tyr
705                 710                 715                 720

Cys His Lys Phe Lys Asn Gly Asp Ser Ser Leu Leu Asp Ser Thr Gln
                725                 730                 735

Arg Ser Lys Lys Phe Ala Lys Met Met Lys Thr Asp Thr Ser Ser Lys
            740                 745                 750

Tyr Asp Ile Gly Phe Leu Ala Arg Asn Leu Asn Asp Thr Arg Tyr Ala
        755                 760                 765

Thr Ile Val Phe Arg Asp Ala Leu Lys Asp Tyr Ala Asn Asn His Leu
    770                 775                 780

Val Glu Asp Lys Pro Met Phe Lys Val Val Cys Ile Asn Gly Gly Val
785                 790                 795                 800

Thr Ser Phe Leu Arg Lys Asn Phe Asp Pro Lys Ser Trp Tyr Ala Lys
                805                 810                 815

Lys Asp Arg Asp Lys Asn Ile His His Ala Val Asp Ala Ser Ile Ile
            820                 825                 830

Ser Ile Phe Ser Asn Glu Thr Lys Thr Leu Phe Asn Gln Leu Thr Lys
        835                 840                 845
```

```
Phe Ala Asp Tyr Lys Leu Phe Lys Asn Thr Asp Gly Ser Trp Lys Lys
    850                 855                 860

Ile Asp Pro Lys Thr Gly Val Val Ser Glu Val Thr Asp Glu Asn Trp
865                 870                 875                 880

Lys Gln Ile Arg Val Arg Asn Gln Val Ser Glu Ile Ala Lys Val Ile
                885                 890                 895

Asp Lys Tyr Ile Gln Asp Ser Asn Ile Glu Arg Lys Ala Arg Tyr Ser
            900                 905                 910

Arg Lys Ile Glu Asn Lys Thr Asn Ile Ser Leu Phe Asn Asp Thr Val
        915                 920                 925

Tyr Ser Ala Lys Lys Val Gly Tyr Glu Asp Gln Ile Lys Arg Lys Asn
    930                 935                 940

Leu Lys Thr Leu Asp Ile His Glu Ser Ala Glu Glu Asn Lys Asn Ser
945                 950                 955                 960

Lys Val Lys Lys Gln Phe Val Tyr Arg Lys Leu Val Asn Val Ser Leu
                965                 970                 975

Leu Asn Asn Asp Lys Leu Ala Asp Leu Phe Ala Glu Lys Glu Asp Ile
            980                 985                 990

Leu Met Tyr Arg Ala Asn Pro Trp  Val Ile Asn Leu Ala  Glu Gln Ile
        995                 1000                1005

Phe Asn  Glu Tyr Thr Glu Asn  Lys Lys Ile Lys Ser  Gln Asn Val
    1010                1015                1020

Phe Glu  Lys Tyr Met Leu Asp  Leu Thr Lys Glu Phe  Pro Glu Lys
    1025                1030                1035
```

```
Phe Ser  Glu Ala Phe Val Lys  Ser Met Ile Arg Asn  Lys Thr Ala
    1040                1045                1050

Ile Ile  Tyr Asn Val Glu Lys  Asp Val Val His Arg  Ile Lys Arg
    1055                1060                1065

Leu Lys  Ile Leu Ser Ser Glu  Leu Lys Glu Asn Lys  Trp Ser Asn
    1070                1075                1080

Val Ile  Ile Arg Ser Lys Asn  Glu Ser Gly Thr Lys  Leu Ser Tyr
    1085                1090                1095

Gln Asp  Thr Ile Asn Ser Ile  Ala Leu Met Ile Met  Arg Ser Ile
    1100                1105                1110

Asp Pro  Thr Ala Lys Lys Gln  Tyr Ile Arg Val Pro  Leu Asn Thr
    1115                1120                1125

Leu Asn  Leu His Leu Gly Asp  Gln Asp Phe Asp Leu  His Asn Ile
    1130                1135                1140

Asp Ala  Tyr Leu Lys Lys Pro  Lys Phe Val Lys Tyr  Leu Lys Ala
    1145                1150                1155

Asn Glu  Ile Gly Asp Glu Tyr  Lys Pro Trp Arg Val  Leu Thr Ser
    1160                1165                1170

Gly Thr  Leu Leu Ile His Lys  Lys Asp Lys Lys Leu  Met Tyr Ile
    1175                1180                1185

Ser Ser  Phe Gln Asn Leu Asn  Asp Leu Ile Glu Ile  Lys Asn Leu
    1190                1195                1200

Ile Glu  Thr Glu Tyr Lys Glu  Asn Val Asp Ser Asp  Pro Lys Lys
    1205                1210                1215

Lys Lys  Lys Ala Ser Gln Ile  Leu Arg Ser Leu Ser  Val Ile Leu
    1220                1225                1230
```

Asn Asp Tyr Ile Leu Leu Asp Ala Lys Tyr Asn Phe Asp Ile Leu
    1235   1240   1245

Gly Leu Ser Lys Asn Lys Ile Asp Glu Ile Leu Asn Ser Lys Leu
    1250   1255   1260

Asp Leu Asp Lys Ile Ala Lys
    1265   1270

<210> 149
<211> 1204
<212> PRT
<213> Prevotella ruminicola

<400> 149

Met Glu Arg Ile Leu Gly Ile Asp Thr Gly Thr Asn Ser Leu Gly Trp
1   5   10   15

Ala Ile Val Asp Lys Asp Glu Asn Gln Tyr His Leu Val Ala Lys Gly
            20   25   30

Thr Asn Ile Phe Ser Glu Gly Val Lys Ile Glu Lys Gly Ile Glu Ser
        35   40   45

Ser Lys Ala Ala Glu Arg Thr Glu His Arg Ser Val Arg Lys His Tyr
    50   55   60

Trp Arg Arg Lys Ile Arg Lys Ile Arg Leu Leu Thr Ile Leu Ser Asp
65   70   75   80

Asn Asp Leu Cys Pro Arg Leu Lys His Glu Gln Leu Arg Gln Trp Arg
                85   90   95

Leu Lys Lys Val Tyr Pro Thr Asp Asp Thr Phe Met Glu Trp Gln Arg
            100   105   110

Thr Glu Asp Lys Ala Gln Val Asn Pro Tyr Lys Phe Arg Tyr Ile Cys

```
        115                 120                 125

Leu Thr Gln Lys Leu Asp Leu Ser Asp Ile Thr Gln Arg Phe Ile Leu
    130                 135                 140

Gly Arg Ala Leu Tyr His Leu Asn Gln Arg Arg Gly Phe Leu Ser Asn
145                 150                 155                 160

Arg Lys Glu Ala Thr Lys Glu Ser Glu Gly Thr Val Lys Glu Gly Ile
                165                 170                 175

Ser Ser Leu Ser Lys Asp Met Lys Asp Ser Gly Cys Glu Tyr Leu Gly
            180                 185                 190

Glu Tyr Phe Tyr Gln Leu Tyr Gln Gln Gly Lys Lys Ile Arg Asn His
        195                 200                 205

Tyr Thr Ala Arg Lys Glu His Tyr Leu Lys Glu Phe Lys Ala Ile Cys
    210                 215                 220

Ser Lys Gln Glu Leu Asp Asp Ala Leu Ile Glu Lys Leu Glu Lys Ala
225                 230                 235                 240

Ile Phe Asp Gln Arg Pro Leu Lys Ser Gln Lys Gly Gln Val Gly Thr
                245                 250                 255

Cys Thr Phe Glu Lys Gly Lys Ser Arg Cys Pro Ser Ser His Pro Leu
            260                 265                 270

Tyr Glu Asp Phe Arg Met Tyr Ser Phe Ile Asn Asn Ile Lys Val Gln
        275                 280                 285

Val Asp Thr Leu Tyr Asp Lys Gly Glu Arg Ser Leu Thr Asp Glu Glu
    290                 295                 300

Lys Gln Leu Ile Ile Pro Leu Phe Lys Arg Lys Ser Lys Arg Thr Phe
305                 310                 315                 320
```

```
Pro Phe Glu Asp Ile Ala Lys Lys Ile Ala Gly Lys Asn Asn Tyr Cys
                325                 330                 335

Tyr Ile Lys Ser Asn Glu Glu Lys Ala Tyr Lys Phe Asn Tyr Gln Met
            340                 345                 350

Asp Thr Gln Val Ser Gly Ser Pro Val Asn Ala Gln Leu Glu Glu Ile
        355                 360                 365

Phe Gly Glu Asp Trp Leu Ser Ser Val Cys Glu Val Tyr Thr Leu Ala
    370                 375                 380

Asn Asn Lys Ser Arg Phe Gln Ile Met Asn Asp Val Trp His Val Leu
385                 390                 395                 400

Phe Phe Tyr Asp Asp Glu Asp Lys Leu Lys Glu Phe Ala Lys Asp Arg
                405                 410                 415

Leu Gln Leu Asp Asp Glu Leu Ala Glu Lys Phe Ser Lys Ile Ser Ile
            420                 425                 430

Pro Asn Asp Tyr Ala Ala Leu Ser Leu Lys Ala Ile Arg Lys Ile Met
        435                 440                 445

Pro Tyr Leu Arg Asp Tyr Gly Leu Ile Tyr Ser Glu Ala Val Phe Leu
    450                 455                 460

Ala Asn Leu Val Asp Val Leu Pro Gln His Val Trp Gly Ile Lys Glu
465                 470                 475                 480

Met Arg Glu Ala Ala Ile Glu Asn Val Ile Asp Val Met His Ser Tyr
                485                 490                 495

Asp Lys Asn Asn Ile Asp Gly Ile Thr Leu Glu Gly Cys Val Lys Thr
            500                 505                 510

Phe Leu Lys Glu Arg Tyr Gln Val Ser Asp Asp Asn Leu Lys Lys Leu
```

```
        515                 520                 525

Tyr His Pro Ser Met Leu Asp Pro Tyr Pro Arg Gln Arg Pro Asn Asp
    530                 535                 540

Glu Gly Val Phe Gln Leu Gly Ser Pro Arg Ile Ser Ser Val Lys Asn
545                 550                 555                 560

Pro Met Ala Met His Ser Leu Phe Arg Leu Arg Lys Val Val Asn Leu
                565                 570                 575

Met Leu Lys Lys Gly Tyr Ile Thr Pro Asp Thr Lys Val His Ile Glu
            580                 585                 590

Phe Ser Arg Asp Leu Asn Asp Ala Asn Lys Arg Trp Ala Ile Gln Thr
        595                 600                 605

Trp Gln Arg Glu Asn Glu Lys Glu Arg Glu Arg Cys Arg Lys Glu Ile
    610                 615                 620

Glu Lys Tyr Ile Ala Ser Pro Ser Asp Thr Asp Ile Leu Lys Tyr Gln
625                 630                 635                 640

Leu Trp Glu Glu Gln Asn His Lys Cys Leu Tyr Thr Gly Asp Glu Ile
                645                 650                 655

Arg Ile Thr Asp Phe Leu Gly Asp Asn Pro Lys Tyr Asp Ile Glu His
            660                 665                 670

Thr Ile Pro Arg Ser Ala Gly Gly Asp Ser Thr Lys Met Asn Leu Thr
        675                 680                 685

Leu Cys Ser Ser Arg Phe Asn Arg Asp Glu Lys Lys Thr Lys Leu Pro
    690                 695                 700

Ala Glu Leu Val Asn His Asp Glu Ile Leu Glu Arg Ile Ser Asn Trp
705                 710                 715                 720
```

```
Lys Glu Lys Tyr Glu Asp Ile Asp Lys Gln Ile Arg Lys Ile Ser Thr
               725                 730                 735

Lys Gly Ala Thr Ser Lys Glu Asp Lys Asp Ser Lys Ile Arg Arg Arg
            740                 745                 750

His Tyr Leu Ile Leu Gln Arg Asp Tyr Trp Arg Gly Lys Tyr Gln Arg
        755                 760                 765

Phe Thr Met Thr Glu Val Pro Glu Gly Phe Ser Arg Arg Gln Gly Thr
    770                 775                 780

Asp Ile Ser Val Ile Ser Arg Tyr Ala Arg Met Tyr Leu Lys Ser Val
785                 790                 795                 800

Phe Lys Gln Val Tyr Ile Val Lys Gly Ile Ala Thr Ser Asp Phe Arg
               805                 810                 815

Lys Met Trp Gly Ile Gln Asp Glu Tyr Ala Lys Lys Glu Arg Val Asn
            820                 825                 830

His Val His His Cys Ile Asp Ala Ile Thr Ile Ala Cys Ile Gly Lys
        835                 840                 845

Ala Glu Tyr Asp Lys Leu Ala Asp Tyr Arg His Gln Tyr Asp Asp Tyr
    850                 855                 860

Leu Phe Gln Gly Lys Thr Lys Pro Thr Phe Asp Lys Pro Trp Pro Ser
865                 870                 875                 880

Phe Val Ile Asp Ile Lys His Ile Gln Asp Glu Leu Leu Ile Ala His
               885                 890                 895

Tyr Ala Lys Asp Asn Leu Glu Lys Phe Thr Lys Lys Asn Leu Arg Gly
            900                 905                 910

Lys Asp Gly Arg Ile Ile Arg Asp Lys Phe Gly Asn Lys Leu Gln Met
```

```
        915                 920                 925

Lys Gly Asp Thr Ser Arg Asn Ser Leu His Asn Asp Lys Phe Tyr Gly
    930                 935                 940

Ala Ile Asn His Glu Gly Glu Ile Lys Tyr Val Tyr Arg Thr Asn Ile
945                 950                 955                 960

Glu Ala Leu Asp Ala Lys Ser Ile Gly Asn Ile Val Asp Pro Thr Val
                965                 970                 975

Arg Ser Ile Ile Glu Ser Ala Ile Ala Ile His Gly Ser Leu Lys Ala
            980                 985                 990

Ala Ile Asn Lys Gly Ile Trp Met  Asn Glu Glu Lys His  Ile Pro Ile
        995                 1000                1005

Lys Lys  Val Arg Val Phe Arg  Asn Asp Val Lys Lys  Pro Ile Glu
    1010                1015                1020

Leu Lys  Asp Gln Arg Asp Leu  Ser Asp Lys Asp Tyr  Lys Gln His
    1025                1030                1035

Tyr Tyr  Val Thr Asn Asp Gly  Asn Tyr Met Met Leu  Ile Phe Ser
    1040                1045                1050

Lys Leu  Asn Asn Lys Gly Arg  Glu Ile Arg Gln His  Val Val Ile
    1055                1060                1065

Asn Ser  Leu Glu Ala Thr Glu  Val Ile Lys Ser His  Lys Arg Ser
    1070                1075                1080

Gln Val  Gly Lys Val Val Trp  Glu Ser Tyr Tyr Ser  Lys Glu Gly
    1085                1090                1095

Phe Asp  Leu Ile Tyr Lys Leu  Lys Ser Gly Thr Met  Ile Leu Leu
    1100                1105                1110
```

```
Tyr Glu  Asn Asn Arg Asp Glu  Val Trp Asp Leu Asp  Ile Arg Asn
    1115                1120                1125


Leu Gln  Lys Arg Leu Tyr Ile  Ile Thr Lys Met Lys  Tyr Asp Gly
    1130                1135                1140


Arg Ile  Tyr Met Met His His  Gln Glu Ala Arg Glu  Lys Lys Asp
    1145                1150                1155


Leu Glu  Glu Lys Ser Gly Ser  Phe Lys Ile Asn Glu  Asp Tyr Arg
    1160                1165                1170


Pro Leu  Ile Val Asn Ser Tyr  Asn Gln Phe Asn Ala  Leu Val Gln
    1175                1180                1185


Asp Leu  Asp Phe Glu Ile Asn  Asp Leu Gly Glu Ile  Arg Arg Leu
    1190                1195                1200


Ile
```

<210> 150
<211> 1178
<212> PRT
<213> Scardovia inopinata

<400> 150

```
Met Gly Lys Arg His Asn Ser Asn Met Ala Lys Lys Lys Ile Ser Tyr
1               5                   10                  15


Arg Ile Gly Ile Asp Val Gly Leu Asn Ser Thr Gly Leu Ala Ala Ile
            20                  25                  30


Glu Val Asp Asp Asp Gly Ala Pro Ile Arg Ile Leu Asn Thr Met Ser
        35                  40                  45


Val Ile His Asp Gly Gly Val Asp Pro Asp Ala Ala Lys Val Arg Gly
    50                  55                  60
```

```
Thr Arg Leu Ala Ile Ser Gly Ile Ala Arg Arg Thr Arg Arg Met Arg
65                  70                  75                  80

Arg Arg Arg Ala Lys Arg Leu Asp Arg Leu Glu Gln Ile Leu Glu Lys
                85                  90                  95

Tyr Gly Tyr Thr Asp Thr Glu Pro Val Leu Glu Glu Pro Tyr Gly Pro
            100                 105                 110

Trp Ile Cys Arg Ala Glu Leu Ala Asp Gly Phe Ile Asn Asp Asp Glu
        115                 120                 125

Gln Arg Arg Met Met Ile Gly Ile Ala Ile Arg His Ile Ala Arg His
    130                 135                 140

Arg Gly Trp Arg Asn Pro Tyr Gln Asn Val Arg Ala Leu Leu Asn Ile
145                 150                 155                 160

Asp Asp Ser Asp Leu Ser Glu Glu Tyr Lys Asn Leu Lys Glu Lys Val
                165                 170                 175

Gln Asp Gln Ile Asn Asp Gly Lys Asp Leu Pro Asn Phe Thr Pro Ser
            180                 185                 190

Gln Leu Val Arg Asp Tyr Leu Asp Asn Phe Ser Gly Gln Pro Ala Ala
        195                 200                 205

Arg Ile Arg Thr Gly Lys Ala Gly Pro Arg Gly Asn Arg Arg Asp Ala
    210                 215                 220

Val Gly Ile Leu Pro Gln Arg Met Arg Gln Ser Asp Tyr Ala Tyr Glu
225                 230                 235                 240

Leu Gln Arg Ile Phe Asp Met Gln Lys Ile Gly Arg Asp Glu Ala Gln
                245                 250                 255
```

```
Glu Leu Leu Met Ala Val Phe Glu Ala Lys Ser Pro Lys Gly Ser Ala
            260                 265                 270

Glu Lys Arg Ile Gly Lys Asp Pro Leu Thr Gly Lys Lys Arg Ala Leu
        275                 280                 285

Lys Ala Ser Leu Ala Phe Gln Lys Tyr Arg Ile Val Ala Thr Ile Thr
    290                 295                 300

Asn Leu Arg Ile Lys Thr Gly Thr Gly Ser Glu Arg Met Leu Ser Pro
305                 310                 315                 320

Thr Glu Leu Asn Asp Ile Tyr Thr Tyr Leu Leu Arg Val Gln Asp Asp
                325                 330                 335

Asn His Leu Pro Thr Trp Glu Asp Ile Cys Glu Glu Val Leu His Ile
            340                 345                 350

Gly Arg Tyr Gln Leu Ala Gly Ile Gly Lys Thr Phe Glu Gly Gly Glu
        355                 360                 365

Arg Ile Ser Asn Met Pro Pro Val Ile Gln Thr Ser Leu Ala Ile His
    370                 375                 380

Gly Leu Ser Glu Gly Thr Leu Ala Glu Lys Leu Thr Lys Trp Trp Asp
385                 390                 395                 400

Lys Ala Asp Asp Asp Ser Arg Glu Ser Met Ile Lys Leu Leu Ser Asn
                405                 410                 415

Thr Val Asp Ile Asp Arg Val Asn Glu Val Asp Glu Asn Phe Ala Ser
            420                 425                 430

Ala Leu Asp Phe Ile Asp Ser Leu Asp Asp Glu Glu Leu Thr Lys Leu
        435                 440                 445

Asp Lys Ile Ala Leu Pro Arg Gly Arg Ala Ala Tyr Ser Glu Glu Ala
    450                 455                 460
```

```
Leu Asn Lys Leu Thr Ala Asp Met Leu Asn Thr Gly Asp Asp Leu Phe
465                 470                 475                 480

Ser Ala Arg Gln Arg Ile Tyr His Val Asn Asn Ser Trp Arg Pro Pro
                485                 490                 495

Gln Pro Pro Ile Gly Glu Pro Leu Gly Asn Pro Ala Val Asp Arg Val
            500                 505                 510

Leu Lys Ile Thr Asn Arg Tyr Leu Met Asn Cys Leu Asn Arg Trp Gly
        515                 520                 525

Gln Pro Arg Arg Val Thr Ile Glu His Thr Arg Ser Gly Phe Thr Ser
    530                 535                 540

Val Lys Gln Ala Thr Glu His Gln Lys Ile Ser Asp Lys Arg Ala Glu
545                 550                 555                 560

Tyr Arg Arg Asp Ile Val Lys Gln Leu Glu Glu Ala Gly Val Glu Ser
                565                 570                 575

Val His Glu Tyr Asp Ile Arg Arg Trp Glu Ala Val Gln Arg Gln Asn
            580                 585                 590

Gly Gln Cys Leu Tyr Cys Gly Arg Asp Ile Thr Phe Lys Thr Cys Glu
        595                 600                 605

Met Asp His Ile Val Pro Arg Lys Gly Pro Gly Ser Thr Asn Thr Arg
    610                 615                 620

Thr Asn Phe Ala Ala Val Cys Pro Glu Cys Asn Arg Met Lys Ser Asn
625                 630                 635                 640

Ile Pro Phe Ala Ser Trp Ala Glu Thr Lys Glu Ala Lys Asp Arg Gly
                645                 650                 655
```

```
Val Ser Leu Asp Lys Ala Ile Lys Gln Val Arg Phe Phe Asn Phe Thr
            660                 665                 670

Lys Asn Glu Tyr Ser Pro Gln Ala Gln Arg Asn Phe Lys Lys Ser Met
        675                 680                 685

Ile Glu Arg Leu Lys Gln Lys Thr Ser Asp Glu Pro Leu Asp Asn Arg
    690                 695                 700

Ser Ile Glu Ser Val Ser Trp Met Ala Asp Glu Leu Tyr Lys Arg Ile
705                 710                 715                 720

Asp Trp Tyr Phe Asn His Glu Gln Tyr Glu Thr Ser Lys Lys Ala Ile
                725                 730                 735

Asn Asp Asp Lys Asp Asn Leu Ser Gly Thr Gln Val Val Val Tyr Pro
            740                 745                 750

Gly Ser Ile Thr Ala Glu Ala Arg Asn Ala Ala Gly Leu Gly Gly Asn
        755                 760                 765

Ile His Phe Ile Gly Gly Arg Tyr Lys Thr Arg Leu Asp Arg Arg His
    770                 775                 780

His Ala Val Asp Ala Cys Val Ile Ala Met Met Glu Pro Gly Ile Ala
785                 790                 795                 800

Arg Ile Leu Thr Glu Arg Asn Gln Leu Arg Gln Ala Gln Arg Leu Thr
                805                 810                 815

Ala Arg Ile Glu Asp Asp Glu Val Asn Trp Lys Asp Tyr Pro Thr Glu
            820                 825                 830

Asn Thr Ala Gly Tyr Asn Lys Tyr Gln Ala Trp Ser Asp Arg Met His
        835                 840                 845

Ala Leu Leu Glu Tyr Met Asn Asn Ala Leu Asp Tyr Asp Lys Ile Pro
    850                 855                 860
```

```
Val Val Arg Trp Glu Arg Leu Gln Leu Gly Asn Arg Ser Ala His Glu
865                 870                 875                 880


Asp Thr Ile His Pro Leu Lys Lys Leu Pro Leu Ser His Glu Ile Ser
                885                 890                 895


Ala Ile Asp Ile Asn His Ala Ser Thr Pro Ala Leu Tyr Glu Ala Leu
            900                 905                 910


Val Ser Leu Pro Asp Phe Ser Glu Gln Asp Gly Leu Pro Ala Asp Pro
        915                 920                 925


Ser Arg Gln Ile Asn Val Asn Gly Glu Arg Tyr Ser Gly Asp Asp Leu
    930                 935                 940


Val Ser Phe Phe Asn Ser Asn Ala Ala Gln Ile Ala Ile Gln Gly Gly
945                 950                 955                 960


Ser Ala Glu Leu Gly Thr Ala Phe His His Ala Arg Ile Tyr Arg Cys
                965                 970                 975


Trp Thr Val Gly Lys Asn Gly Lys Lys Lys Ile Phe Phe Gly Met Ile
            980                 985                 990


Arg Val Tyr Gln His Asp Leu Leu  His Ala Lys Asn Glu  Asp Leu Phe
        995                 1000                1005


Thr Tyr  Pro Leu Lys Arg Ser  Ser Val Ser Met Arg  Tyr Ala Lys
    1010                1015                1020


Lys Glu  Val Val His Ala Ile  Leu Ser Gly Asn Ala  Glu Tyr Val
    1025                1030                1035


Gly Tyr  Leu Cys Val Gly Asp  Glu Leu Val Leu Asp  Leu Lys Gly
    1040                1045                1050
```

```
Asp Lys  Ser Asn Asp Glu Gly  Gly Ser Arg Leu Ser  Gly Gln Val
    1055                1060                1065


Gly Glu  Phe Val Gln Lys Phe  Glu Glu Asp Ser Lys  Val Asn Ser
    1070                1075                1080


Gln Ile  Val Asn Arg Trp Thr  Val Asp Gly Phe Pro  Asp Glu Ala
    1085                1090                1095


Lys Leu  Arg Leu Arg Pro Ser  Met Phe Ala Gly Glu  Gly Leu Lys
    1100                1105                1110


Asn Met  Lys Ser Glu Leu Val  Glu Asn Ala Ala Ile  Lys Asn Ile
    1115                1120                1125


Leu Ser  Lys Thr Gly Trp Arg  Val Ser Val Asp Val  Ile Ser Lys
    1130                1135                1140


Lys Ser  Pro Val Val Leu Arg  Arg Asn Ala Phe Gly  Glu Pro Arg
    1145                1150                1155


Trp Lys  Thr Asn Ala Gly Leu  Pro Val Ser Tyr Arg  Trp Gln Asp
    1160                1165                1170


Thr Glu  Thr Lys Glu
    1175


<210>  151
<211>  1371
<212>  PRT
<213>  Gordonibacter pamelaeae

<400>  151

Met Asn Leu Arg Asn Val Glu Ser Tyr Gln Val Gly Leu Asp Ile Gly
1               5                   10                  15


Thr Gly Ser Val Gly Trp Ala Val Leu Asp Asp Asn Gly Asp Leu Cys
            20                  25                  30
```

```
Arg Phe Lys Gly Lys Pro Thr Trp Gly Ser Arg Val Phe Pro Thr Ala
        35                  40                  45

Glu Thr Ala Ala Glu Ala Arg Val His Arg Gly Gln Arg Arg Arg Tyr
    50                  55                  60

Asp Arg Arg Arg Gln Arg Ile Asp Leu Leu Gln Arg Phe Phe Ala Asp
65                  70                  75                  80

Glu Val Ala Lys Val Asp Pro Glu Phe Phe Ile Arg Leu Asn Gln Ala
                85                  90                  95

Arg Leu His Pro Glu Asn Arg Asp Pro Ala His Ala Asp Tyr Arg Trp
            100                 105                 110

Pro Leu Phe Asn Gly Ser Asn Phe Thr Glu Lys Asp Tyr Tyr Arg Gln
        115                 120                 125

Phe Pro Thr Ile Tyr His Leu Arg Ala His Leu Leu Lys Ser Asp Glu
    130                 135                 140

Pro Ala Asp Ile Arg Leu Val Tyr Leu Ala Leu His Asn Ile Val Lys
145                 150                 155                 160

His Arg Gly Asn Phe Leu His Gln Asp Asn Pro Ser Leu Ser Ala Arg
                165                 170                 175

Asn Ala Asn Val Gly Asp Ala Val Glu Ala Leu Cys Leu Ala Leu Asp
            180                 185                 190

Glu Trp Cys Gly Ala His Asp Val Glu Cys Ala Cys Asp Glu Ala Ala
        195                 200                 205

Leu Ala Glu Ala Leu Gly Asp Ala Ser Leu Arg Pro Gly Glu Lys Arg
    210                 215                 220

Glu Arg Ala Glu Ala Ala Leu Gly Val Glu Lys Ala His Lys Lys Leu
```

225 230 235 240

Ala Lys Ala Val Ser Ser Ala Val Val Gly Tyr Ala Ala Glu Phe Gly
245 250 255

His Val Phe Phe Ala Glu Ser Glu Gly Ser Lys Phe Ala Leu Ser Asn
260 265 270

Asp Glu Lys Val Glu Ala Tyr Val Cys Pro Asp Glu Gly Arg Asp Leu
275 280 285

Phe Asp Ala Met Arg Ala Val His Ser Ser Tyr Val Leu Met Gly Ile
290 295 300

Leu Ser Glu Ala Gln Gly Glu Leu Leu Ser Val Cys Lys Val Gly Glu
305 310 315 320

Tyr Glu Arg Tyr Lys Arg Asp Leu Glu Thr Leu Lys Ser Leu Val Arg
325 330 335

Ala Tyr Gly Pro Glu Arg Tyr Asp Glu Phe Phe Cys Gly Pro Phe Tyr
340 345 350

Glu Gly Thr Arg Asp Tyr Asp Pro Gly Lys Ala Gln Gly Tyr Thr Lys
355 360 365

Tyr Asn Leu Gly Ala Ser Lys Leu Ser His Glu Asp Phe Leu Lys Glu
370 375 380

Val Gln Lys Leu Leu Lys Asp Ile Gly Ala Gln Ala Asp Glu Arg Tyr
385 390 395 400

Ala Asp Ile Glu Arg Ala Ile Glu Ala Gly Ala Phe Leu Arg Arg Leu
405 410 415

Lys Thr Ser Asp Asn Gly Thr Ile Pro Tyr Gln Leu His Leu Glu Glu
420 425 430

```
Met Asp Ala Ile Ile Glu Arg Gln Ala Ala Phe Tyr Pro Phe Leu Ala
        435                 440                 445

Gln Glu Lys Asp Lys Leu Lys Ser Leu Val Ser Phe Arg Ile Pro Tyr
    450                 455                 460

Tyr Val Gly Pro Leu Thr Gln Lys Asn Ala Ala Arg Asp Gly Lys Gly
465                 470                 475                 480

Glu Ala Arg Phe Ala Trp Ser Ser Arg Lys Pro Gly Met Glu Asp Ala
                485                 490                 495

Arg Val Tyr Pro Trp Asn Trp Glu Asp Val Ile Asp Lys Asp Gln Ser
            500                 505                 510

Ala Glu Asp Phe Ile Arg Arg Met Thr Gly Thr Cys Thr Tyr Leu Lys
        515                 520                 525

Gly Glu Pro Val Leu Ala Arg Cys Ser Leu Asp Tyr Glu Leu Phe Cys
    530                 535                 540

Val Leu Asn Glu Leu Ala Gly Ala Arg Trp Thr Gln Asp Gly Asp Lys
545                 550                 555                 560

Ser Tyr Arg Phe Asp Ala Ala Asp Arg Leu Gly Ile Val Glu Asp Leu
                565                 570                 575

Phe Lys Lys Arg Lys Arg Val Thr Tyr Glu Ala Ala Glu Lys Trp Leu
            580                 585                 590

Ala Arg Thr His Gly Pro Glu Ser Gly Lys Ser Ala Gly Gly Ala Tyr
        595                 600                 605

His Val Ser Gly Gly Gln Gly Glu Asp Ala Phe Glu Ser Gln Leu Ser
    610                 615                 620

Ser His Tyr Asp Phe Cys Lys Ile Leu Gly Val Asp Glu Leu Ser Asp
```

625 630 635 640

Ala Asp Glu Ala Met Ala Glu Asp Ile Ile Leu Trp Asn Thr Val Phe
645 650 655

Glu Asp Arg Ser Ile Leu Lys Arg Lys Ile Lys Leu Ala Tyr Gly Asp
660 665 670

Arg Leu Gly Asp Ala Gln Val Arg Lys Leu Cys Gln Lys Arg Tyr Thr
675 680 685

Gly Trp Gly Arg Leu Ser Gly Glu Leu Leu Arg Gly Leu Arg Ser Ala
690 695 700

Thr Asp Asn Gly Pro Lys Thr Ile Met Asp Ile Leu Leu Glu Gly Asp
705 710 715 720

Pro Asn His Ala Arg Arg Met Gly Ala Ala Met Asn Leu Met Glu Ile
725 730 735

Leu His Asp Asp Leu Leu Glu Phe Gln Ala Lys Ile Asp Glu His Asn
740 745 750

Arg Glu Arg Ala Leu Ala Val Gly Gly Met Ser Val Asp Glu Val Thr
755 760 765

Gly Ser Pro Ala Leu Arg Arg Gly Ile Asn Gln Ala Leu Arg Val Val
770 775 780

Asp Glu Ile Ala Gly Ile Ala Gly Lys Pro Pro Ala His Ile Tyr Val
785 790 795 800

Glu Val Thr Arg Asp Glu Gly Ala Arg Asn Lys Gly Arg Arg Thr Thr
805 810 815

Ser Arg Tyr Arg Ala Leu Glu Ala Ala Leu Ser Ser Ile Lys Ala Gln
820 825 830

```
Cys Ala Asp Val Tyr Ala Glu Leu Lys Glu Arg Asp Pro Arg Ala Leu
        835                 840                 845

Asp Asp Glu Arg Leu Thr Leu Tyr Phe Met Gln Cys Gly Lys Cys Met
    850                 855                 860

Tyr Ser Gly Asp Ala Leu Asp Ile Asn Lys Leu Gln Thr Tyr Gln Val
865                 870                 875                 880

Asp His Ile Leu Pro Gln Ser Tyr Val Lys Asp Asp Ser Phe Glu Asn
                885                 890                 895

Lys Val Leu Val Arg Pro Asp Thr Asn Gln Arg Lys Gly Asp Thr Leu
            900                 905                 910

Leu Leu Asp Glu Arg Leu Ile Ala Arg Met Arg Gly Phe Trp Arg Thr
        915                 920                 925

Leu Arg Asp Ala Glu Leu Ile Gly Glu Lys Lys Phe Asn Asn Leu Thr
    930                 935                 940

Arg Thr Ser Val Ser Asp Glu Gln Met Lys Lys Phe Val Ser Arg Gln
945                 950                 955                 960

Leu Val Glu Thr Gly Gln Met Val Lys Gln Val Gln Gln Leu Leu Gln
                965                 970                 975

Ala Arg Tyr Pro Glu Ser Glu Val Gln Pro Val Lys Ala Gly Val Ser
            980                 985                 990

His Gln Leu Arg Val Gly Cys Ala  Leu Ala Lys Ser Arg  Glu Ile Asn
        995                 1000                1005

Asp Phe  His His Ala His Asp  Ala Tyr Leu Ala Cys  Gln Val Gly
    1010                1015                1020

Arg Phe  Val Gln Tyr Arg His  Ser Ala Val Tyr Ser  Glu Pro Val
```

```
    1025                1030                1035

Lys Met  Ala Ala Val Val Lys  Gln Phe Ile Lys Lys  Gln Ala Glu
    1040                1045                1050

Asp Tyr  Arg Arg Thr Arg Glu  Leu Pro Gly Ser Asp  Gly Phe Ile
    1055                1060                1065

Val Ser  Ser Phe Met Thr Pro  Gly Phe Asp Val Lys  Thr Gly Glu
    1070                1075                1080

Val Phe  Arg Asp Ala Trp Asp  Ala Gly Ala Glu Ile  Asp Arg Ile
    1085                1090                1095

Arg Arg  Cys Phe Asp Tyr Lys  Asp Cys Phe Ile Ser  Arg Met Pro
    1100                1105                1110

Glu Glu  Thr His Gly Ala Phe  Trp Asp Ala Thr Ile  Tyr Ser Pro
    1115                1120                1125

Arg Ala  Ala Gly Lys Thr Leu  Ser Leu Pro Leu Lys  Arg Gly Leu
    1130                1135                1140

Asp Pro  Arg Lys Tyr Gly Ser  Tyr Ser Arg Glu Gln  Phe Ala Tyr
    1145                1150                1155

Phe Phe  Val Tyr Glu Ala Val  Lys Pro Lys Lys Lys  Gln Arg Val
    1160                1165                1170

Leu Glu  Phe Ala Pro Val Pro  Val Arg Val Ala Ser  Ala Leu Ala
    1175                1180                1185

Asn Asp  Pro Asp Ala Leu Glu  Asp Tyr Ala Arg Glu  Leu Ala Glu
    1190                1195                1200

Ala Glu  Gly Leu Val Phe Glu  Arg Ile Arg Arg Arg  Lys Val Tyr
    1205                1210                1215
```

```
Lys Tyr  Gln Gln Ile Ile Val  Gly Asp Ser Arg Leu  Tyr Val Thr
    1220                1225                1230

Gly Arg  Glu Glu Val Arg Asn  Ala Arg Gln Leu Ala  Phe Ser Gln
    1235                1240                1245

Asp Glu  Thr Lys Leu Ile Cys  Arg Ile Glu Gln Gly  Glu Glu Cys
    1250                1255                1260

Glu Glu  Gly Glu Leu Leu Asp  Leu Phe Arg Ser Met  Gln Arg Lys
    1265                1270                1275

Tyr Leu  Ala Cys Ala Pro Arg  Leu Ala Arg Leu Met  Lys Val Ala
    1280                1285                1290

Glu Met  Glu Glu Gly Phe Ile  Ala Ala Thr Ala Ser  Gly Lys Arg
    1295                1300                1305

Glu Val  Leu Leu Ser Leu Thr  Ser Ile Ala Ala Ala  His Arg Asn
    1310                1315                1320

Ser Ile  Asp Leu Lys Pro Ile  Gly Arg Lys Gly Ser  Ser Gly Gln
    1325                1330                1335

Met Lys  Ile Thr Phe Ser Lys  Glu Leu Ser Thr Asn  Gly Ile Leu
    1340                1345                1350

Phe Val  Asp Ser Ser Val Thr  Gly Met Phe Glu Arg  Arg Cys Arg
    1355                1360                1365

Leu Gly  Leu
    1370
```

<210> 152
<211> 1388
<212> PRT
<213> Zunongwangia profunda

<400> 152

```
Met Lys Arg Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                  10                  15

Ala Leu Val Asn Glu Ala Glu Asn Glu Lys Glu Ile Ser Lys Ile Ile
            20                  25                  30

Lys Leu Gly Val Arg Val Asn Pro Leu Thr Ile Asp Glu Lys Thr Asn
        35                  40                  45

Phe Glu Lys Gly Arg Pro Leu Ser Thr Asn Ala Asp Arg Thr Leu Lys
    50                  55                  60

Arg Gly Ala Arg Arg Asn Leu Gln Arg Tyr Lys Leu Arg Arg Glu Asn
65                  70                  75                  80

Leu Ile Glu Ile Leu Ile Asp Asn His Ile Ile Thr Lys Glu Thr Pro
                85                  90                  95

Leu Thr Glu Ile Gly Lys Gly Thr Thr Tyr Gln Thr Leu Ser Leu Arg
            100                 105                 110

Ala Lys Ala Val Arg Glu Arg Ile Asp Leu Glu Asp Phe Ala Lys Val
        115                 120                 125

Leu Leu Ala Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Ala
    130                 135                 140

Ser Asn Asp Glu Glu Gly Gln Ala Ile Asp Gly Met Ala Ile Ala Lys
145                 150                 155                 160

Glu Leu Tyr Glu Arg Gly Ile Thr Pro Gly Gln Tyr Val Leu Glu Leu
                165                 170                 175

Leu Glu Asn Asp Arg Lys Tyr Ile Pro Asp Phe Tyr Arg Ser Asp Leu
            180                 185                 190
```

```
Lys Gln Glu Phe Asn Lys Ile Trp Asn Asn Gln Lys Thr Phe Tyr Pro
        195                 200                 205

Glu Ile Leu Thr Asp Glu Leu Phe Lys Glu Leu Asp Gly Lys Asn Lys
    210                 215                 220

Ser Gln Thr Trp Ala Ile Cys Gln Lys Pro Phe Asn Ile Lys Gly Ile
225                 230                 235                 240

Lys Arg Ile Thr Lys Gly Arg Glu Lys Thr Ile Glu Asn Tyr His Trp
                245                 250                 255

Arg Val Lys Gly Leu Ser Gly Lys Leu Asn Leu Glu Lys Leu Ala Ile
            260                 265                 270

Ile Leu Gln Glu Ile Asn Asn Asp Ile Asn Gln Ser Ser Gly Tyr Leu
        275                 280                 285

Gly Gly Ile Ser Asp Lys Ser Lys Lys Leu Tyr Leu Asn Lys Glu Thr
    290                 295                 300

Val Gly Glu Phe Leu Tyr Lys Gln Ile Ala Lys Asn Pro His Thr Ser
305                 310                 315                 320

Leu Lys Asn Gln Val Phe Tyr Arg His Asp Tyr Leu Asp Glu Phe Glu
                325                 330                 335

Gln Ile Trp Lys Thr Gln Ser Asn Phe Asn Ala Asn Leu Thr Asp Glu
            340                 345                 350

Leu Lys Gln Glu Ile Arg Asp Val Ile Ile Phe Tyr Gln Arg Lys Ile
        355                 360                 365

Lys Ser Gln Lys Ser Leu Ile Ser Phe Cys Gln Phe Glu Ser Trp Glu
    370                 375                 380

Gln Glu Tyr Phe Asp Lys Glu Thr Gly Lys Thr Lys Thr Arg Thr Val
385                 390                 395                 400
```

```
Gly Arg Arg Val Ile Pro Lys Ser Ser Pro Leu Phe Gln Glu Phe Lys
               405                 410                 415

Ile Trp Gln Asn Leu Asn His Leu Val Phe Thr Asn Ser Glu Thr Asp
            420                 425                 430

Glu Lys Ile Glu Ile Lys Glu Val Glu Gln Glu Ile Arg Lys Glu Leu
        435                 440                 445

Phe Glu Glu Leu Asn Leu Arg Gly Asp Leu Asn Pro Asn Asp Leu Leu
    450                 455                 460

Lys Ile Leu Arg Ser Gln Phe Lys Ile Gly Lys Leu Ser Asn Trp Lys
465                 470                 475                 480

Cys Asn Phe Glu Lys Ile Glu Gly Asn Arg Thr Asn Ala Ala Leu Phe
               485                 490                 495

Asn Ile Tyr Gln Lys Ile Ser Asp Phe Glu Gly Tyr Gly Ile Asp Trp
            500                 505                 510

Asn Lys Ser Asn Ala Lys Lys Ile Arg Lys Glu Leu Lys Ala Thr Phe
        515                 520                 525

Pro Glu Ile Gly Ile Asp Ala Ser Ile Leu Glu Phe Asp Ala Tyr Lys
    530                 535                 540

Lys Gln Leu Thr Asn Gln Ser Ser Tyr Glu Leu Trp His Leu Leu Tyr
545                 550                 555                 560

Ser Ala Glu Glu Asp Phe Lys Ile Ser Glu Gln Asp Lys Leu Ile Tyr
               565                 570                 575

Gly Asn Ser Ser Val Ser Leu Lys Lys Lys Leu His Leu Lys Phe Gly
            580                 585                 590
```

```
Phe Asn Pro Glu Tyr Ala Lys Met Leu Ala Asn Leu Ser Leu Met Ser
        595                 600                 605

Asp Tyr Gly Asn Leu Ser Ala Lys Ala Ile Lys Lys Ile Leu Pro Tyr
    610                 615                 620

Leu Glu Asp Gly His Leu Tyr Ser Glu Ala Cys Arg Leu Ala Gly Tyr
625                 630                 635                 640

Asn His Ser Lys Ser Leu Thr Ala Glu Glu Leu Glu Lys Phe Glu Pro
                645                 650                 655

Lys Ala Lys Leu Asp Leu Leu Lys Lys Asn Ser Leu Arg Asn Pro Val
            660                 665                 670

Val Glu Lys Ile Leu Asn Gln Met Val Asn Val Val Asn Gln Val Ile
        675                 680                 685

Asp Thr Tyr Gly Lys Pro Asp Gly Val Arg Ile Glu Leu Ala Arg Glu
    690                 695                 700

Leu Lys Lys Ser Ala Lys Glu Arg Ala Glu Met Thr Lys Gly Ile Ala
705                 710                 715                 720

Asp Gly Thr Arg Arg Asn Glu Glu Ile Lys Lys Ile Ile Thr Gln Lys
                725                 730                 735

Phe Gly Ile Pro Asn Pro Thr Lys Ser Asp Leu Val Arg Tyr Arg Leu
            740                 745                 750

Trp Gln Glu Leu Glu Ser Arg Gly Tyr Lys Asp Ile Phe Thr Asp Lys
        755                 760                 765

Tyr Ile Ser Pro Asp Lys Ile Phe Ser Ser Glu Ile Asp Ile Glu His
    770                 775                 780

Ile Ile Pro Lys Ala Leu Leu Phe Asp Asp Ser Phe Ser Asn Lys Thr
785                 790                 795                 800
```

```
Leu Ser Phe Arg Asn Val Asn Leu Lys Lys Ala Asn Arg Thr Ala Leu
                805                 810                 815

Asp Phe Ile Thr Gln Asp Tyr Gln Ser Asn Val Glu Ala Tyr Lys Glu
            820                 825                 830

Arg Val Glu Thr Trp Asn Lys Asp Asn His Ile Ser Lys Gly Lys Arg
        835                 840                 845

Asn Lys Leu Leu Met Ser Leu Lys Asp Ile Pro Asp Gly Phe Ile Glu
    850                 855                 860

Arg Asp Leu Arg Asn Ser Gln Tyr Ile Ala Arg Lys Ala Lys Arg Met
865                 870                 875                 880

Leu Tyr Glu Val Phe Pro Asn Glu Val Leu Ala Thr Ser Gly Ser Ile
                885                 890                 895

Thr Asp Lys Leu Arg Ser Asp Trp Asp Leu Ile Asn Val Met Lys Glu
            900                 905                 910

Leu Asn Leu Pro Lys Tyr Lys Ala Leu Gly Leu Thr Glu Tyr Glu Glu
        915                 920                 925

Arg Leu Asp Lys Gly Thr Glu Glu Leu Phe Lys His Glu Val Ile Lys
    930                 935                 940

Asp Trp Thr Lys Arg Asn Asp His Arg His His Ala Met Asp Ala Leu
945                 950                 955                 960

Ala Val Ala Phe Thr Thr His Asn His Ile Gln Tyr Ile Asn Asn Leu
                965                 970                 975

Asn Ala Arg Lys Asp Ile Thr Gln Asp Asn His Pro Ile Ile Lys Asn
            980                 985                 990
```

```
Ile Glu Asn Leu Ile Thr Glu Val  Asn Ser Lys Gly Lys  Arg Val Phe
        995                 1000                1005


Lys Ala  Pro Met Ser Ser Phe  Arg Glu Ser Ala Lys  Glu Gln Ile
    1010                1015                1020


Glu Ala  Ile Leu Val Ser Phe  Lys Asn Lys Asn Lys  Val Val Thr
    1025                1030                1035


Lys Asn  Ile Asn Gln Thr Lys  Lys Glu Gly Gly Phe  Asn Tyr Gln
    1040                1045                1050


Asn Ala  Lys Thr Pro Arg Gly  Gln Leu His Lys Glu  Thr Ile Tyr
    1055                1060                1065


Gly Lys  Ser Lys Gln Pro Leu  Glu Lys Pro Val Lys  Ile Asn Asn
    1070                1075                1080


Arg Phe  Cys Lys Lys Gln Val  Gly Leu Ile Ile Asn  Phe Lys Glu
    1085                1090                1095


Gln Glu  Ala Val Leu His His  Leu Lys Lys Tyr Asp  Asn Asn Glu
    1100                1105                1110


Lys Ile  Ala Phe Ser Asn Lys  Thr Leu Lys Ser Asp  Pro Ile Gln
    1115                1120                1125


Val Asn  Gly Ser Pro Leu Arg  Glu Val Lys Ile Phe  Glu Glu Ile
    1130                1135                1140


Phe Thr  Ile Arg Lys Asp Ile  Asn Pro Asp Asn Phe  Lys Thr Gln
    1145                1150                1155


Lys His  Leu Asp Lys Ile Ile  Asp Lys Gly Ile Lys  Glu Val Met
    1160                1165                1170


Lys Lys  Arg Leu Glu Glu Tyr  Asn Gly Asp Phe Lys  Thr Ala Phe
    1175                1180                1185
```

```
Ser Asp  Leu Asp Lys Asn Pro  Ile Trp Leu Asn Gln  Ser Lys Gly
    1190                1195                1200

Ile Thr  Ile Lys Arg Ala Thr  Ile Ser Gly Val Thr  Asn Ala Glu
    1205                1210                1215

Pro Leu  His Gln Ala Lys Asp  His Leu Gly Asn Ile  Ile Leu Asp
    1220                1225                1230

Asp Asn  Gly Lys Glu Ile Pro  Ile Asp Tyr Val Ser  Thr Gly Asn
    1235                1240                1245

Asn His  His Val Ala Ile Tyr  Gln Asp Glu Ser Gly  Asn Leu Gln
    1250                1255                1260

Glu Glu  Val Val Ser Phe Tyr  Glu Ala Val Ile Arg  Lys Asn Gln
    1265                1270                1275

Asp Gln  Pro Ile Ile Lys Lys  Arg His Pro Lys Gly  Trp Lys Phe
    1280                1285                1290

Leu Phe  Thr Met Lys Gln Asn  Glu Met Phe Val Phe  Ser Ser Glu
    1295                1300                1305

Asn Phe  Asn Pro Ser Glu Ile  Asp Leu Leu Asp Glu  Lys Asn Ala
    1310                1315                1320

Ala Ile  Ile Ser Pro Asn Leu  Phe Arg Val Gln Lys  Ile Ala Thr
    1325                1330                1335

Lys Asn  Tyr Met Phe Arg His  His Leu Glu Thr Glu  Val Thr Asn
    1340                1345                1350

Asn Leu  Asp Phe Thr Tyr Arg  His Phe Gln Ala Thr  Glu Trp Leu
    1355                1360                1365
```

```
Arg Asn  Leu Cys Lys Val Arg  Ile Asp His Ile Gly  Arg Ile Val
    1370                1375                1380


Gln Ile  Gly Glu Tyr
    1385
```

<210> 153
<211> 1082
<212> PRT
<213> Methylosinus trichosporium

<400> 153

```
Met Arg Val Leu Gly Leu Asp Ala Gly Ile Ala Ser Leu Gly Trp Ala
1               5                   10                  15


Leu Ile Glu Ile Glu Glu Ser Asn Arg Gly Glu Leu Ser Gln Gly Thr
            20                  25                  30


Ile Ile Gly Ala Gly Thr Trp Met Phe Asp Ala Pro Glu Glu Lys Thr
        35                  40                  45


Gln Ala Gly Ala Lys Leu Lys Ser Glu Gln Arg Arg Thr Phe Arg Gly
    50                  55                  60


Gln Arg Arg Val Val Arg Arg Arg Arg Gln Arg Met Asn Glu Val Arg
65                  70                  75                  80


Arg Ile Leu His Ser His Gly Leu Leu Pro Ser Ser Asp Arg Asp Ala
                85                  90                  95


Leu Lys Gln Pro Gly Leu Asp Pro Trp Arg Ile Arg Ala Glu Ala Leu
            100                 105                 110


Asp Arg Leu Leu Gly Pro Val Glu Leu Ala Val Ala Leu Gly His Ile
        115                 120                 125


Ala Arg His Arg Gly Phe Lys Ser Asn Ser Lys Gly Ala Lys Thr Asn
    130                 135                 140
```

```
Asp Pro Ala Asp Asp Thr Ser Lys Met Lys Arg Ala Val Asn Glu Thr
145                 150                 155                 160

Arg Glu Lys Leu Ala Arg Phe Gly Ser Ala Ala Lys Met Leu Val Glu
                165                 170                 175

Asp Glu Ser Phe Val Leu Arg Gln Thr Pro Thr Lys Asn Gly Ala Ser
            180                 185                 190

Glu Ile Val Arg Arg Phe Arg Asn Arg Glu Gly Asp Tyr Ser Arg Ser
        195                 200                 205

Leu Leu Arg Asp Asp Leu Ala Ala Glu Met Arg Ala Leu Phe Thr Ala
    210                 215                 220

Gln Ala Arg Phe Gln Ser Ala Ile Ala Thr Ala Asp Leu Gln Thr Ala
225                 230                 235                 240

Phe Thr Lys Ala Ala Phe Phe Gln Arg Pro Leu Gln Asp Ser Glu Lys
                245                 250                 255

Leu Val Gly Pro Cys Pro Phe Glu Val Asp Glu Lys Arg Ala Pro Lys
            260                 265                 270

Arg Gly Tyr Ser Phe Glu Leu Phe Arg Phe Leu Ser Arg Leu Asn His
        275                 280                 285

Val Thr Leu Arg Asp Gly Lys Gln Glu Arg Thr Leu Thr Arg Asp Glu
    290                 295                 300

Leu Ala Leu Ala Ala Ala Asp Phe Gly Ala Ala Ala Lys Val Ser Phe
305                 310                 315                 320

Thr Ala Leu Arg Lys Lys Leu Lys Leu Pro Glu Thr Thr Val Phe Val
                325                 330                 335

Gly Val Lys Ala Asp Glu Glu Ser Lys Leu Asp Val Val Ala Arg Ser
```

```
            340                 345                 350

Gly Lys Ala Ala Glu Gly Thr Ala Arg Leu Arg Ser Val Ile Val Asp
        355                 360                 365

Ala Leu Gly Glu Leu Ala Trp Gly Ala Leu Leu Cys Ser Pro Glu Lys
    370                 375                 380

Leu Asp Lys Ile Ala Glu Val Ile Ser Phe Arg Ser Asp Ile Gly Arg
385                 390                 395                 400

Ile Ser Glu Gly Leu Ala Gln Ala Gly Cys Asn Ala Pro Leu Val Asp
                405                 410                 415

Ala Leu Thr Ala Ala Ala Ser Asp Gly Arg Phe Asp Pro Phe Thr Gly
            420                 425                 430

Ala Gly His Ile Ser Ser Lys Ala Ala Arg Asn Ile Leu Ser Gly Leu
        435                 440                 445

Arg Gln Gly Met Thr Tyr Asp Lys Ala Cys Cys Ala Ala Asp Tyr Asp
    450                 455                 460

His Thr Ala Ser Arg Glu Arg Gly Ala Phe Asp Val Gly Gly His Gly
465                 470                 475                 480

Arg Glu Ala Leu Lys Arg Ile Leu Gln Glu Glu Arg Ile Ser Arg Glu
                485                 490                 495

Leu Val Gly Ser Pro Thr Ala Arg Lys Ala Leu Ile Glu Ser Ile Lys
            500                 505                 510

Gln Val Lys Ala Ile Val Glu Arg Tyr Gly Val Pro Asp Arg Ile His
        515                 520                 525

Val Glu Leu Ala Arg Asp Val Gly Lys Ser Ile Glu Glu Arg Glu Glu
    530                 535                 540
```

```
Ile Thr Arg Gly Ile Glu Lys Arg Asn Arg Gln Lys Asp Lys Leu Arg
545                 550                 555                 560


Gly Leu Phe Glu Lys Glu Val Gly Arg Pro Pro Gln Asp Gly Ala Arg
                565                 570                 575


Gly Lys Glu Glu Leu Leu Arg Phe Glu Leu Trp Ser Glu Gln Met Gly
            580                 585                 590


Arg Cys Leu Tyr Thr Asp Asp Tyr Ile Ser Pro Ser Gln Leu Val Ala
        595                 600                 605


Thr Asp Asp Ala Val Gln Val Asp His Ile Leu Pro Trp Ser Arg Phe
    610                 615                 620


Ala Asp Asp Ser Tyr Ala Asn Lys Thr Leu Cys Met Ala Lys Ala Asn
625                 630                 635                 640


Gln Asp Lys Lys Gly Arg Thr Pro Tyr Glu Trp Phe Lys Ala Glu Lys
                645                 650                 655


Thr Asp Thr Glu Trp Asp Ala Phe Ile Val Arg Val Glu Ala Leu Ala
            660                 665                 670


Asp Met Lys Gly Phe Lys Lys Arg Asn Tyr Lys Leu Arg Asn Ala Glu
        675                 680                 685


Glu Ala Ala Ala Lys Phe Arg Asn Arg Asn Leu Asn Asp Thr Arg Trp
    690                 695                 700


Ala Cys Arg Leu Leu Ala Glu Ala Leu Lys Gln Leu Tyr Pro Lys Gly
705                 710                 715                 720


Glu Lys Asp Lys Asp Gly Lys Glu Arg Arg Arg Val Phe Ser Arg Pro
                725                 730                 735


Gly Ala Leu Thr Asp Arg Leu Arg Arg Ala Trp Gly Leu Gln Trp Met
```

```
            740                 745                 750

Lys Lys Ser Thr Lys Gly Asp Arg Ile Pro Asp Asp Arg His His Ala
        755                 760                 765

Leu Asp Ala Ile Val Ile Ala Ala Thr Thr Glu Ser Leu Leu Gln Arg
    770                 775                 780

Ala Thr Arg Glu Val Gln Glu Ile Glu Asp Lys Gly Leu His Tyr Asp
785                 790                 795                 800

Leu Val Lys Asn Val Thr Pro Pro Trp Pro Gly Phe Arg Glu Gln Ala
                805                 810                 815

Val Glu Ala Val Glu Lys Val Phe Val Ala Arg Ala Glu Arg Arg Arg
            820                 825                 830

Ala Arg Gly Lys Ala His Asp Ala Thr Ile Arg His Ile Ala Val Arg
        835                 840                 845

Glu Gly Glu Gln Arg Val Tyr Glu Arg Arg Lys Val Ala Glu Leu Lys
    850                 855                 860

Leu Ala Asp Leu Asp Arg Val Lys Asp Ala Glu Arg Asn Ala Arg Leu
865                 870                 875                 880

Ile Glu Lys Leu Arg Asn Trp Ile Glu Ala Gly Ser Pro Lys Asp Asp
                885                 890                 895

Pro Pro Leu Ser Pro Lys Gly Asp Pro Ile Phe Lys Val Arg Leu Val
            900                 905                 910

Thr Lys Ser Lys Val Asn Ile Ala Leu Asp Thr Gly Asn Pro Lys Arg
        915                 920                 925

Pro Gly Thr Val Asp Arg Gly Glu Met Ala Arg Val Asp Val Phe Arg
    930                 935                 940
```

```
Lys Ala Ser Lys Lys Gly Lys Tyr Glu Tyr Tyr Leu Val Pro Ile Tyr
945                 950                 955                 960


Pro His Asp Ile Ala Thr Met Lys Thr Pro Pro Ile Arg Ala Val Gln
                965                 970                 975


Ala Tyr Lys Pro Glu Asp Glu Trp Pro Glu Met Asp Ser Ser Tyr Glu
            980                 985                 990


Phe Cys Trp Ser Leu Val Pro Met  Thr Tyr Leu Gln Val  Ile Ser Ser
        995                 1000                1005


Lys Gly  Glu Ile Phe Glu Gly  Tyr Tyr Arg Gly Met  Asn Arg Ser
    1010                1015                1020


Val Gly  Ala Ile Gln Leu Ser  Ala His Ser Asn Ser  Ser Asp Val
    1025                1030                1035


Val Gln  Gly Ile Gly Ala Arg  Thr Leu Thr Glu Phe  Lys Lys Phe
    1040                1045                1050


Asn Val  Asp Arg Phe Gly Arg  Lys His Glu Val Glu  Arg Glu Leu
    1055                1060                1065


Arg Thr  Trp Arg Gly Glu Thr  Trp Arg Gly Lys Ala  Tyr Ile
    1070                1075                1080


<210>  154
<211>  1186
<212>  PRT
<213>  Gardnerella vaginalis

<400>  154

Met Glu Gly Asn Ile Ser Tyr Ala Ile Gly Ile Asp Val Gly Leu Asn
1               5                   10                  15


Ser Val Gly Leu Ala Ala Ile Arg Leu Asp Asn Asn Gly Glu Pro Ile
            20                  25                  30
```

```
Arg Ile Leu Lys Ala Met Ser Val Ile His Asp Ala Gly Ile Asp Pro
        35                  40                  45

Asn Gly Ala Lys Glu Ser Asp Thr Arg Lys Ala Ile Ser Gly Val Ala
    50                  55                  60

Arg Arg Val Arg Arg Leu Tyr Arg Gln Arg Arg Arg Arg Leu Gln Lys
65                  70                  75                  80

Leu Asp Phe Leu Leu His Ser Leu Gly Phe Pro Val Val Glu Asn Lys
                85                  90                  95

Asp Leu Asp Phe Ser Asp Ser Phe Thr Pro Trp Ile Phe Arg Ala Lys
            100                 105                 110

Leu Ala Asp Glu Tyr Ile Ala Asp Glu Lys Gln Arg Lys Gln Met Leu
        115                 120                 125

Ser Val Ala Ile Arg His Ile Ala Arg His Arg Gly Trp Arg Asn Pro
    130                 135                 140

Tyr Gln Ser Ile Lys Ser Met Thr Gln Glu Thr Glu Tyr Ser Glu Phe
145                 150                 155                 160

Tyr Asn Glu Leu Leu Lys Asn Ile Glu Lys Phe Ala Pro Gly Val Ser
                165                 170                 175

Cys Glu Gly Ser Thr Pro Ala Gln Leu Val Arg Asp Tyr Leu Leu Ser
            180                 185                 190

Gln Gln Gly Lys Ala Ser Arg Arg Leu Arg Ile Thr Thr Asp Asp Arg
        195                 200                 205

Arg Lys Asn His Pro Asn Ser Leu Asp Pro Val Leu Pro Arg Lys Leu
    210                 215                 220
```

```
Met Gln Ser Asp Asn Met Leu Glu Ile Leu Asn Ile Phe Asn Val Gln
225                 230                 235                 240

His Ile Asp Asn Lys Tyr Val Arg Glu Gln Ile Ile Asn Ala Val Phe
                245                 250                 255

Tyr Ala Lys Ser Pro Arg Gly Ser Ala Glu Asn Arg Val Gly Lys Asp
            260                 265                 270

Ala Ile Thr Gly Lys Gly Lys Arg Ala Leu Lys Ala Ser Leu Ala Phe
        275                 280                 285

Gln Lys Tyr Arg Ile Ile Ser Thr Ile Ser Asn Leu Arg Ile Arg Glu
    290                 295                 300

Asn Ser Lys Glu Arg Cys Leu Thr Ile Glu Glu Lys Gln Ser Val Tyr
305                 310                 315                 320

Lys Leu Leu Thr Thr Ser Thr Asp Glu Tyr Ser Lys Glu Lys Ser Ala
                325                 330                 335

Glu Ala Pro Leu Tyr Thr Trp Ile Asp Val Ala Asp Cys Leu Gly Ile
            340                 345                 350

Glu Arg Tyr Lys Leu Arg Gly Val Gly Ser Gln Ile Glu Asp Gly Glu
        355                 360                 365

Ser Val Gly Asn Arg Pro Pro Met Leu Asn Ser Glu Leu Ala Ile Leu
    370                 375                 380

Tyr Ala Asn Ala Lys Ser Leu Lys Gln Ser Leu Ile Thr Trp Trp Leu
385                 390                 395                 400

Ala Ala Asn Arg Thr Gln Glu Asp Lys Glu Ala Phe Ile Glu Ile Leu
                405                 410                 415

Ser Asn Thr Val Asp Ile Glu Ala Ile His Asp Asn Pro Glu Tyr Gln
            420                 425                 430
```

```
Asp Lys Tyr Gly Ser Val Ile Ala Phe Ile Asp Ser Met Asp Glu Thr
        435                 440                 445

Glu Ile Ala Ala Leu Glu Asn Ile Ser Leu Pro Asn Gly Arg Ala Ala
    450                 455                 460

Tyr Ser Leu Glu Thr Leu Asp Lys Leu Asn Lys Gln Met Leu Glu Thr
465                 470                 475                 480

Asp Asp Asp Leu Phe Glu Ala Arg Lys Lys Leu Phe Asn Leu Pro Asn
                485                 490                 495

Asn Trp Arg Pro Ser Glu Ala Pro Ile Ala Glu Pro Thr Gly Asn Pro
            500                 505                 510

Ser Val Asp Arg Val Leu Lys Ile Val His Arg Phe Leu Ile Ser Ala
        515                 520                 525

Lys Asn Arg Trp Gly Asn Pro Glu Arg Ile Asn Ile Glu His Val Arg
    530                 535                 540

Ser Gly Phe Gln Ser Lys Lys Met Ala Asn Ser Tyr Lys Lys Leu Leu
545                 550                 555                 560

Asp Lys Arg Thr Glu Gly Lys Glu Asn Leu Lys Ala Met Met Arg Asn
                565                 570                 575

Ser Leu His Leu Gly Thr Ser Asp Ser Ile Ser Asp Ala Asp Ile Arg
            580                 585                 590

Arg Tyr Glu Ala Val Gln Arg Gln Asn Gly Gln Cys Leu Tyr Cys Gly
        595                 600                 605

Ser Glu Ile Thr Tyr His Thr Cys Glu Leu Asp His Ile Val Pro Arg
    610                 615                 620
```

```
Lys Gly Pro Gly Ser Thr Asn Thr Arg Glu Asn Leu Val Ala Thr Cys
625                 630                 635                 640


Ser Ser Cys Asn Ala Gln Lys Cys Asn Thr Pro Phe Ala Thr Trp Cys
                645                 650                 655


Glu Glu Ser Thr Tyr Cys Lys Asn His Asp Ile Ser Val Asp Ser Ala
            660                 665                 670


Ile Asn Arg Val Arg Ala Phe Ile Phe Pro Pro Asn Ser Tyr Asp Lys
        675                 680                 685


Arg Gly Ala Ser Gln Phe Lys Lys Glu Val Ile Ala Arg Leu Lys Gln
    690                 695                 700


Lys Val Gly Asp Glu Ala Phe Asp Asn Arg Ser Ile Glu Ser Val Ala
705                 710                 715                 720


Trp Met Ala Asn Glu Leu His Arg Arg Ile Asp Trp Tyr Tyr Asn Ser
                725                 730                 735


Gln Asn Tyr Gln Thr Asn Asn Gly Ile Ser Asp Ile Thr Asn Lys Ala
            740                 745                 750


Gln Thr Asn Val Gly Val Tyr Ala Gly Ser Leu Thr Ala Ile Ala Arg
        755                 760                 765


Arg Met Ser Gly Ile Asp Gly Lys Leu Glu Phe Phe Asp Gly Arg Arg
    770                 775                 780


Lys Thr Arg Phe Asp Arg Arg His His Ala Val Asp Ala Ser Val Ile
785                 790                 795                 800


Ala Met Met Thr Pro Gly Ile Ala Gln Ile Leu Ala Ile Lys Cys Asn
                805                 810                 815


Leu Arg Glu Thr Gln Leu Leu Gln Gly Asn Lys Val Val Pro Gly Gly
            820                 825                 830
```

```
Ile Asp Trp Lys Glu Tyr Pro Thr Ala Asn Asp Gln Gly Tyr Gln Gln
        835                 840                 845

Tyr Ala Asn Trp Ser Val Arg Met Asn Ala Leu Leu Glu Leu Leu Asn
    850                 855                 860

Glu Glu Met Arg Ala Asp Arg Ile Ala Val Val Asn Ser Ile Arg Leu
865                 870                 875                 880

Arg Tyr Ser Asn Ser Ser Val His Lys Asp Asp Val His Ala Leu Leu
                885                 890                 895

Lys Leu His Val Gly Asp Glu Ile Asp Ser Glu Thr Ile Arg Arg Ala
            900                 905                 910

Ser Thr Pro Ala Leu Tyr Cys Ala Leu Thr Arg Asn Pro Asp Tyr Asp
        915                 920                 925

Val Asn Asn Gly Leu Pro Glu Asn Thr Asp Arg Thr Ile Leu Leu His
    930                 935                 940

Asp Lys Lys Leu Asn Ala Asp Asp Ser Ile Thr Phe Phe Lys Ser Lys
945                 950                 955                 960

Ala Ala Gln Leu Phe Val Arg Glu Gly Ser Val Glu Ile Gly Asn Ser
                965                 970                 975

Ile His His Leu Arg Ile Tyr Glu Tyr Phe Glu Lys Leu Lys Ser Gly
            980                 985                 990

Lys Val Lys Lys Ser Tyr Gly Met  Ile Arg Val Phe Gln  Asp Asp Leu
        995                 1000                1005

His Arg  Tyr Ile His Glu Asp  Leu Phe Ser Cys Asp  Leu Pro Glu
    1010                1015                1020
```

```
Gln Ser  Ile Ser Met Arg Tyr  Ala Asp Thr Lys Val  Ala His Ala
    1025                1030                1035

Val Gln  Thr Gly Asn Ala Asn  Tyr Leu Gly Tyr Leu  Val Pro Gly
    1040                1045                1050

Asp Glu  Ile Ile Val Asp Phe  Ser His Val Lys Leu  Ser Gly Tyr
    1055                1060                1065

Ile Gly  Glu Phe Val Glu Phe  Leu Asn Lys Ile Gly  Ala Asn Cys
    1070                1075                1080

Ala Ala  Tyr Lys His Trp Val  Val Ala Gly Thr Asp  Asp Lys Thr
    1085                1090                1095

Thr Leu  Ile Leu Lys Pro Ser  Met Ile Ser Ser Glu  Gly Ile Asp
    1100                1105                1110

Lys Leu  Tyr Ser Asn Cys Glu  Arg Asn Asn Phe Asp  Tyr Ala Ser
    1115                1120                1125

Tyr Glu  Lys Ser Ile Asp Lys  Ile Leu Val Asp Lys  Gly Trp Arg
    1130                1135                1140

Val Ser  Val Asn Val Leu Asp  Gln Tyr Lys Ala Ala  Thr Ile Arg
    1145                1150                1155

Arg Asn  Ala Leu Gly Glu Pro  Arg Trp Ala Ser Arg  Ser His Leu
    1160                1165                1170

Pro Ile  Ser Trp Ser Trp Asp  Thr Gly Glu Asn Arg  Glu
    1175                1180                1185
```

<210> 155
<211> 1434
<212> PRT
<213> Bacteroidetes oral

<400> 155

```
Met Lys Asn Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                  10                  15

Ala Tyr Val Lys Gln Ala Gln Asn Asp Ser Glu Lys Ser Glu Ile Ala
            20                  25                  30

Glu Leu Gly Val Arg Val Asn Pro Leu Thr Val Asp Glu Lys Thr Asn
        35                  40                  45

Phe Glu Lys Gly Lys Pro Ile Ser Thr Asn Ala Asp Arg Thr Leu Lys
    50                  55                  60

Arg Gly Ala Arg Arg Asn Leu Gln Arg Tyr Lys Leu Arg Arg Gln Glu
65                  70                  75                  80

Leu Ile Glu Leu Leu Lys Asp Tyr Gln Val Ile Ser Asp Lys Thr Ile
                85                  90                  95

Leu Ala Glu Asp Gly Lys Glu Thr Thr Phe Glu Thr Leu Arg Leu Arg
            100                 105                 110

Val Lys Ser Ala Lys Glu Gln Val Ser Leu Glu Glu Leu Ala Arg Ile
        115                 120                 125

Leu Leu Met Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Ala
    130                 135                 140

Lys Asn Glu Asp Glu Gly Gln Leu Ile Asp Gly Met Glu Ile Ala Arg
145                 150                 155                 160

Arg Leu Tyr Asp Glu Asn Leu Thr Thr Gly Gln Leu Ser Leu Gln Leu
                165                 170                 175

Leu Lys Glu Gly Lys Lys Ser Leu Pro Asp Tyr Tyr Arg Ser Asp Leu
            180                 185                 190

Gln His Glu Leu Asp Lys Val Trp Asn Phe Gln Lys Gln Phe His Pro
```

```
        195                 200                 205

Asp Ile Leu Thr Asp Glu Phe Tyr Thr Ser Ile Gln Gly Lys Gly Gln
    210                 215                 220

Lys Ala Thr Arg Glu Ser Phe Ser Ser Lys Tyr Gly Ile Asp Thr Ala
225                 230                 235                 240

Glu Asn Lys Gly Ser Arg Glu Glu Lys Lys Leu Gln Ala Tyr Gln Trp
                245                 250                 255

Arg Ala Asp Ala Thr His Lys Glu Leu Thr Lys Glu Glu Leu Ala Phe
            260                 265                 270

Val Ile Thr Glu Ile Asn Asn Asn Ile Asn Asn Ser Ser Gly Tyr Leu
        275                 280                 285

Gly Ala Ile Ser Asp Arg Ser Lys Glu Leu Ile Phe Ala Asn Glu Thr
    290                 295                 300

Val Gly Glu Tyr Leu Trp Lys Gln Ile Gln Asn Asp Pro His Thr Ser
305                 310                 315                 320

Leu Lys Asn Gln Val Phe Tyr Arg Gln Asp Tyr Phe Asp Glu Phe Glu
                325                 330                 335

Arg Ile Trp Glu Thr Gln Ser Gly Phe Tyr Pro Gln Ile Leu Thr Glu
            340                 345                 350

Ser Leu Lys Asn Glu Leu Arg Asp Ile Leu Ile Phe Tyr Gln Arg Lys
        355                 360                 365

Leu Lys Ser Gln Lys Ala Leu Val Ser Ile Cys Glu Phe Glu Ser Lys
    370                 375                 380

Glu Ile Pro Leu Lys Asp Lys Gln Gly Asn Pro Ile Ser Lys Asn Gly
385                 390                 395                 400
```

```
Ile Pro Val Thr Lys Leu Val Gly Pro Lys Val Ala Pro Lys Ser Ser
                405                 410                 415

Pro Leu Phe Gln Glu Phe Lys Ile Trp Gln Asn Leu Asn Asn Val Leu
            420                 425                 430

Val Arg Pro Lys Gly Ser Arg Lys Arg Lys Val Thr Thr Asn Gln Gln
        435                 440                 445

Ser Thr Leu Leu Glu Gly Gln Glu Pro Val Phe Glu Leu Asn Leu Glu
    450                 455                 460

Gln Lys Glu Leu Leu Phe Glu Glu Leu Asn Leu Lys Gly Asn Leu Lys
465                 470                 475                 480

Thr Asp Tyr Cys Leu Glu Leu Ile Gly Tyr Ser Ala Lys Glu Trp Glu
                485                 490                 495

Met Asn Tyr Pro Thr Leu Glu Gly Asn Lys Thr Asn Lys Ala Leu Tyr
            500                 505                 510

Glu Ala Tyr Leu Lys Ile Ile Asp Ser Glu Gly Tyr Asp Ala Lys Lys
        515                 520                 525

Leu Leu Lys Val Lys Thr Asp Lys Asp Asp Ile Asn Leu Asp Asp Ile
    530                 535                 540

Lys Val Ser Ala Ser Glu Ile Lys Thr Met Ile Ser Asp Ile Phe Asn
545                 550                 555                 560

Glu Leu Gly Ile Asn Thr Lys Ile Leu Asp Phe Asp Ala Glu Leu Glu
                565                 570                 575

Arg Lys Gln Phe Glu Ala Gln Ala Ser Tyr Arg Leu Trp His Leu Leu
            580                 585                 590

Tyr Ser Tyr Glu Gly Asp Asp Ser Lys Ser Gly Asn Glu Leu Leu Tyr
```

```
        595                 600                 605

Arg Leu Leu Glu Asp Lys Phe Gly Phe Lys Arg Glu His Ser Lys Thr
    610                 615                 620

Leu Ala Asn Val Ser Leu Leu Ser Asp Tyr Gly Asn Leu Ser Thr Lys
625                 630                 635                 640

Ala Ile Arg Thr Ile Tyr Pro Tyr Ile Lys Glu Asn Lys Phe Ser Thr
                645                 650                 655

Ala Cys Glu Leu Ala Gly Tyr Arg His Ser Lys Leu Ser Ile Ser Lys
            660                 665                 670

Glu Glu Asn Glu Asn Arg Thr Leu Lys Asp Thr Leu Asp Val Leu Lys
        675                 680                 685

Lys Asn Ser Leu Arg Gln Pro Val Val Glu Lys Ile Leu Asn Gln Met
    690                 695                 700

Ile Asn Leu Ile Asn Glu Leu Ile Glu Lys His Ser Glu Lys Asp Glu
705                 710                 715                 720

Lys Gly Asn Ile Val Lys Tyr Phe Lys Phe Asp Glu Ile His Ile Glu
                725                 730                 735

Leu Ala Arg Glu Leu Lys Lys Asn Ala Glu Glu Arg Arg Glu Leu Asp
            740                 745                 750

Ser Lys Val Arg Glu Gly Lys Asp Arg Asn Glu Lys Ile Ile Thr Ile
        755                 760                 765

Leu Lys Ser Glu Phe Gly Leu Pro Tyr Pro Thr Lys Asn Asp Ile Thr
    770                 775                 780

Arg Tyr Arg Leu Tyr Glu Glu Leu Lys Asp Asn Gly Tyr Lys Asp Leu
785                 790                 795                 800
```

```
Tyr Thr Asn Thr Tyr Ile Pro Arg Glu Lys Leu Phe Ser Lys Glu Ile
                805                 810                 815

Asp Ile Glu His Ile Ile Pro Lys Ser Arg Leu Phe Asn Asp Ser Phe
            820                 825                 830

Ser Asn Lys Thr Ile Cys Tyr Arg Gln Asp Asn Leu Asn Lys Gly Glu
        835                 840                 845

Arg Thr Ala Tyr Asp Tyr Ile Glu Gly Leu Gly Lys Thr Gln Leu Asp
    850                 855                 860

Glu Tyr Leu Asn Arg Val Glu Asn Leu Tyr Thr Asn Lys Phe Ile Thr
865                 870                 875                 880

Lys Ala Lys Tyr Arg Asn Leu Leu Lys Lys Glu Ser Glu Ile Gly Asp
                885                 890                 895

Gly Phe Ile Glu Arg Asp Leu Arg Glu Thr Gln Tyr Ile Ala Lys Lys
            900                 905                 910

Ala Lys Glu Met Leu Leu Gln Ile Thr Arg His Val Val Ser Thr Thr
        915                 920                 925

Gly Ser Ile Thr Asp Arg Leu Arg Asp Asp Trp Glu Leu Val Asn Val
    930                 935                 940

Met Arg Glu Leu Asn Leu Pro Lys Tyr Lys Val Leu Gly Leu Thr Glu
945                 950                 955                 960

Ile Gln Glu Arg Lys Asn Gly Gln Thr Val Glu Val Ile Thr Asp Trp
                965                 970                 975

Thr Lys Arg Asn Asp His Arg His His Ala Met Asp Ala Leu Thr Val
            980                 985                 990

Ala Phe Thr Lys His Ser His Ile  Gln Tyr Leu Asn Phe  Leu Asn Ala
```

```
        995                 1000                1005

Arg Lys  Asp Glu Lys His Lys  Glu Tyr Ser Asn Ile  Met Gly Ile
    1010                1015                1020

Gln Gln  Leu Glu Thr Glu Lys  Thr Thr Asp Lys Asp  Gly Lys Asp
    1025                1030                1035

Arg Arg  Val Phe Lys Thr Pro  Ile Pro Asn Phe Arg  Gln Val Ala
    1040                1045                1050

Lys Glu  His Leu Glu Ser Ile  Leu Ile Ser His Lys  Thr Lys Asn
    1055                1060                1065

Lys Val  Val Thr Arg Ala Thr  Asn Lys Ile Ala Gly  Ser Lys Lys
    1070                1075                1080

Gln Gln  Glu Thr Leu Ser Pro  Arg Gly Gln Leu His  Lys Glu Thr
    1085                1090                1095

Val Tyr  Gly Lys Tyr Arg Arg  Tyr Val Gln Lys Glu  Glu Lys Ile
    1100                1105                1110

Gly Ser  Lys Phe Asp Leu Gln  Thr Ile Glu Arg Val  Ala Asn Pro
    1115                1120                1125

Leu Tyr  Lys Arg Leu Leu Thr  Lys Arg Leu Glu Glu  Asn Gly Gly
    1130                1135                1140

Asp Pro  Lys Lys Ala Phe Thr  Gly Lys Asn Ala Leu  Ala Lys Ser
    1145                1150                1155

Pro Ile  Tyr Leu Asp Glu Thr  Gln Thr Gln Gln Leu  Pro Glu Lys
    1160                1165                1170

Val Lys  Leu Val Trp Leu Glu  Thr Asp Phe Ser Ile  Arg Lys Asp
    1175                1180                1185
```

```
Ile Thr  Pro Asp Asn Phe Lys  Asp Glu Lys Ser Ile  Asp Lys Val
    1190                1195                1200

Leu Asp  Glu Gly Ile Lys Arg  Ile Leu Lys Asp Arg  Leu Lys Ser
    1205                1210                1215

Phe Asp  Gly Asp Ala Lys Arg  Ala Phe Thr Asp Leu  Glu Gln Asn
    1220                1225                1230

Pro Ile  Trp Leu Asn Lys Glu  Lys Gly Ile Ala Ile  Lys Arg Val
    1235                1240                1245

Thr Ile  Ser Gly Val Ser Asn  Ala Glu Pro Leu His  Thr Lys Lys
    1250                1255                1260

Asp His  Leu Gly Asn Glu Ile  Phe Asp Asp Thr Gly  Lys Pro Ile
    1265                1270                1275

Pro Val  Asp Tyr Val Ser Thr  Gly Asn Asn His His  Ile Ala Ile
    1280                1285                1290

Tyr Arg  Asp Glu Asn Gly Asn  Leu Gln Glu Lys Ala  Val Ser Phe
    1295                1300                1305

Phe Glu  Ala Val Thr Arg Ala  Asn Gln Gly Leu Pro  Thr Val Asp
    1310                1315                1320

Lys Thr  Tyr Asn Gln His Leu  Gly Trp Gln Phe Leu  Phe Thr Met
    1325                1330                1335

Lys Gln  Asn Glu Met Phe Val  Phe Pro Asn Lys Glu  Thr Gly Phe
    1340                1345                1350

Asp Pro  Gln Glu Ile Asp Leu  Leu Asp Pro Lys Asn  Lys Lys Leu
    1355                1360                1365

Ile Ser  Pro Asn Leu Phe Arg  Val Gln Lys Ile Ser  Thr Lys Asn
```

```
    1370                1375                1380

Tyr Phe  Phe Arg His His Leu  Glu Thr Ser Val Glu  Thr His Asn
    1385                1390                1395

Ala Leu  Asn Gly Val Thr Tyr  Lys Ser Gln Leu Gly  Leu Asn Gly
    1400                1405                1410

Ile Thr  Asp Ile Ile Lys Val  Arg Ile Asn His Leu  Gly Asp Ile
    1415                1420                1425

Val His  Ile Gly Glu Tyr
    1430
```

<210> 156
<211> 1341
<212> PRT
<213> Peptoniphilus sp.

<400> 156

```
Met Trp Gly Ser Arg Leu Phe Glu Glu Ala Ser Thr Ala Gln Asp Arg
1               5                   10                  15

Arg Glu His Arg Ser Asn Arg Arg Arg Leu Glu Arg Arg Lys Tyr Arg
            20                  25                  30

Leu Asp Leu Leu Glu Glu Leu Phe Val Glu Glu Ile Asn Lys Ile Asp
        35                  40                  45

Pro Glu Phe Phe Ile Arg Leu Arg Glu Ser Lys Phe His Phe Glu Asp
    50                  55                  60

Arg Ser Leu Lys Asn Thr Phe Ile Leu Phe Asn Asp Lys Met Glu Gly
65                  70                  75                  80

Gly Tyr Asn Asp Lys Val Phe Phe Ser Lys Tyr Pro Thr Ile Tyr His
                85                  90                  95
```

```
Leu Arg Ser Ala Leu Ile Asn Gly Asn Lys Glu Asp Val Arg Ala Val
            100                 105                 110

Phe Leu Ala Ile His Asn Ile Leu Lys Asn Arg Gly His Phe Leu Leu
        115                 120                 125

Ala Gly Asn Asp Ile Asn Ile Ser Leu Ser Leu Asn Asp Thr Leu Thr
    130                 135                 140

Asp Leu Phe Glu Tyr Leu Lys Ile His Leu Gly Ile Glu Val Glu Phe
145                 150                 155                 160

Glu Asn Lys Leu Lys Asp Ile Glu Lys Ile Ala Leu Asp Lys Asn Leu
                165                 170                 175

Ser Lys Ser Asp Lys Gln Lys Lys Ile Val Gln Leu Leu Glu Thr Asp
            180                 185                 190

Tyr Lys Lys Gln Leu Ala Asp Val Phe Lys Leu Ser Leu Gly Leu Thr
        195                 200                 205

Ala Asn Met Glu Asn Ile Phe Gly Lys Glu Asn Glu Gln Gly Leu Glu
    210                 215                 220

Phe Ile Asn Ala Glu Asn Lys Ile Lys Lys Ile Gln Phe Asp Ser Ser
225                 230                 235                 240

Tyr Glu Glu Asn Ile Ala Glu Phe Asp Gln Phe Tyr Gly Glu Tyr Phe
                245                 250                 255

Glu Ile Ile Asp Ile Cys Lys Lys Ile Tyr Asp Ala Ile Ser Leu Ser
            260                 265                 270

Gln Ile Leu Val Asp Gly Lys Gly Leu Ser Glu Ser Lys Val Leu Ser
        275                 280                 285

Tyr Glu Lys His Lys Glu Asp Leu Lys Leu Leu Lys Lys Val Leu Lys
    290                 295                 300
```

```
Asn Ile Asp Lys Ala Tyr Asp Asn Lys Gly Glu Asp Arg Leu Val Tyr
305                 310                 315                 320

Lys Val Leu Lys Glu Asp Lys Asp Lys Gly Thr Asn Tyr Val Asn Tyr
                325                 330                 335

Ser Lys Leu Ser Asn Asn Gly Thr Ala Thr Thr Lys Glu Glu Phe Tyr
            340                 345                 350

Lys Phe Leu Ser Lys Asn Leu Asp Leu Lys Lys Phe Gly Lys Leu Asn
        355                 360                 365

Lys Glu Asp Ile Glu Thr Leu Asp Tyr Ile Asn Ser Glu Ile Leu Leu
    370                 375                 380

Gly Arg Phe Leu Pro Leu Gln Lys Glu Lys Ile Asn Gly Val Ile Pro
385                 390                 395                 400

Tyr Gln Leu Gln Met Lys Glu Leu Thr Gln Ile Leu Asn Asn Ala Ser
                405                 410                 415

Lys Tyr Leu Pro Phe Leu Asn Lys Ile Glu Asp Gly Met Thr Val Lys
            420                 425                 430

Asp Lys Ile Ile Ser Leu Ile Lys Phe Arg Ile Pro Tyr Tyr Val Gly
        435                 440                 445

Pro Leu Asn Glu Tyr Asn Arg Ile Glu Asn Gly Asn Gly Phe Ala Trp
    450                 455                 460

Ile Glu Lys Lys Lys Asn Glu Lys Ile Phe Pro Trp Asn Phe Asn Asp
465                 470                 475                 480

Val Val Asp Ile Glu Lys Ser Ala Glu Lys Phe Ile Asn Asn Leu Thr
                485                 490                 495
```

```
Asn Lys Cys Thr Tyr Ile Lys Glu Glu Thr Val Leu Pro Lys Asn Ser
            500                 505                 510

Ile Ile Tyr Ser Lys Phe Met Val Leu Asn Glu Leu Asn Asn Leu Gln
        515                 520                 525

Tyr Gly Asn Lys Lys Leu Asp Ile Glu Leu Lys Met Lys Met Tyr Thr
    530                 535                 540

Asp Leu Phe Leu Glu Lys Lys Asp Asn Arg Lys Val Thr Glu Lys Arg
545                 550                 555                 560

Ile Leu Glu Tyr Phe Arg Ile Asn Gly Ile Asn Asp Gly Lys Glu Lys
                565                 570                 575

Leu Thr Gly Leu Asn Asn Glu Ile His Ala Asp Met Lys Ser Tyr Arg
            580                 585                 590

Asp Met Cys Glu Ile Met Gly Glu Asn Phe Asn Ile Asn Val Ala Glu
        595                 600                 605

Asn Ile Ile Asn Trp Ile Thr Val Phe His Gly Glu Lys Lys Ile Leu
    610                 615                 620

Ile Asn Lys Ile Lys Asn Val Tyr Gly Lys Met Phe Asn Asp Glu Gln
625                 630                 635                 640

Ile Ser Lys Leu Ser Lys Leu Asn Tyr Ser Asp Trp Gly Arg Leu Ser
                645                 650                 655

Lys Lys Leu Leu Thr Asp Ile Lys Cys Tyr Ile Asp Ala Asp Gly Ile
            660                 665                 670

Asn Phe Pro Val Ser Ile Leu Glu Ala Met Glu Val Ser Asn Lys Asn
        675                 680                 685

Leu Met Glu Leu Leu Ser Asn Lys Tyr Glu Phe Ile Ser Cys Ile Asp
    690                 695                 700
```

```
Asp Ile Asn Asn Lys Tyr Phe Gly Asp Arg Asp Ile Ser Ala Ser Glu
705                 710                 715                 720

Leu Ile Asp Glu Leu Tyr Val Ser Pro Ala Val Lys Arg Gly Ile Trp
                725                 730                 735

Gln Ser Val Arg Ile Leu Glu Glu Ile Val Ser Ile Ile Gly His Asn
            740                 745                 750

Pro Lys Lys Ile Phe Ile Glu Met Thr Arg His Asn Glu Glu Lys Val
        755                 760                 765

Gln Lys Ser Ser Arg Arg His Asn Leu Glu Glu Leu Tyr Lys Ala Ile
    770                 775                 780

Arg Lys Asp Pro Glu Tyr Val Glu Leu Ile Lys Glu Phe Asp Ser Thr
785                 790                 795                 800

Thr Asp Thr Asp Ser Phe Lys Ile Lys Lys Leu Tyr Leu Tyr Phe Met
                805                 810                 815

Gln Leu Gly Lys Cys Ala Tyr Ser Lys Glu Lys Ile Asp Phe Asp Lys
            820                 825                 830

Leu Phe Thr Asp Ser Tyr Asp Ile Asp His Ile Tyr Pro Arg Ser Lys
        835                 840                 845

Thr Lys Asp Asp Ser Ile His Asn Asn Leu Val Leu Val Lys Ala Lys
    850                 855                 860

Tyr Asn Arg Glu Lys Thr Asp Val Tyr Pro Ile Asp Ile Asn Ile Gln
865                 870                 875                 880

Lys Asn Met Asn Ser Phe Trp Asn Phe Leu Tyr Thr Lys Lys Phe Ile
                885                 890                 895
```

```
Thr Glu Glu Lys Tyr Lys Arg Leu Ile Arg Thr Ser Asp Leu Thr Asp
            900                 905                 910

Glu Glu Leu Ala Lys Phe Ile Ser Arg Gln Leu Val Glu Thr Ser Gln
        915                 920                 925

Ser Thr Lys Ala Thr Ala Glu Val Leu Lys Gln Ile Tyr Gly Asp Ser
    930                 935                 940

Asp Ile Cys Tyr Val Lys Ala Glu Asn Val Ser Asp Phe Arg Tyr Gly
945                 950                 955                 960

Ser Ser Arg Gln Lys Asp Lys Asn Asp Ile Gln Lys Leu Phe Val Lys
                965                 970                 975

Cys Arg Glu Val Asn His Phe His His Ala Lys Asp Ala Tyr Leu Asn
            980                 985                 990

Ile Val Val Gly Asn Val Tyr Asp  Val Lys Phe Thr Lys  Asn Pro Val
        995                 1000                1005

Asn Phe  Ile Lys Lys Asn Lys  Met Gly Asn Lys Ser  Asn Tyr Ser
    1010                1015                1020

Leu Asn  His Met Phe Cys Phe  Asp Val Glu Arg Asn  Gly Tyr Lys
    1025                1030                1035

Ala Trp  Asp Ser Ser Glu Thr  Ile Lys Thr Val Gly  Arg Met Met
    1040                1045                1050

Lys Ser  Asn Asp Val Arg Ile  Thr Lys His Val His  Pro Thr Arg
    1055                1060                1065

Gly Glu  Leu Tyr Asp Ala Thr  Ile Tyr Lys Ala Lys  Ile Ala Lys
    1070                1075                1080

Thr Gly  Ser Tyr Met Pro Leu  Lys Ser Ser Lys Asn  Thr Pro Leu
    1085                1090                1095
```

```
Ser Asp  Val Thr Lys Tyr Gly  Gly Tyr Thr Lys Ile  Lys Ile Ala
    1100                1105                1110

Tyr Tyr  Ser Val Tyr Lys Tyr  Lys Phe Ser Asp Lys  Asn Leu Ile
    1115                1120                1125

Lys Thr  Glu Ile Arg Leu Ile  Pro Ile Pro Ile Tyr  Leu Ser Lys
    1130                1135                1140

Asn Asp  Asp Asp Ile Lys Glu  Tyr Val Lys Asn Tyr  Leu Asn Asp
    1145                1150                1155

Arg Val  Asn Ser Lys Leu Ile  Asp Phe Thr Lys Ile  Tyr Asp Lys
    1160                1165                1170

Leu Tyr  Val Asn Ser Leu Ile  Lys Ile Asn Gly Tyr  Leu Tyr Tyr
    1175                1180                1185

Leu Gly  Gly Lys Thr Asn Asp  Arg Val Trp Ile Asp  Asn Ala Val
    1190                1195                1200

Ser Ile  Val Leu Asp Asp Lys  Ile Glu Tyr Leu Ile  Lys Arg Ile
    1205                1210                1215

Ser Asn  Asp Ile Lys Tyr Gly  Tyr Glu Ile Asn Val  Ser Asp Asp
    1220                1225                1230

Glu Leu  Met Asp Ile Tyr Glu  Ser Leu Ala Glu Lys  Ala Asn Lys
    1235                1240                1245

Lys Ile  Phe Tyr Asn Arg Leu  Ser Asp Phe Glu Lys  Ile Phe Ser
    1250                1255                1260

Asn Met  Asp Val Lys Lys Lys  Phe Val Lys Leu Glu  Lys Asn Asp
    1265                1270                1275
```

Lys Cys Arg Val Leu Leu Gln Leu Leu Asn Val Leu Thr Asp Ser
    1280   1285   1290

Gln Thr Thr Tyr Lys Leu Glu Met Val Gly Leu Lys His Ser Arg
    1295   1300   1305

Ser Asn Ile Gly Met Lys Ile Ser Asn Leu Glu Glu Phe Lys Val
    1310   1315   1320

Ile Asn Ser Ser Ile Thr Gly Leu Tyr Ser Asn Glu Ile Asp Ile
    1325   1330   1335

Leu Asn Ile
    1340

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<212> PRT
<213> Lactobacillus gasseri

<400> 157

Met Thr Lys Ile Lys Asn Glu Tyr Ile Val Gly Leu Asp Val Gly Thr
1   5   10   15

Asn Ser Cys Gly Trp Val Ala Met Asp Phe Gln Asn Thr Ile Leu Arg
            20   25   30

Met His Gly Lys Thr Ala Ile Gly Ser His Leu Phe Asp Ala Gly Asn
        35   40   45

Ser Ala Ala Asp Arg Arg Ala Phe Arg Thr Thr Arg Arg Arg Ile Lys
    50   55   60

Arg Arg Lys Trp Arg Leu Lys Leu Leu Glu Glu Ile Phe Asp Pro Tyr
65   70   75   80

Met Thr Glu Val Asp Pro Tyr Phe Phe Ala Arg Leu Lys Glu Ser Gly
                85   90   95

```
Leu Ser Pro Leu Asp Lys Arg Lys Asn Val Ser Ser Ile Val Phe Pro
            100                 105                 110

Thr Ala Leu Glu Asp Lys Lys Phe Tyr Cys Asn Tyr Pro Thr Ile Tyr
        115                 120                 125

His Leu Arg Tyr Asp Leu Met Ser Glu Asp Lys Lys Phe Asp Leu Arg
    130                 135                 140

Glu Ile Tyr Leu Ala Ile His His Ile Val Lys Tyr Arg Gly Asn Phe
145                 150                 155                 160

Leu Tyr Asn Thr Pro Val Lys Asp Phe Glu Ala Ser Lys Ile Asp Val
                165                 170                 175

Lys Asp Ser Leu Glu Lys Leu Asn Glu Leu Tyr Glu Arg Leu Asp Ser
            180                 185                 190

Glu Phe Thr Val Glu Leu Asp Ser Ser Asn Ala Leu Glu Ile Glu Lys
        195                 200                 205

Ile Ile Arg Asp Lys Lys Val Phe Lys Ile Asn Lys Val Lys Ser Ile
    210                 215                 220

His Gln Leu Leu Ser Leu Lys Thr Glu Asn Lys Glu Arg Thr Lys Leu
225                 230                 235                 240

Ile Lys Asp Val Ser Lys Gln Ile Ile Asn Ala Ile Leu Gly Tyr Lys
                245                 250                 255

Thr Lys Phe Glu Thr Ile Leu Leu Lys Asn Ile Ser Lys Asp Glu Ala
            260                 265                 270

Asp Asp Trp Glu Phe Lys Leu Thr Asp Val Asp Ala Asp Asn Lys Phe
        275                 280                 285

Glu Asn Leu Ile Gly Asp Leu Asn Glu Asn Glu Gln Glu Ile Leu Leu
```

```
    290                 295                 300

Glu Ile Arg Asn Leu Ala Asn Ala Ile Thr Leu Ser Asn Ile Val Glu
305                 310                 315                 320

Glu Gly Lys Thr Leu Ser Glu Ser Met Ile Asp Lys Tyr Asn Lys His
                325                 330                 335

Ser Asp Asp Leu Glu Leu Leu Lys Gln Val Ile Ser Asp His Pro Asp
            340                 345                 350

Arg Asp Lys Ala Lys Lys Leu Ala Leu Ala Tyr Asp Leu Tyr Val Asn
        355                 360                 365

Asn Arg His Gly Lys Leu Leu Gln Ala Lys Asp Val Leu Gly Ser Lys
    370                 375                 380

Lys Thr Leu Ser Lys Glu Asp Phe Tyr Lys Glu Val Lys Lys Asn Leu
385                 390                 395                 400

Asp Asp Ser Lys Ala Ser Gln Glu Ile Leu Asp Thr Ile Ala Leu Asp
                405                 410                 415

Ser Phe Met Pro Lys Gln Arg Thr Asn Glu Asn Gly Val Ile Pro Tyr
            420                 425                 430

Gln Leu His Gln Leu Glu Leu Asp Arg Ile Ile Lys Asn Gln Gly Lys
        435                 440                 445

Tyr Tyr Pro Phe Leu Lys Glu Val Asn Pro Val Ser Ser His Leu Lys
    450                 455                 460

Glu Ala Pro Tyr Lys Leu Asp Glu Leu Ile Arg Phe Arg Val Pro Tyr
465                 470                 475                 480

Tyr Val Gly Pro Leu Ile Ser Pro Asn Glu Ser Thr Lys Asn Lys Gln
                485                 490                 495
```

```
Thr Lys Lys Asn Gln Asn Phe Ala Trp Met Ile Arg Lys Glu Gln Gly
            500                 505                 510

Gln Ile Thr Pro Trp Asn Phe Asp Gln Lys Val Asp Arg Met Ala Ser
        515                 520                 525

Ala Asn Lys Phe Ile Lys Arg Met Thr Thr Lys Asp Thr Tyr Leu Leu
    530                 535                 540

Gly Glu Asp Val Leu Pro Ala Asn Ser Leu Leu Tyr Gln Lys Phe Thr
545                 550                 555                 560

Val Leu Asn Glu Leu Asn Asn Ile Lys Ile Asn Gly Lys Arg Ile Ser
                565                 570                 575

Val Pro Leu Lys Glu Glu Leu Tyr Asn Asn Leu Phe Lys Lys Asn Ser
            580                 585                 590

Thr Val Thr Thr Asn Lys Leu Lys Ser Tyr Leu Lys Glu Asn Tyr Asn
        595                 600                 605

Leu Ile Asn Val Glu Ile Lys Gly Leu Ala Asp Glu Lys Lys Phe Asn
    610                 615                 620

Ser Gly Leu Thr Thr Tyr Asn Lys Leu Arg Asn Leu Lys Ile Phe Asp
625                 630                 635                 640

Gln Gln Leu Asp Asp Leu Asn Tyr Asp Lys Asp Phe Glu Arg Ile Ile
                645                 650                 655

Glu Trp Ser Thr Ile Phe Glu Asp Lys Ala Ile Tyr Lys Asp Lys Leu
            660                 665                 670

Lys Thr Ile Lys Trp Leu Ser Asp Arg Gln Ile Asp Lys Leu Ser Lys
        675                 680                 685

Ile Arg Met Gln Gly Trp Gly Gln Leu Ser Lys Lys Leu Leu Ser Gln
```

```
    690                 695                 700

Leu Thr Asp Asn Asn Gly Gln Thr Ile Ile Glu Gln Leu Trp Asp Ser
705                 710                 715                 720

Gln Asn Asn Phe Met Gln Ile Val Asn Gln Ser Asp Phe Lys Asp Ala
                725                 730                 735

Ile Ala Val Ala Asn Gln Asn Leu Leu Val Asn Thr Ser Val Glu Asp
            740                 745                 750

Ile Leu Asn Glu Ala Tyr Thr Ser Pro Ala Asn Lys Lys Ala Ile Arg
        755                 760                 765

Gln Val Val Lys Val Val Asp Asp Ile Val Lys Ala Ala Ser Gly Lys
    770                 775                 780

Val Pro Lys Gln Ile Ala Ile Glu Phe Thr Arg Asp Ala Asp Asp Lys
785                 790                 795                 800

Ala Lys Ile Ser Gln Thr Arg Ala Asn Lys Leu Arg Lys Val Tyr Lys
                805                 810                 815

Glu Leu Ser Asn Glu Leu Ala Ser Glu Thr Ile Arg Asn Glu Leu Glu
            820                 825                 830

Arg Val Ala Lys Asp Gln Lys Leu Leu Lys Asp Lys Tyr Tyr Leu Tyr
        835                 840                 845

Phe Met Gln Leu Gly Arg Asp Ala Tyr Thr Gly Glu Pro Ile Asn Ile
    850                 855                 860

Asp Asp Leu Gly Gln Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Phe
865                 870                 875                 880

Ile Lys Asp Asp Ser Leu Glu Asn Arg Val Leu Val Lys Lys Ala Val
                885                 890                 895
```

```
Asn Asn Gly Lys Ser Asp Asn Val Pro Val Lys Leu Tyr Gly Asn Arg
            900                 905                 910

Met Ala Ala Asp Leu Gly Met Thr Ile Arg His Met Trp Glu Lys Trp
        915                 920                 925

Lys Asp Gln Gly Leu Ile Thr Lys Thr Lys Tyr Asn Asn Leu Ile Ile
    930                 935                 940

Asp Pro Asp Lys Ile Asn Lys Tyr Glu Ser Ser Gly Phe Ile His Arg
945                 950                 955                 960

Gln Leu Val Glu Thr Ser Gln Ile Ile Lys Leu Val Ser Thr Ile Leu
                965                 970                 975

Gln Ser Lys Tyr Pro Asp Thr Glu Ile Ile Val Val Lys Ala Arg Tyr
            980                 985                 990

Asn His Tyr Leu Arg Lys His Leu  Asn Leu Tyr Lys Ser  Arg Glu Val
        995                 1000                1005

Asn Asp  Tyr His His Ala Ile  Asp Ala Tyr Leu Ser  Ala Ile Cys
    1010                1015                1020

Gly Asn  Leu Leu Tyr Gln Val  Tyr Pro Tyr Leu Arg  Pro Phe Phe
    1025                1030                1035

Val Tyr  Gly Gln Tyr Lys Lys  Phe Ser Ser Asp Pro  Lys Lys Glu
    1040                1045                1050

Lys Ile  Ile Tyr Asp Lys Thr  Arg Lys Tyr Asn Phe  Ile Ser Gln
    1055                1060                1065

Ile Phe  Glu Asn Lys Ser Asn  Asp Ile Ile Ser Leu  Glu Thr Lys
    1070                1075                1080

Lys Lys  Val Phe Asp Lys Lys  Asp Ile Ile Glu Lys  Leu Lys His
```

```
    1085                1090                1095

Ala Tyr  Asn Tyr Lys Tyr Met  Leu Val Ser Arg Glu  Thr Glu Thr
    1100                1105                1110

His Asp  Gln Glu Met Phe Lys  Met Thr Val Tyr Pro  Arg Leu Ser
    1115                1120                1125

Arg Asp  Thr Lys Lys Ser Arg  Asn Leu Ile Ser Lys  Lys Lys Asp
    1130                1135                1140

Met Pro  Thr Glu Ile Tyr Gly  Gly Tyr Thr Asn Asn  Ser Asp Ala
    1145                1150                1155

Tyr Met  Val Ile Ala Arg Ile  Asn Lys Lys Lys Gly  Thr Glu Tyr
    1160                1165                1170

Arg Val  Phe Gly Val Pro Met  Arg Glu Leu Val Asn  Leu Arg Lys
    1175                1180                1185

Ala Glu  Lys Asn Gly Arg Tyr  Asn Ala Tyr Leu Lys  Gln Val Leu
    1190                1195                1200

Glu Pro  Glu Ile Met Tyr Ser  Lys Asn Gly Lys Lys  Asn Lys Thr
    1205                1210                1215

Ile Ser  Ser Phe Glu Ile Val  Lys Ala Lys Val Pro  Tyr Lys Gln
    1220                1225                1230

Val Ile  Leu Asp Gly Asp Lys  Lys Phe Met Leu Ala  Ser Ser Thr
    1235                1240                1245

Tyr Val  Gln Asn Ala Lys Gln  Leu Thr Leu Ser Gln  Asn Ser Met
    1250                1255                1260

Gln Ala  Ile Thr Asp Asn Cys  Glu Asn Asp Thr Glu  Glu Glu Lys
    1265                1270                1275
```

```
Ala Leu  Glu Glu Lys Ala Leu  Ile Glu Ala Tyr Asp  Glu Ile Leu
    1280                1285                1290


Thr Asn  Ile Asp Lys Tyr Leu  Pro Leu Phe Asp Ile  Asn Lys Phe
    1295                1300                1305


Arg Glu  Lys Leu His Ala Gly  Arg Glu Lys Phe Ile  Asn Leu Ser
    1310                1315                1320


Leu Asp  Val Lys Lys Asp Thr  Ile Leu Gln Val Leu  Asn Gly Leu
    1325                1330                1335


His Asp  Asn Ala Val Met Pro  Lys Ile Lys Ser Leu  Gly Leu Ser
    1340                1345                1350


Thr Pro  Leu Gly Phe Met Gln  Phe Ser Ser Gly Val  Pro Leu Ser
    1355                1360                1365


Glu Asn  Ala Lys Leu Ile Tyr  Gln Ser Pro Thr Gly  Leu Phe Glu
    1370                1375                1380


Lys Arg  Val Lys Ile Ser Asp  Leu
    1385                1390
```

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<400> 158

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Met Lys His Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Leu Ile Lys Gln Asp Phe Glu Asn Lys Gln Gly Glu Ile Leu Gly
            20                  25                  30


Met Gly Ser Arg Ile Ile Pro Met Ser Gln Asp Ile Leu Gly Asp Phe
        35                  40                  45
```

```
Gly Lys Gly Asn Ser Val Ser Gln Thr Ala Glu Arg Thr Lys Tyr Arg
    50                  55                  60

Ser Val Arg Arg Leu Arg Glu Arg Phe Leu Leu Arg Arg Glu Arg Leu
65                  70                  75                  80

His Arg Ile Leu Asn Val Leu Gly Phe Leu Pro Glu His Tyr Ala Ser
                85                  90                  95

Gln Ile Asp Phe Thr Lys Arg Phe Gly Lys Phe Lys Glu Glu Thr Glu
            100                 105                 110

Pro Lys Leu Val Tyr Ser Asn Glu Gly Phe Ile Phe Lys Lys Ser Phe
        115                 120                 125

Glu Glu Met Leu Ser Asp Phe Lys Thr His Gln Pro Gln Leu Leu Glu
    130                 135                 140

Asp Asn Lys Lys Ile Pro Tyr Asp Trp Thr Ile Tyr Tyr Leu Arg Lys
145                 150                 155                 160

Lys Ala Leu Ser Arg Lys Ile Glu Lys Glu Glu Leu Ala Trp Ile Leu
                165                 170                 175

Leu Asn Phe Asn Gln Lys Arg Gly Tyr Tyr Gln Leu Arg Gly Glu Glu
            180                 185                 190

Glu Glu Glu Asn Pro Asn Lys Leu Ile Glu Phe Tyr Ser Leu Lys Ile
        195                 200                 205

Val Asp Val Leu Ala Asp Glu Pro Gln Lys Gly Lys Ser Asp Ile Trp
    210                 215                 220

Tyr Ser Leu Ile Leu Glu Asn Gly Trp Ile Tyr Arg Arg Ser Ser Lys
225                 230                 235                 240
```

```
Thr Pro Leu Phe Asp Trp Lys Glu Lys Thr Arg Asp Phe Ile Val Thr
                245                 250                 255

Ile Asp Leu Asn Asp Asp Gly Ser Val Lys Thr Asp Lys Glu Gly Asn
            260                 265                 270

Glu Lys Arg Ser Phe Arg Ala Pro Gly Glu Asn Asp Trp Thr Leu Val
        275                 280                 285

Lys Lys Lys Thr Glu Gln Glu Ile Asp Ser Ser Arg Lys Thr Val Gly
    290                 295                 300

Thr Tyr Ile Tyr Glu Thr Leu Leu Lys Asn Pro Lys Gln Lys Ile Lys
305                 310                 315                 320

Gly Lys Leu Val Arg Thr Ile Glu Arg Lys Phe Tyr Lys Thr Glu Leu
                325                 330                 335

Lys Gln Ile Leu Glu Lys Gln Lys Glu Phe His Pro Glu Leu Arg Gln
            340                 345                 350

Asp Asp Leu Tyr Ser Asp Cys Val Arg Glu Leu Tyr Lys Asn Asn Glu
        355                 360                 365

Ala His Gln Leu Thr Leu Ser Lys Lys Asp Phe Val His Leu Phe Met
    370                 375                 380

Glu Asp Ile Ile Phe Tyr Gln Arg Pro Leu Gly Ser Gln Lys Ser Ser
385                 390                 395                 400

Ile Ser Asn Cys Thr Leu Glu Phe Arg Lys Tyr Lys Asp Glu Asn Gly
                405                 410                 415

Thr Glu His Thr Gln Tyr Leu Lys Ala Ile Pro Lys Ser Asn Pro Tyr
            420                 425                 430

Tyr Gln Glu Phe Arg Ile Trp Gln Trp Met Tyr Asn Leu Asn Ile Tyr
        435                 440                 445
```

```
Lys Lys Glu Asp Asp Thr Asn Val Thr Lys Asp Phe Leu Asn Thr Lys
    450                 455                 460

Ala Asp Phe Glu Ser Leu Phe Glu Phe Leu Asn Asn Arg Lys Glu Val
465                 470                 475                 480

Asp Gln Lys Ala Leu Leu Lys His Phe Lys Leu Asn Asp Lys Thr His
                485                 490                 495

Arg Trp Asn Tyr Val Glu Asp Lys Lys Tyr Pro Cys Asn Glu Thr Lys
            500                 505                 510

Thr Met Ile Leu Ser Arg Leu Asp Lys Val Glu Asn Ile Ser Asp Asp
        515                 520                 525

Phe Leu Thr Arg Glu Met Glu Gln Lys Ile Trp His Ile Ile Tyr Ser
    530                 535                 540

Val Asn Asp Lys Val Glu Tyr Glu Lys Ala Leu Lys Ser Phe Ala Gly
545                 550                 555                 560

Lys Asn Asn Leu Glu Asp Asn Ser Phe Phe Glu Ala Phe Lys Lys Phe
                565                 570                 575

Pro Pro Phe Lys Ser Glu Tyr Gly Ala Phe Ser Glu Lys Ala Ile Lys
            580                 585                 590

Lys Leu Leu Pro Leu Met Arg Met Gly Lys Phe Trp Asn Tyr Asn Asn
        595                 600                 605

Ile Ser Glu Gln Ser Lys Ser Arg Ile Gln Lys Ile Ile Thr Gly Glu
    610                 615                 620

Tyr Asp Glu Asn Ile Lys Asp Lys Val Arg Glu Lys Ala Ile His Leu
625                 630                 635                 640
```

```
Thr Thr Glu Thr Asp Phe Gln Gly Leu Gln Leu Trp Leu Val Gln Tyr
                645                 650                 655

Ile Val Tyr Gly Arg His Ser Glu Ala Ala Met Leu Gly Lys Trp Asn
            660                 665                 670

Ser Ala Asp Asp Leu Glu Glu Phe Leu Lys Glu Phe Lys Gln His Ser
        675                 680                 685

Leu Arg Asn Pro Ile Val Glu Gln Val Ile Thr Glu Thr Leu Arg Val
    690                 695                 700

Val Lys Asp Ile Trp Gln Lys Tyr Gly Asn Gly Ala Lys Asp Phe Phe
705                 710                 715                 720

Arg Glu Ile His Ile Glu Leu Gly Arg Glu Met Lys Leu Pro Ala Glu
                725                 730                 735

Glu Arg Glu Arg Leu Thr Arg Gln Ile Ser Glu Asn Glu Asn Thr Asn
            740                 745                 750

Phe Arg Ile Lys Ala Leu Leu Ala Glu Met Met Asp Asp Asn Ser Val
        755                 760                 765

Glu Asn Val Arg Pro Phe Ser Pro Met Gln Gln Glu Ile Leu Lys Ile
    770                 775                 780

Tyr Glu Glu Gly Val Leu Asn Ser Asp Ile Glu Ile Glu Asp Asp Ile
785                 790                 795                 800

Leu Lys Ile Ser Lys Thr Ala Gln Pro Ser Ser Ser Asp Leu Lys Arg
                805                 810                 815

Tyr Lys Leu Trp Leu Glu Gln Lys Tyr Lys Ser Pro Tyr Thr Gly Gln
            820                 825                 830

Ile Ile Pro Leu Asn Lys Leu Phe Thr Pro Glu Tyr Glu Ile Glu His
        835                 840                 845
```

```
Ile Ile Pro Gln Ser Arg Tyr Phe Asp Asp Ser Phe Thr Asn Lys Ile
    850                 855                 860

Ile Cys Glu Ser Ala Val Asn Lys Leu Lys Asp Asn Tyr Ile Gly Leu
865                 870                 875                 880

Glu Phe Ile Lys Lys Leu Gly Gly Ser Ile Val Glu Cys Gly Asn Gly
                885                 890                 895

Lys Ser Val Ala Ile Leu Lys His Asp Ala Tyr Glu Asp Phe Ile Lys
            900                 905                 910

Lys His Tyr Ala Asn Asn Arg Ser Lys Arg Asn Lys Leu Leu Leu Glu
        915                 920                 925

Asp Ile Pro Glu Lys Met Ile Glu Arg Gln Met Asn Asp Thr Arg Tyr
    930                 935                 940

Ile Ser Lys Tyr Ile Ser Gly Val Leu Ser Asn Ile Val Arg Val Glu
945                 950                 955                 960

Asp Gly Thr Asp Glu Gly Val Asn Ser Lys Asn Ile Val Pro Gly Asn
                965                 970                 975

Gly Lys Ile Thr Thr Gln Leu Lys Gln Asp Trp Gly Leu Asn Asp Val
            980                 985                 990

Trp Asn Asp Leu Ile Leu Pro Arg  Phe Glu Arg Met Asn  His Leu Thr
        995                 1000                1005

Asn Ser  Thr Asp Phe Thr Ala  Trp Asn Glu Asn His  Gln Lys Phe
    1010                1015                1020

Leu Pro  Thr Val Pro Val Glu  Phe Ser Lys Gly Phe  Ser Lys Lys
    1025                1030                1035
```

```
Arg Ile  Asp His Arg His His  Ala Leu Asp Ala Leu  Val Ile Ala
    1040                1045                1050

Cys Ala  Thr Lys Asp His Val  Asn Leu Leu Asn Asn  Gln Ser Ala
    1055                1060                1065

Lys Ser  Asp Thr Lys Arg Tyr  Asp Leu Lys Lys Lys  Leu Met Lys
    1070                1075                1080

Phe Glu  Lys Val Ala Tyr Asn  His Pro Gln Thr Gly  Glu Arg Ile
    1085                1090                1095

Glu Arg  Glu Ala Pro Lys Gln  Phe Leu Lys Pro Trp  Glu Thr Phe
    1100                1105                1110

Thr Ile  Asp Ala Lys Asn His  Leu Glu Thr Ile Ile  Val Ser Phe
    1115                1120                1125

Lys Gln  Asn Leu Arg Val Ile  Asn Lys Ala Thr Asn  Tyr Tyr Glu
    1130                1135                1140

Lys Tyr  Val Glu Lys Glu Gly  Thr Lys Val Lys Glu  Arg Val Glu
    1145                1150                1155

Gln Lys  Gly Thr Asn Trp Ala  Ile Arg Lys Pro Met  His Lys Glu
    1160                1165                1170

Thr Val  Ser Gly Lys Ile Asp  Leu Pro Arg Ile Lys  Val Pro Lys
    1175                1180                1185

Gly Lys  Ile Leu Thr Ala Thr  Arg Lys Ser Leu Asp  Thr Ser Phe
    1190                1195                1200

Asn Leu  Lys Thr Ile Gly Ser  Ile Thr Asp Thr Gly  Ile Gln Lys
    1205                1210                1215

Ile Leu  Lys Asn Tyr Leu Gln  Tyr Lys Asp Asn Asn  Pro Glu Leu
    1220                1225                1230
```

```
Ala Phe  Ser Pro Glu Gly Ile  Glu Asp Met Asn Lys  Asn Ile Glu
    1235                1240                1245

Lys Phe  Asn Asn Gly Lys Ala  His Gln Ser Ile Ser  Lys Val Arg
    1250                1255                1260

Val Phe  Glu Leu Gly Ser Lys  Phe Pro Leu Gly Gln  Ser Gly Asn
    1265                1270                1275

Lys Lys  Glu Lys Tyr Val Glu  Ala Ala Lys Gly Thr  Asn Leu Phe
    1280                1285                1290

Phe Ala  Ile Tyr Gln Asp Lys  Asn Gly Lys Arg Ser  Tyr Glu Thr
    1295                1300                1305

Ile Pro  Leu Asn Glu Val Ile  Glu Arg Gln Lys Gln  Gly Leu Ser
    1310                1315                1320

Val Val  Asp Leu Lys Gly Val  Asp Asp Phe Tyr Leu  Ser Pro Asn
    1325                1330                1335

Asp Leu  Val Tyr Val Pro Ser  Glu Asp Glu Leu Glu  Asn Ile Ser
    1340                1345                1350

Met Ile  Asp Phe Asn Lys Met  Ser Ser Glu Arg Ile  Tyr Lys Val
    1355                1360                1365

Val Ser  Phe Thr Gly Asn Gln  Ile Phe Phe Val Arg  Gln Asp Ile
    1370                1375                1380

Ala Thr  Ser Val Val Asn Lys  Ala Glu Phe Ser Thr  Leu Asn Lys
    1385                1390                1395

Met Glu  Arg Ala Ile Asp Gly  Thr Met Ile Lys Glu  Thr Cys Val
    1400                1405                1410
```

```
Lys Leu  Gln Ile Asp Arg Leu  Gly Asn Ile Ser Lys  Ile
    1415                1420                1425


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<212>  PRT
<213>  Lactobacillus casei

<400>  159

Met Thr Lys Leu Gly Lys Pro Tyr Gly Ile Gly Val Asp Ile Gly Ser
1               5                   10                  15


Asn Ser Ile Gly Phe Ala Ala Val Asp Glu Asn Ser His Leu Ile Arg
            20                  25                  30


Leu Lys Gly Lys Thr Val Ile Gly Ala Arg Leu Phe Glu Glu Gly Lys
        35                  40                  45


Ala Ala Ala Asp Arg Arg Ala Ser Arg Thr Thr Arg Arg Arg Leu Ser
    50                  55                  60


Arg Asn Arg Trp Arg Leu Ser Phe Leu Arg Asp Phe Phe Glu Ser His
65                  70                  75                  80


Ile Thr Pro Thr Gly Pro Asn Phe Phe Met Arg Gln Lys Tyr Ser Glu
                85                  90                  95


Ile Ser Pro Lys Asp Lys Ala Arg Tyr Lys Tyr Glu Lys Arg Leu Phe
            100                 105                 110


Asn Asp Arg Thr Asp Ala Glu Phe Tyr Gln Gln Tyr Pro Thr Met Tyr
        115                 120                 125


His Leu Arg Asn Arg Leu Leu Thr Asp Pro Ser Lys Ala Asp Val Arg
    130                 135                 140


Glu Ile Tyr Phe Ala Ile His His Ile Leu Lys Ser Arg Gly His Phe
145                 150                 155                 160
```

```
Leu Thr Ser Gly Tyr Ala Lys Asp Phe Asn Thr Asn Lys Val Ala Leu
                165                 170                 175

Asn Glu Ile Phe Pro Ala Leu Gln Asp Ala Tyr Ala Gln Val Tyr Pro
            180                 185                 190

Asp Leu Asp Ile Thr Phe Asp Glu Asn Lys Val Asn Glu Phe Lys Thr
        195                 200                 205

Val Leu Leu Asn Glu Lys Ala Thr Pro Ser Asp Thr Gln Arg Ala Leu
    210                 215                 220

Val Asn Leu Leu Leu Ala Glu Asp Gly Asp Lys Asp Ile Leu Lys Gln
225                 230                 235                 240

Gln Lys Gln Val Leu Thr Glu Phe Ala Lys Ala Val Val Gly Leu Lys
                245                 250                 255

Thr Lys Leu Asn Val Ala Leu Gly Thr Glu Val Asp Ser Ser Glu Ala
            260                 265                 270

Thr Val Trp Asn Phe Ser Leu Gly Gln Leu Asp Asp Lys Trp Ala Gly
        275                 280                 285

Ile Glu Ser Ala Met Thr Asp Glu Gly Thr Glu Ile Leu Asp Gln Ile
    290                 295                 300

Arg Asp Leu Tyr Arg Ala Arg Leu Leu Asn Gly Ile Val Pro Ala Gly
305                 310                 315                 320

Lys Thr Leu Ser Gln Ala Lys Val Asp Asp Tyr Ala Gln His His Glu
                325                 330                 335

Asp Leu Glu Leu Phe Lys Asp Tyr Leu Lys Gln Leu Glu Asp Asp Gly
            340                 345                 350

Thr Ala Lys Ala Ile Arg Gln Leu Tyr Asp Arg Tyr Ile Asp Gly Asp
```

```
        355                 360                 365

Asp Ala Lys Pro Phe Val Arg Glu Asp Phe Val Lys Ala Leu Thr Lys
    370                 375                 380

Glu Val Thr Ala His Pro Asn Ala Lys Ser Pro Glu Leu Leu Glu Arg
385                 390                 395                 400

Leu Ala Gln Pro Asp Phe Met Leu Lys Gln Arg Asn Lys Ala Asn Gly
                405                 410                 415

Ala Ile Pro Val Gln Met Gln Gln Arg Glu Leu Asp Gln Ile Ile Lys
            420                 425                 430

Asn Gln Ser Val Tyr Tyr Asp Trp Leu Ala Ala Pro Asn Pro Val Glu
        435                 440                 445

Lys His Arg Lys Ser Met Pro Tyr Gln Leu Asp Glu Leu Leu Asn Phe
    450                 455                 460

Arg Ile Pro Tyr Tyr Val Gly Pro Leu Val Thr Ala Lys Glu Gln Lys
465                 470                 475                 480

Ala Ala Gln Gly Gly Val Phe Ala Trp Met Val Arg Lys Asp Pro Asp
                485                 490                 495

Gly Asn Ile Thr Pro Tyr Asn Phe Asp Glu Lys Val Asp Arg Glu Ala
            500                 505                 510

Ser Ala Asn Thr Phe Ile Gln Arg Met Lys Thr Thr Asp Thr Tyr Leu
        515                 520                 525

Ile Gly Glu Asp Val Leu Pro Lys Gln Ser Leu Leu Tyr Gln Arg Tyr
    530                 535                 540

Glu Val Leu Asn Glu Leu Asn Asn Val Arg Val Asn Asn Glu Lys Leu
545                 550                 555                 560
```

```
Ser Ile Glu Gln Lys Gln Gln Val Ile Arg Glu Leu Phe Glu Arg His
               565                 570                 575

Asn Ser Val Thr Ile Lys Gln Phe Ala Glu Asn Leu Arg Ala His Gly
            580                 585                 590

Asp Tyr Ala His Ile Pro Glu Ile Arg Gly Leu Ala Asp Glu Lys Arg
        595                 600                 605

Phe Leu Ser Ser Leu Ser Thr Tyr Arg Gln Leu Lys Ser Leu Leu Pro
    610                 615                 620

Asp Ala Ile Asp Asp Pro Ala Lys Gln Ala Asp Ile Glu Asn Ile Ile
625                 630                 635                 640

Ala Trp Ser Thr Val Phe Glu Asp Ala Ala Ile Phe Lys Thr Lys Leu
               645                 650                 655

Lys Glu Ile Asn Trp Leu Asp Ser Gln Thr Ile Thr Lys Leu Ser Asn
            660                 665                 670

Ile Arg Tyr Arg Gly Trp Gly Gln Phe Ser His Lys Phe Leu Asn Gly
        675                 680                 685

Leu Thr Leu Gly Asn Gly His Thr Ile Ile Gln Glu Leu Phe Leu Ser
    690                 695                 700

Asn Asn Asn Leu Met Gln Ile Leu Thr Asp Glu Thr Leu Gln Lys Lys
705                 710                 715                 720

Met Thr Glu Leu Asn Ala Asp Lys Leu Lys Ala Ala Asn Ile Asn Asp
               725                 730                 735

Ala Ile Asp Asp Ala Tyr Thr Ser Pro Ser Asn Lys Lys Ala Leu Arg
            740                 745                 750

Gln Val Leu Arg Val Ile Glu Asp Ile Lys Arg Ala Ala Asp Gly Gln
```

```
        755                 760                 765

Asp Pro Ser Trp Leu Tyr Val Glu Thr Ala Asp Gly Gly Gly Thr Pro
    770                 775                 780

Gly Lys Arg Thr Arg Ala Arg Gln His Gln Leu Gln Glu Ile Tyr Ala
785                 790                 795                 800

Asn Ala Ala His Glu Leu Ile Asp Ser Ala Val Arg Gly Glu Leu Glu
                805                 810                 815

Asp Lys Ile Ala Asp Lys Ala Asp Phe Asn Asp Arg Leu Val Leu Tyr
            820                 825                 830

Phe Met Gln Gly Gly Arg Asp Ile Tyr Thr Gly Thr Pro Leu Asn Ile
        835                 840                 845

Asp Gln Leu Ser Ser Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Leu
    850                 855                 860

Ile Lys Asp Asn Ser Leu Asp Asn Arg Val Leu Val His Ala Ile Ile
865                 870                 875                 880

Asn Arg Glu Lys Asn Ala Thr Phe Ala Ser Thr Ile Tyr Ala Gln Lys
                885                 890                 895

Met Asn Ala Thr Trp Arg Gln Trp His Glu Ala Gly Leu Ile Ser Gly
            900                 905                 910

Arg Lys Leu Arg Asn Leu Gln Met Arg Pro Asp Gln Ile Asp Lys Tyr
        915                 920                 925

Ala Ser Gly Phe Val Ala Arg Gln Leu Val Glu Thr Arg Gln Ile Ile
    930                 935                 940

Lys Leu Thr Glu Gln Ile Val Ala Ala Gln Tyr Pro Glu Thr Lys Ile
945                 950                 955                 960
```

```
Ile Ala Val Lys Ala Gly Leu Ser His Gln Leu Arg Glu Glu Leu Glu
               965                 970                 975


Phe Pro Lys Asn Arg Asp Val Asn His Tyr His His Ala Phe Asp Ala
            980                 985                 990


Phe Leu Ala Ala Arg Ile Gly Thr  Tyr Leu Leu Lys Arg  Phe Pro Asn
        995                 1000                1005


Leu Gln  Ala Phe Phe Thr Tyr  Gly Lys Phe Lys Lys  Ala Asp Val
    1010                1015                1020


Lys Lys  Leu Arg Gly Phe Asn  Phe Ile Arg Asp Ile  Thr His Ala
    1025                1030                1035


Glu Asp  Lys Ile Val Val Lys  Asp Thr Gly Glu Val  Ile Trp Asp
    1040                1045                1050


Lys Lys  Arg Asp Val Asp Glu  Leu Asp Arg Ile Tyr  Asn Phe Lys
    1055                1060                1065


Arg Met  Leu Ile Thr His Glu  Val His Phe Glu Lys  Ala Asp Leu
    1070                1075                1080


Phe Lys  Gln Thr Val Tyr Gly  Ala Lys Asp Ser Lys  Glu Ala Gly
    1085                1090                1095


Gly Lys  Lys Gln Leu Ile Ser  Lys Lys Lys Gly Tyr  Pro Val Asp
    1100                1105                1110


Ile Tyr  Gly Gly Tyr Thr Gln  Glu Thr Gly Ser Tyr  Leu Ser Val
    1115                1120                1125


Val Arg  Leu Thr Lys Lys Ala  Met Tyr Ala Val Val  Lys Val Ser
    1130                1135                1140


Thr Arg  Asp Ala Ala Lys Leu  Ala Val Ala Lys Ser  Ile Ser Glu
```

```
    1145                1150                1155

Gln Lys  Glu Asn Glu Thr Leu  Asn Asp Ile Ile Asp  Glu Lys Leu
    1160                1165                1170

Ser Lys  Ile Ser Lys Asn Gly  Lys Ile Thr His Glu  Leu Phe Glu
    1175                1180                1185

Val Val  Leu Pro Arg Val Gly  Gln Lys Thr Leu Phe  Lys Asn Ser
    1190                1195                1200

Lys Tyr  Asn Leu Phe Leu Val  Asn Ser Asp Thr Tyr  Met His Asn
    1205                1210                1215

Tyr Gln  Glu Leu Trp Met Pro  Arg Glu Tyr Gln Lys  Met Trp Lys
    1220                1225                1230

Asp Ile  Ser Leu Ser Lys Tyr  Gly Asp Ala Gln Thr  Glu Asp Gln
    1235                1240                1245

Leu Asp  Gln Ile Phe Gly Phe  Ile Val Ser Gln Val  Asn Ser Tyr
    1250                1255                1260

Phe Asn  Leu Tyr Asp Ile Asn  Gln Phe Arg Lys Lys  Leu Asn Asp
    1265                1270                1275

Ala Ala  Asp Lys Phe Ala Thr  Leu Pro Met Arg Asp  Thr Asp Asp
    1280                1285                1290

Met Gln  Gly Lys Ile Ala Thr  Ile Gly Gln Leu Leu  Ile Gly Leu
    1295                1300                1305

Gln Ala  Asn Ala Ala Arg Ser  Asp Leu Arg Asn Leu  Asp Ile Lys
    1310                1315                1320

Thr Pro  Leu Gly Leu Leu Gln  Ile Pro Asn Gly Ile  Ser Leu Asp
    1325                1330                1335
```

Ser Asp Thr Ser Val Val Tyr Gln Ser Pro Thr Gly Leu Leu Glu
    1340   1345   1350

Arg Glu Val His Leu Ser Asp Leu
    1355   1360

<210> 160
<211> 1436
<212> PRT
<213> Bacteroides fragilis

<400> 160

Met Lys Arg Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1   5   10   15

Ala Leu Val Asn Glu Ala Glu Asn Lys Asp Glu Arg Ser Ser Ile Val
            20   25   30

Lys Leu Gly Val Arg Val Asn Pro Leu Thr Val Asp Glu Leu Thr Asn
        35   40   45

Phe Glu Lys Gly Lys Ser Ile Thr Thr Asn Ala Asp Arg Thr Leu Lys
    50   55   60

Arg Gly Met Arg Arg Asn Leu Gln Arg Tyr Lys Leu Arg Arg Glu Thr
65   70   75   80

Leu Thr Glu Val Leu Lys Glu His Lys Leu Ile Thr Glu Asp Thr Ile
                85   90   95

Leu Ser Glu Asn Gly Asn Arg Thr Thr Phe Glu Thr Tyr Arg Leu Arg
            100   105   110

Ala Lys Ala Val Thr Glu Glu Ile Ser Leu Glu Glu Phe Ala Arg Val
        115   120   125

Leu Leu Met Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Ala
    130   135   140

```
Lys Gly Val Glu Glu Gly Thr Leu Ile Asp Gly Met Asp Ile Ala Arg
145                 150                 155                 160

Glu Leu Tyr Asn Asn Asn Leu Thr Pro Gly Glu Leu Cys Leu Gln Leu
                165                 170                 175

Leu Asp Ala Gly Lys Lys Phe Leu Pro Asp Phe Tyr Arg Ser Asp Leu
            180                 185                 190

Gln Asn Glu Leu Asp Arg Ile Trp Glu Lys Gln Lys Glu Tyr Tyr Pro
        195                 200                 205

Glu Ile Leu Thr Asp Val Leu Lys Glu Glu Leu Arg Gly Lys Lys Arg
    210                 215                 220

Asp Ala Val Trp Ala Ile Cys Ala Lys Tyr Phe Val Trp Lys Glu Asn
225                 230                 235                 240

Tyr Thr Glu Trp Asn Lys Glu Lys Gly Lys Thr Glu Gln Gln Glu Arg
                245                 250                 255

Glu His Lys Leu Glu Gly Ile Tyr Ser Lys Arg Lys Arg Asp Glu Ala
            260                 265                 270

Lys Arg Glu Asn Leu Gln Trp Arg Val Asn Gly Leu Lys Glu Lys Leu
        275                 280                 285

Ser Leu Glu Gln Leu Val Ile Val Phe Gln Glu Met Asn Thr Gln Ile
    290                 295                 300

Asn Asn Ser Ser Gly Tyr Leu Gly Ala Ile Ser Asp Arg Ser Lys Glu
305                 310                 315                 320

Leu Tyr Phe Asn Lys Gln Thr Val Gly Gln Tyr Gln Met Glu Met Leu
                325                 330                 335
```

```
Asp Lys Asn Pro Asn Ala Ser Leu Arg Asn Met Val Phe Tyr Arg Gln
            340                 345                 350

Asp Tyr Leu Asp Glu Phe Asn Met Leu Trp Glu Lys Gln Ala Val Tyr
        355                 360                 365

His Lys Glu Leu Thr Glu Glu Leu Lys Lys Glu Ile Arg Asp Ile Ile
    370                 375                 380

Ile Phe Tyr Gln Arg Arg Leu Lys Ser Gln Lys Gly Leu Ile Gly Phe
385                 390                 395                 400

Cys Glu Phe Glu Ser Arg Gln Ile Glu Val Asp Ile Asp Gly Lys Lys
                405                 410                 415

Lys Ile Lys Thr Val Gly Asn Arg Val Ile Ser Arg Ser Ser Pro Leu
            420                 425                 430

Phe Gln Glu Phe Lys Ile Trp Gln Ile Leu Asn Asn Ile Glu Val Thr
        435                 440                 445

Val Val Gly Lys Lys Arg Lys Arg Arg Lys Leu Lys Glu Asn Tyr Ser
    450                 455                 460

Ala Leu Phe Glu Glu Leu Asn Asp Ala Glu Gln Leu Glu Leu Asn Gly
465                 470                 475                 480

Ser Arg Arg Leu Cys Gln Glu Glu Lys Glu Leu Leu Ala Gln Glu Leu
                485                 490                 495

Phe Ile Arg Asp Lys Met Thr Lys Ser Glu Val Leu Lys Leu Leu Phe
            500                 505                 510

Asp Asn Pro Gln Glu Leu Asp Leu Asn Phe Lys Thr Ile Asp Gly Asn
        515                 520                 525

Lys Thr Gly Tyr Ala Leu Phe Gln Ala Tyr Ser Lys Met Ile Glu Met
    530                 535                 540
```

```
Ser Gly His Glu Pro Val Asp Phe Lys Lys Pro Val Glu Lys Val Val
545                 550                 555                 560

Glu Tyr Ile Lys Ala Val Phe Asp Leu Leu Asn Trp Asn Thr Asp Ile
                565                 570                 575

Leu Gly Phe Asn Ser Asn Glu Glu Leu Asp Asn Gln Ser Tyr Tyr Lys
            580                 585                 590

Leu Trp His Leu Leu Tyr Ser Phe Glu Gly Asp Asn Thr Pro Thr Gly
        595                 600                 605

Asn Gly Arg Leu Ile Gln Lys Met Thr Glu Leu Tyr Gly Phe Glu Lys
    610                 615                 620

Glu Tyr Ala Thr Ile Leu Ala Asn Val Ser Phe Gln Asp Asp Tyr Gly
625                 630                 635                 640

Ser Leu Ser Ala Lys Ala Ile His Lys Ile Leu Pro His Leu Lys Glu
                645                 650                 655

Gly Asn Arg Tyr Asp Val Ala Cys Val Tyr Ala Gly Tyr Arg His Ser
            660                 665                 670

Glu Ser Ser Leu Thr Arg Glu Glu Ile Ala Asn Lys Val Leu Lys Asp
        675                 680                 685

Arg Leu Met Leu Leu Pro Lys Asn Ser Leu His Asn Pro Val Val Glu
    690                 695                 700

Lys Ile Leu Asn Gln Met Val Asn Val Ile Asn Val Ile Ile Asp Ile
705                 710                 715                 720

Tyr Gly Lys Pro Asp Glu Ile Arg Val Glu Leu Ala Arg Glu Leu Lys
                725                 730                 735
```

```
Lys Asn Ala Lys Glu Arg Glu Glu Leu Thr Lys Ser Ile Ala Gln Thr
            740                 745                 750

Thr Lys Ala His Glu Glu Tyr Lys Thr Leu Leu Gln Thr Glu Phe Gly
        755                 760                 765

Leu Thr Asn Val Ser Arg Thr Asp Ile Leu Arg Tyr Lys Leu Tyr Lys
    770                 775                 780

Glu Leu Glu Ser Cys Gly Tyr Lys Thr Leu Tyr Ser Asn Thr Tyr Ile
785                 790                 795                 800

Ser Arg Glu Lys Leu Phe Ser Lys Glu Phe Asp Ile Glu His Ile Ile
                805                 810                 815

Pro Gln Ala Arg Leu Phe Asp Asp Ser Phe Ser Asn Lys Thr Leu Glu
            820                 825                 830

Ala Arg Ser Val Asn Ile Glu Lys Gly Asn Lys Thr Ala Tyr Asp Phe
        835                 840                 845

Val Lys Glu Lys Phe Gly Glu Ser Gly Ala Asp Asn Ser Leu Glu His
    850                 855                 860

Tyr Leu Asn Asn Ile Glu Asp Leu Phe Lys Ser Gly Lys Ile Ser Lys
865                 870                 875                 880

Thr Lys Tyr Asn Lys Leu Lys Met Ala Glu Gln Asp Ile Pro Asp Gly
                885                 890                 895

Phe Ile Glu Arg Asp Leu Arg Asn Thr Gln Tyr Ile Ala Lys Lys Ala
            900                 905                 910

Leu Ser Met Leu Asn Glu Ile Ser His Arg Val Val Ala Thr Ser Gly
        915                 920                 925

Ser Val Thr Asp Lys Leu Arg Glu Asp Trp Gln Leu Ile Asp Val Met
    930                 935                 940
```

```
Lys Glu Leu Asn Trp Glu Lys Tyr Lys Ala Leu Gly Leu Val Glu Tyr
945                 950                 955                 960


Phe Glu Asp Arg Asp Gly Arg Gln Ile Gly Arg Ile Lys Asp Trp Thr
                965                 970                 975


Lys Arg Asn Asp His Arg His His Ala Met Asp Ala Leu Thr Val Ala
            980                 985                 990


Phe Thr Lys Asp Val Phe Ile Gln  Tyr Phe Asn Asn Lys  Asn Ala Ser
        995                 1000                1005


Leu Asp  Pro Asn Ala Asn Glu  His Ala Ile Lys Asn  Lys Tyr Phe
    1010                1015                1020


Gln Asn  Gly Arg Ala Ile Ala  Pro Met Pro Leu Arg  Glu Phe Arg
    1025                1030                1035


Ala Glu  Ala Lys Lys His Leu  Glu Asn Thr Leu Ile  Ser Ile Lys
    1040                1045                1050


Ala Lys  Asn Lys Val Ile Thr  Gly Asn Ile Asn Lys  Thr Arg Lys
    1055                1060                1065


Lys Gly  Gly Val Asn Lys Asn  Met Gln Gln Thr Pro  Arg Gly Gln
    1070                1075                1080


Leu His  Leu Glu Thr Ile Tyr  Gly Ser Gly Lys Gln  Tyr Leu Thr
    1085                1090                1095


Lys Glu  Glu Lys Val Asn Ala  Ser Phe Asp Met Arg  Lys Ile Gly
    1100                1105                1110


Thr Val  Ser Lys Leu Ala Tyr  Arg Asp Ala Leu Leu  Lys Arg Leu
    1115                1120                1125
```

```
Tyr Glu  Asn Asp Asn Asp Pro  Lys Lys Ala Phe Ala  Gly Lys Asn
    1130                1135                1140

Ser Leu  Asp Lys Gln Pro Ile  Trp Leu Asp Lys Glu  Gln Met Arg
    1145                1150                1155

Lys Val  Pro Glu Lys Val Lys  Ile Val Thr Leu Glu  Ala Ile Tyr
    1160                1165                1170

Thr Ile  Arg Lys Glu Ile Ser  Pro Asp Leu Lys Val  Asp Lys Val
    1175                1180                1185

Ile Asp  Val Gly Val Arg Lys  Ile Leu Ile Asp Arg  Leu Asn Glu
    1190                1195                1200

Tyr Gly  Asn Asp Ala Lys Lys  Ala Phe Ser Asn Leu  Asp Glu Asn
    1205                1210                1215

Pro Ile  Trp Leu Asn Lys Glu  Lys Gly Ile Ser Ile  Lys Arg Val
    1220                1225                1230

Thr Ile  Ser Gly Ile Ser Asn  Ala Gln Ser Leu His  Val Lys Lys
    1235                1240                1245

Asp Lys  Asp Gly Lys Pro Ile  Leu Asp Glu Asn Gly  Arg Asn Ile
    1250                1255                1260

Pro Val  Asp Phe Val Asn Thr  Gly Asn Asn His His  Val Ala Val
    1265                1270                1275

Tyr Tyr  Arg Pro Val Ile Asp  Lys Arg Gly Gln Leu  Val Val Asp
    1280                1285                1290

Glu Ala  Gly Asn Pro Lys Tyr  Glu Leu Glu Glu Val  Val Val Ser
    1295                1300                1305

Phe Phe  Glu Ala Val Thr Arg  Ala Asn Leu Gly Gln  Pro Ile Ile
    1310                1315                1320
```

```
Asp Lys  Asp Tyr Lys Thr Thr  Glu Gly Trp Gln Phe  Leu Phe Ser
    1325                1330                1335


Met Lys  Gln Asn Glu Tyr Phe  Val Phe Pro Asn Glu  Lys Thr Gly
    1340                1345                1350


Phe Asn  Pro Lys Glu Ile Asp  Leu Leu Asp Val Glu  Asn Tyr Gly
    1355                1360                1365


Leu Ile  Ser Pro Asn Leu Phe  Arg Val Gln Lys Phe  Ser Leu Lys
    1370                1375                1380


Asn Tyr  Val Phe Arg His His  Leu Glu Thr Thr Ile  Lys Asp Thr
    1385                1390                1395


Ser Ser  Ile Leu Arg Gly Ile  Thr Trp Ile Asp Phe  Arg Ser Ser
    1400                1405                1410


Lys Gly  Leu Asp Thr Ile Val  Lys Val Arg Val Asn  His Ile Gly
    1415                1420                1425


Gln Ile  Val Ser Val Gly Glu  Tyr
    1430                1435


<210>  161
<211>  1517
<212>  PRT
<213>  Bacteroides sp.

<400>  161

Met Lys Lys Ile Val Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Leu Ile Asn Ala Tyr Ile Asn Lys Glu His Leu Tyr Gly Ile Glu
            20                  25                  30


Ala Cys Gly Ser Arg Ile Ile Pro Met Asp Ala Ala Ile Leu Gly Asn
```

```
        35                  40                  45

Phe Asp Lys Gly Asn Ser Ile Ser Gln Thr Ala Asp Arg Thr Ser Tyr
    50                  55                  60

Arg Gly Ile Arg Arg Leu Arg Glu Arg His Leu Leu Arg Arg Glu Arg
65                  70                  75                  80

Leu His Arg Ile Leu Asp Leu Leu Gly Phe Leu Pro Lys His Tyr Ser
                85                  90                  95

Asp Ser Leu Asn Arg Tyr Gly Lys Phe Leu Asn Asp Ile Glu Cys Lys
            100                 105                 110

Leu Pro Trp Val Lys Asp Glu Thr Gly Ser Tyr Lys Phe Ile Phe Gln
        115                 120                 125

Glu Ser Phe Lys Glu Met Leu Ala Asn Phe Thr Glu His His Pro Ile
    130                 135                 140

Leu Ile Ala Asn Asn Lys Lys Val Pro Tyr Asp Trp Thr Ile Tyr Tyr
145                 150                 155                 160

Leu Arg Lys Lys Ala Leu Thr Gln Lys Ile Ser Lys Glu Glu Leu Ala
                165                 170                 175

Trp Ile Leu Leu Asn Phe Asn Gln Lys Arg Gly Tyr Tyr Gln Leu Arg
            180                 185                 190

Gly Glu Glu Glu Glu Thr Pro Asn Lys Leu Val Glu Tyr Tyr Ser Leu
        195                 200                 205

Lys Val Glu Lys Val Glu Asp Ser Gly Glu Arg Lys Gly Lys Asp Thr
    210                 215                 220

Trp Tyr Asn Val His Leu Glu Asn Gly Met Ile Tyr Arg Arg Thr Ser
225                 230                 235                 240
```

```
Asn Ile Pro Leu Asp Trp Glu Gly Lys Thr Lys Glu Phe Ile Val Thr
               245                 250                 255

Thr Asp Leu Glu Ala Asp Gly Ser Pro Lys Lys Asp Lys Glu Gly Asn
            260                 265                 270

Ile Lys Arg Ser Phe Arg Ala Pro Lys Asp Asp Asp Trp Thr Leu Ile
        275                 280                 285

Lys Lys Lys Thr Glu Ala Asp Ile Asp Lys Ile Lys Met Thr Val Gly
    290                 295                 300

Ala Tyr Ile Tyr Asp Thr Leu Leu Gln Lys Pro Asp Gln Lys Ile Arg
305                 310                 315                 320

Gly Lys Leu Val Arg Thr Ile Glu Arg Lys Tyr Tyr Lys Asn Glu Leu
               325                 330                 335

Tyr Gln Ile Leu Lys Thr Gln Ser Glu Phe His Glu Glu Leu Arg Asp
            340                 345                 350

Lys Gln Leu Tyr Ile Ala Cys Leu Asn Glu Leu Tyr Pro Asn Asn Glu
        355                 360                 365

Pro Arg Arg Asn Ser Ile Ser Thr Arg Asp Phe Cys His Leu Phe Ile
    370                 375                 380

Glu Asp Ile Ile Phe Tyr Gln Arg Pro Leu Lys Ser Lys Lys Ser Leu
385                 390                 395                 400

Ile Asp Asn Cys Pro Tyr Glu Glu Asn Arg Tyr Ile Asp Lys Glu Ser
               405                 410                 415

Gly Glu Ile Lys His Ala Ser Ile Lys Cys Ile Ala Lys Ser His Pro
            420                 425                 430

Leu Tyr Gln Glu Phe Arg Leu Trp Gln Phe Ile Val Asn Leu Arg Ile
```

```
        435                 440                 445

Tyr Arg Lys Glu Thr Asp Val Asp Val Thr Gln Glu Leu Leu Pro Thr
    450                 455                 460

Glu Ala Asp Tyr Val Thr Leu Phe Glu Trp Leu Asn Glu Lys Lys Glu
465                 470                 475                 480

Ile Asp Gln Lys Ala Phe Phe Lys Tyr Pro Pro Phe Gly Phe Lys Lys
                485                 490                 495

Thr Thr Ser Asn Tyr Arg Trp Asn Tyr Val Glu Asp Lys Pro Tyr Pro
            500                 505                 510

Cys Asn Glu Thr His Ala Gln Ile Ile Ala Arg Leu Gly Lys Ala His
        515                 520                 525

Ile Pro Lys Ala Phe Leu Ser Lys Glu Lys Glu Glu Thr Leu Trp His
    530                 535                 540

Ile Leu Tyr Ser Ile Glu Asp Lys Gln Glu Ile Glu Lys Ala Leu His
545                 550                 555                 560

Ser Phe Ala Asn Lys Asn Asn Leu Ser Glu Glu Phe Ile Glu Gln Phe
                565                 570                 575

Lys Asn Phe Pro Pro Phe Lys Lys Glu Tyr Gly Ser Tyr Ser Ala Lys
            580                 585                 590

Ala Ile Lys Lys Leu Leu Pro Leu Met Arg Met Gly Lys Tyr Trp Ser
        595                 600                 605

Ile Glu Asn Ile Asp Asn Gly Thr Arg Ile Arg Ile Asn Lys Ile Ile
    610                 615                 620

Asp Gly Glu Tyr Asp Glu Asn Ile Arg Glu Arg Val Arg Gln Lys Ala
625                 630                 635                 640
```

```
Ile Asn Leu Thr Asp Ile Thr His Phe Arg Ala Leu Pro Leu Trp Leu
               645                 650                 655

Ala Cys Tyr Leu Val Tyr Asp Arg His Ser Glu Val Lys Asp Ile Val
            660                 665                 670

Lys Trp Lys Thr Pro Lys Asp Ile Asp Leu Tyr Leu Lys Ser Phe Lys
        675                 680                 685

Gln His Ser Leu Arg Asn Pro Ile Val Glu Gln Val Ile Thr Glu Thr
    690                 695                 700

Leu Arg Thr Val Arg Asp Ile Trp Gln Gln Val Gly His Ile Asp Glu
705                 710                 715                 720

Ile His Ile Glu Leu Gly Arg Glu Met Lys Asn Pro Ala Asp Lys Arg
               725                 730                 735

Ala Arg Met Ser Gln Gln Met Ile Lys Asn Glu Asn Thr Asn Leu Arg
            740                 745                 750

Ile Lys Ala Leu Leu Thr Glu Phe Leu Asn Pro Glu Phe Gly Ile Glu
        755                 760                 765

Asn Val Arg Pro Tyr Ser Pro Ser Gln Gln Asp Leu Leu Arg Ile Tyr
    770                 775                 780

Glu Glu Gly Val Leu Asn Ser Ile Leu Glu Leu Pro Glu Asp Ile Gly
785                 790                 795                 800

Ile Ile Leu Gly Lys Phe Asn Gln Thr Asp Thr Leu Lys Arg Pro Thr
               805                 810                 815

Arg Ser Glu Ile Leu Arg Tyr Lys Leu Trp Leu Glu Gln Lys Tyr Arg
            820                 825                 830

Ser Pro Tyr Thr Gly Glu Met Ile Pro Leu Ser Lys Leu Phe Thr Pro
```

```
        835                 840                 845

Ala Tyr Glu Ile Glu His Ile Ile Pro Gln Ser Arg Tyr Phe Asp Asp
    850                 855                 860

Ser Leu Ser Asn Lys Val Ile Cys Glu Ser Glu Ile Asn Lys Leu Lys
865                 870                 875                 880

Asp Arg Ser Leu Gly Tyr Glu Phe Ile Lys Asn His His Gly Glu Lys
                885                 890                 895

Val Glu Leu Ala Phe Asp Lys Pro Val Glu Val Leu Ser Val Glu Ala
            900                 905                 910

Tyr Glu Lys Leu Val His Glu Ser Tyr Ser His Asn Arg Ser Lys Met
        915                 920                 925

Lys Lys Leu Leu Met Glu Asp Ile Pro Asp Gln Phe Ile Glu Arg Gln
    930                 935                 940

Leu Asn Asp Ser Arg Tyr Ile Ser Lys Val Val Lys Ser Leu Leu Ser
945                 950                 955                 960

Asn Ile Val Arg Glu Glu Asn Glu Gln Glu Ala Ile Ser Lys Asn Val
                965                 970                 975

Ile Pro Cys Thr Gly Gly Ile Thr Asp Arg Leu Lys Lys Asp Trp Gly
            980                 985                 990

Ile Asn Asp Val Trp Asn Lys Ile  Val Leu Pro Arg Phe  Ile Arg Leu
        995                 1000                1005

Asn Glu  Leu Thr Glu Ser Thr  Arg Phe Thr Ser Ile  Asn Thr Asn
    1010                1015                1020

Asn Thr  Met Ile Pro Ser Met  Pro Leu Glu Leu Gln  Lys Gly Phe
    1025                1030                1035
```

```
Asn Lys  Lys Arg Ile Asp His  Arg His His Ala Met  Asp Ala Ile
    1040                1045                1050

Ile Ile  Ala Cys Ala Asn Arg  Asn Ile Val Asn Tyr  Leu Asn Asn
    1055                1060                1065

Val Ser  Ala Ser Lys Asn Thr  Lys Ile Thr Arg Arg  Asp Leu Gln
    1070                1075                1080

Thr Leu  Leu Cys His Lys Asp  Lys Thr Asp Asn Asn  Gly Asn Tyr
    1085                1090                1095

Lys Trp  Val Ile Asp Lys Pro  Trp Glu Thr Phe Thr  Gln Asp Thr
    1100                1105                1110

Leu Thr  Ala Leu Gln Lys Ile  Thr Val Ser Phe Lys  Gln Asn Leu
    1115                1120                1125

Arg Val  Ile Asn Lys Thr Thr  Asn His Tyr Gln His  Tyr Glu Asn
    1130                1135                1140

Gly Lys  Lys Ile Val Ser Asn  Gln Ser Lys Gly Asp  Ser Trp Ala
    1145                1150                1155

Ile Arg  Lys Ser Met His Lys  Glu Thr Val His Gly  Glu Val Asn
    1160                1165                1170

Leu Arg  Met Ile Lys Thr Val  Ser Phe Asn Glu Ala  Leu Lys Lys
    1175                1180                1185

Pro Gln  Ala Ile Val Glu Met  Asp Leu Lys Lys Lys  Ile Leu Ala
    1190                1195                1200

Met Leu  Glu Leu Gly Tyr Asp  Thr Lys Arg Ile Lys  Asn Tyr Phe
    1205                1210                1215

Glu Glu  Asn Lys Asp Thr Trp  Gln Asp Ile Asn Pro  Ser Lys Ile
```

```
    1220                1225                1230

Lys Val  Tyr Tyr Phe Thr Lys  Glu Thr Lys Asp Arg  Tyr Phe Ala
    1235                1240                1245

Val Arg  Lys Pro Ile Asp Thr  Ser Phe Asp Lys Lys  Lys Ile Lys
    1250                1255                1260

Glu Ser  Ile Thr Asp Thr Gly  Ile Gln Gln Ile Met  Leu Arg His
    1265                1270                1275

Leu Glu  Thr Lys Asp Asn Asp  Pro Thr Leu Ala Phe  Ser Pro Asp
    1280                1285                1290

Gly Ile  Asp Glu Met Asn Arg  Asn Ile Leu Ile Leu  Asn Lys Gly
    1295                1300                1305

Lys Lys  His Gln Pro Ile Tyr  Lys Val Arg Val Tyr  Glu Lys Ala
    1310                1315                1320

Glu Lys  Phe Thr Val Gly Gln  Lys Gly Asn Lys Arg  Thr Lys Phe
    1325                1330                1335

Val Glu  Ala Ala Lys Gly Thr  Asn Leu Phe Phe Ala  Ile Tyr Glu
    1340                1345                1350

Thr Glu  Glu Ile Asp Lys Asp  Thr Lys Lys Val Ile  Arg Lys Arg
    1355                1360                1365

Ser Tyr  Ser Thr Ile Pro Leu  Asn Val Val Ile Glu  Arg Gln Lys
    1370                1375                1380

Gln Gly  Leu Ser Ser Ala Pro  Glu Asp Glu Asn Gly  Asn Leu Pro
    1385                1390                1395

Lys Tyr  Ile Leu Ser Pro Asn  Asp Leu Val Tyr Val  Pro Thr Gln
    1400                1405                1410
```

```
Glu Glu  Ile Asn Lys Gly Glu  Val Val Met Pro Ile  Asp Arg Asp
    1415                1420                1425


Arg Ile  Tyr Lys Met Val Asp  Ser Ser Gly Ile Thr  Ala Asn Phe
    1430                1435                1440


Ile Pro  Ala Ser Thr Ala Asn  Leu Ile Phe Ala Leu  Pro Lys Ala
    1445                1450                1455


Thr Ala  Glu Ile Tyr Cys Asn  Gly Glu Asn Cys Ile  Gln Asn Glu
    1460                1465                1470


Tyr Gly  Ile Gly Ser Pro Gln  Ser Lys Asn Gln Lys  Ala Ile Thr
    1475                1480                1485


Gly Glu  Met Val Lys Glu Ile  Cys Phe Pro Ile Lys  Val Asp Arg
    1490                1495                1500


Leu Gly  Asn Ile Ile Gln Val  Gly Ser Cys Ile Leu  Thr Asn
    1505                1510                1515
```

<210> 162
<211> 1399
<212> PRT
<213> Olsenella uli

<400> 162

```
Met Asn Leu Arg Asn Thr Thr Asp Glu Tyr Asn Ile Gly Leu Asp Met
1               5                  10                  15


Gly Thr Asn Ser Val Gly Trp Ala Val Thr Asp Lys Ala Gly Ala Ile
            20                  25                  30


Ala His Phe Lys Gly Lys Pro Thr Leu Gly Ser Arg Leu Phe Asp Ala
        35                  40                  45


Ala Gln Thr Ala Ala Gly Ala Arg Ile His Arg Ser Gln Arg Arg Arg
    50                  55                  60
```

```
Tyr Val Arg Arg Arg Trp Arg Leu Asp Leu Leu Gln Ser Leu Phe Gln
65                  70                  75                  80

Asp Glu Val Ser Lys Val Asp Ser Glu Phe Phe Cys Arg Leu Arg Gln
                85                  90                  95

Ser Arg Leu Tyr Val Gly Asp Arg Glu Lys Gly His Ala Asp Tyr Thr
            100                 105                 110

Trp Pro Ile Phe Asn Asp Ser Asp Phe Asn Glu Val Asp Tyr Tyr Lys
        115                 120                 125

Arg Phe Pro Thr Ile Tyr His Leu Arg Lys Trp Leu Met Glu Thr Asp
    130                 135                 140

Glu Lys Ala Asp Ile Arg Leu Ile Tyr Leu Ala Thr His Asn Ile Val
145                 150                 155                 160

Lys His Arg Gly Asn Phe Leu Arg Glu Asn Asn Lys Ser Leu Ser Ser
                165                 170                 175

Arg Asp Ala Asn Pro Ala Gln Ala Val Lys Ser Leu Arg Leu Ala Leu
            180                 185                 190

Asn Asp Trp Cys Ser Glu Arg Asp Tyr Glu Cys Ala Trp Lys Gly Glu
        195                 200                 205

Glu Asp Asp Gly Ala Ile Asp Glu Ala Ile Leu Asn Val Leu Ala Asp
    210                 215                 220

Gly Glu Lys Gly Arg Ser Asp Gln Ala Lys Glu Ile Ala Lys Leu Thr
225                 230                 235                 240

Gly Val Asp Cys Gly Asp Ala Lys Gln Ser Lys Gln Cys Asn Glu Ala
                245                 250                 255
```

```
Ile Ala Lys Ala Ile Val Gly Leu Lys Val Glu Met Lys Asn Ile Phe
            260                 265                 270

Gly Glu Phe Pro Ala Glu Lys Thr Ser Tyr Ile Tyr Leu Ser Ser Asp
        275                 280                 285

Glu Asp Val Glu Ala Val Arg Glu Ser Cys Pro Asp Asp Ser Gly Glu
    290                 295                 300

Leu Phe Gln Ala Leu Cys Lys Leu Tyr Ser Ala Tyr Ile Leu Gln Glu
305                 310                 315                 320

Leu Leu Ser Tyr Ala Asp Pro Ser Gly Gln Thr Ile Ser Ala Asn Met
                325                 330                 335

Val Ala Lys Tyr Lys Gln Tyr Gly Arg Asp Leu Arg Leu Leu Lys Glu
            340                 345                 350

Leu Thr Arg Thr Tyr Ala Pro Gln Lys Tyr Asp Leu Phe Phe Arg Gly
        355                 360                 365

Glu Thr Tyr Ala Gly Ser Ser Asp Tyr Val Val Asp Glu Ala Arg Gly
    370                 375                 380

Tyr Thr Arg Tyr Asn Leu Gly Thr Thr Lys Ala Asn Tyr Asp Asp Phe
385                 390                 395                 400

Gln Lys Ser Val Lys Glu Leu Phe Lys Gly Thr Asp Ala Leu Gln Asp
                405                 410                 415

Glu Arg Tyr Gln Glu Met Met Val Ala Phe Gly Glu Gln Lys Phe Leu
            420                 425                 430

Arg Arg Leu Lys Thr Ser Asp Asn Gly Ser Ile Tyr Tyr Gln Leu His
        435                 440                 445

Leu Glu Glu Leu His Thr Ile Leu Glu Asn Gln Gly Lys His Tyr Pro
    450                 455                 460
```

```
Phe Leu Leu Ser Glu Glu Asp Lys Ile Glu Ser Leu Val Ser Phe Arg
465                 470                 475                 480

Ile Pro Tyr Tyr Val Gly Pro Leu Thr Arg Lys Asn Ala Ala Ile Gly
                485                 490                 495

His Asp Gly Lys Glu Arg Phe Ala Trp Ser Ser Arg Lys Asp Gly Met
            500                 505                 510

Glu His Ala Val Ile Thr Pro Trp Asn Trp Glu Glu Ile Ile Asp Arg
        515                 520                 525

Asp Lys Ser Ala Glu Asp Phe Ile Met Arg Met Thr Gly Asp Cys Thr
    530                 535                 540

Tyr Leu Gln Gly Glu Pro Val Leu Pro Lys Cys Ser Leu Leu Tyr Glu
545                 550                 555                 560

Glu Phe Cys Ala Leu Asn Glu Phe Asn Gly Ala His Trp Thr Val Asp
                565                 570                 575

Gly Asp Asp Glu Arg Arg Phe Asp Ala Ala Gln Arg Glu Arg Ile Met
            580                 585                 590

Cys Asp Leu Phe Arg Arg Thr Arg Ser Val Thr Tyr Asn Lys Val Ser
        595                 600                 605

Asp Trp Leu Glu Arg Lys Tyr Asn Phe Thr Gly Ala Arg Val Arg Gly
    610                 615                 620

Gly Gln Gly Glu His Gly Phe Glu Ser Lys Leu Gly Ser Tyr Ile Phe
625                 630                 635                 640

Phe Cys Lys Asp Val Phe Lys Thr Asp Gly Leu Asp Glu Ala Asp Tyr
                645                 650                 655
```

```
Thr Met Ile Glu Gln Ile Ile Leu Trp Ser Thr Leu Phe Glu Asp Arg
            660                 665                 670

Asp Ile Leu Lys Arg Lys Ile Glu Glu Ala Tyr Gly Gly Asp Arg Leu
        675                 680                 685

Thr Ser Glu Gln Ile Lys Val Ile Cys Lys Lys Arg Phe Thr Gly Trp
    690                 695                 700

Gly Arg Leu Ser Lys Arg Leu Leu Thr Asp Ile Lys Val Asn Thr Asp
705                 710                 715                 720

Thr Gly Arg Lys Ser Ile Met Asp Val Leu Arg Glu Gly Asn Pro Asn
                725                 730                 735

Asn Gly Gln Arg Ser Arg Thr Met Val Phe Met Glu Val Leu Arg Asp
            740                 745                 750

Glu Asp Leu Gly Phe Gln Lys Ala Ile Asp Gly Leu Asn Arg Asp Tyr
        755                 760                 765

Phe Arg Glu His Asn Asn Gly Leu Met Asp Val Asn Asp Leu Pro Gly
    770                 775                 780

Ser Pro Ala Ile Arg Arg Ser Ile Asn Gln Ala Val Arg Ile Val Asp
785                 790                 795                 800

Glu Ile Ala Ser Ile Ala Arg Lys Glu Pro Thr Asn Ile Phe Ile Glu
                805                 810                 815

Val Thr Arg Glu Glu Asp Asp Pro Arg Lys Lys Gly Lys Arg Thr Lys
            820                 825                 830

Arg Arg Tyr Asp Ala Ile Lys Ser Ala Leu Glu Lys Phe Lys Lys Asp
        835                 840                 845

Asp Pro Ser Leu Trp Lys Glu Leu Cys Glu Lys Ala Pro Gly Asp Met
    850                 855                 860
```

```
Asp Glu Arg Leu Ser Leu Tyr Phe Met Gln Arg Gly Lys Cys Met Tyr
865                 870                 875                 880

Ser Gly Arg Pro Ile Lys Ile Glu Glu Leu His Thr Gly Lys Tyr Glu
                885                 890                 895

Val Asp His Ile Ile Pro Arg Ser Tyr Ile Lys Asp Asp Ser Phe Glu
            900                 905                 910

Asn Lys Val Leu Val Tyr Arg Glu Glu Asn Gln His Lys Thr Asp Ala
        915                 920                 925

Leu Leu Ile Asp Ser Ser Ile Arg Gln Lys Met Gly Gly Tyr Trp Arg
    930                 935                 940

Met Leu His Asp Ala Lys Leu Val Gly Asp Lys Lys Phe Arg Asn Leu
945                 950                 955                 960

Phe Arg Asn His Ile Asp Asp Lys Ala Met Lys Gly Phe Val Ala Arg
                965                 970                 975

Gln Ile Val Glu Thr Ser Gln Met Val Lys Leu Val Gln Thr Leu Phe
            980                 985                 990

Glu Ala Arg Tyr Pro Asn Thr Arg  Ile Val Pro Val Lys  Ala Gly Ile
        995                 1000                1005

Ser His  Asp Leu Arg Glu Ala  Ala Gly Leu Val Lys  Cys Arg Glu
    1010                1015                1020

Ala Asn  Asp Phe His His Ala  His Asp Ala Phe Leu  Ala Cys Arg
    1025                1030                1035

Ile Gly  Leu Phe Ile Gln Lys  Arg His Pro Ser Val  Tyr Asp Asn
    1040                1045                1050
```

```
Pro Ile  Gly Leu Ala Arg Ile  Met Arg Asp Tyr Ala  Arg Met Gln
    1055                1060                1065

Ala Arg  Glu Tyr Lys Lys Ser  His Cys Leu Ala His  Thr Gln Gly
    1070                1075                1080

Phe Ile  Val Asn Ser Phe Leu  Ser Ser Gly Phe Asp  Glu Glu Thr
    1085                1090                1095

Gly Glu  Ile Phe Lys Asp Asp  Trp Asp Ala Lys Ala  Glu Val Glu
    1100                1105                1110

Gly Ile  Arg Arg Val Leu Asn  Cys Arg Gln Cys Phe  Ile Ser Arg
    1115                1120                1125

Met Pro  Val Glu Gly Asp Thr  Arg Tyr Gly Gly Arg  Tyr Trp Gly
    1130                1135                1140

Glu Thr  Ile Tyr Ser Pro Lys  Gly Lys His Lys His  Glu Ile Pro
    1145                1150                1155

Leu Lys  Gln Gly Leu Asp Pro  Asn Leu Tyr Gly Gly  Tyr Ser Asp
    1160                1165                1170

Leu Leu  Tyr Ser Tyr Phe Leu  Ile Tyr Glu Ala Ser  Asp Val Ser
    1175                1180                1185

Ser Gly  Glu Arg Val Leu Arg  Phe Ile Gly Ile Pro  Thr Ser Ile
    1190                1195                1200

Ala Ala  Arg Met Ala Asn Gln  Lys Arg Leu Glu Glu  Tyr Val Ser
    1205                1210                1215

Arg Leu  Ala Leu Gln Glu Asn  Leu Glu His Val Arg  Met Val Arg
    1220                1225                1230

Lys Ile  Met Lys Lys Gln Leu  Ile Glu Val Asp Asn  Cys Arg Leu
    1235                1240                1245
```

```
Leu Val  Thr Ala Ala Asp Ala  Val Thr Asn Ala Thr  Glu Leu Ala
    1250                1255                1260

Phe Ser  Leu Asp Glu Met Lys  Ile Ile Ser Thr Cys  Ala Lys Cys
    1265                1270                1275

Ile Asn  Gly Ala Asp Pro Ser  Ala Ile Asp Lys Ile  Gly Asn Ala
    1280                1285                1290

Gln Asp  Ser Phe Phe Asp Asn  Leu Lys Arg Arg Gly  Ser Asp Arg
    1295                1300                1305

Cys Ala  Leu Leu Phe Ser Gln  Leu Lys Leu Asp Lys  Leu Ser Gln
    1310                1315                1320

Asn Phe  Tyr Met Ile Ser Ser  Asp Asp Lys Ser Lys  Ile Leu Ile
    1325                1330                1335

Ser Ile  Leu Asp Arg Ile Arg  Ala Lys Ser Asn Ser  Val Asp Leu
    1340                1345                1350

Ser Leu  Val Gly Gly Ala Lys  His Ala Ala Gln Met  Lys Phe Asp
    1355                1360                1365

Phe Asn  Ala Lys Leu Asn Asn  Pro Ala Ser Ser Phe  Val Leu Ile
    1370                1375                1380

Asp Gln  Ser Val Thr Gly Met  Phe Glu Arg Arg Thr  Arg Ile Gly
    1385                1390                1395

Leu
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<400> 163

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Met Glu Thr Gln Thr Ser Asn Gln Leu Ile Thr Ser His Leu Lys Asp
1               5                  10                  15

Tyr Pro Lys Gln Asp Tyr Phe Val Gly Leu Asp Ile Gly Thr Asn Ser
            20                  25                  30

Val Gly Trp Ala Val Thr Asn Thr Ser Tyr Glu Leu Leu Lys Phe His
        35                  40                  45

Ser His Lys Met Trp Gly Ser Arg Leu Phe Glu Glu Gly Glu Ser Ala
    50                  55                  60

Val Thr Arg Arg Gly Phe Arg Ser Met Arg Arg Arg Leu Glu Arg Arg
65                  70                  75                  80

Lys Leu Arg Leu Lys Leu Leu Glu Glu Leu Phe Ala Asp Ala Met Ala
                85                  90                  95

Gln Val Asp Ser Thr Phe Phe Ile Arg Leu His Glu Ser Lys Tyr His
            100                 105                 110

Tyr Glu Asp Lys Thr Thr Gly His Ser Ser Lys His Ile Leu Phe Ile
        115                 120                 125

Asp Glu Asp Tyr Thr Asp Gln Asp Tyr Phe Thr Glu Tyr Pro Thr Ile
    130                 135                 140

Tyr His Leu Arg Lys Asp Leu Met Glu Asn Gly Thr Asp Asp Ile Arg
145                 150                 155                 160

Lys Leu Phe Leu Ala Val His His Ile Leu Lys Tyr Arg Gly Asn Phe
                165                 170                 175

Leu Tyr Glu Gly Ala Thr Phe Asn Ser Asn Ala Phe Thr Phe Glu Asp
            180                 185                 190
```

```
Val Leu Lys Gln Ala Leu Val Asn Ile Thr Phe Asn Cys Phe Asp Thr
        195                 200                 205

Asn Ser Ala Ile Ser Ser Ile Ser Asn Ile Leu Met Glu Ser Gly Lys
    210                 215                 220

Thr Lys Ser Asp Lys Ala Lys Ala Ile Glu Arg Leu Val Asp Thr Tyr
225                 230                 235                 240

Thr Val Phe Asp Glu Val Asn Thr Pro Asp Lys Pro Gln Lys Glu Gln
                245                 250                 255

Val Lys Glu Asp Lys Lys Thr Leu Lys Ala Phe Ala Asn Leu Val Leu
            260                 265                 270

Gly Leu Ser Ala Asn Leu Ile Asp Leu Phe Gly Ser Val Glu Asp Ile
        275                 280                 285

Asp Asp Asp Leu Lys Lys Leu Gln Ile Val Gly Asp Thr Tyr Asp Glu
    290                 295                 300

Lys Arg Asp Glu Leu Ala Lys Val Trp Gly Asp Glu Ile His Ile Ile
305                 310                 315                 320

Asp Asp Cys Lys Ser Val Tyr Asp Ala Ile Ile Leu Met Ser Ile Lys
                325                 330                 335

Glu Pro Gly Leu Thr Ile Ser Gln Ser Lys Val Lys Ala Phe Asp Lys
            340                 345                 350

His Lys Glu Asp Leu Val Ile Leu Lys Ser Leu Leu Lys Leu Asp Arg
        355                 360                 365

Asn Val Tyr Asn Glu Met Phe Lys Ser Asp Lys Lys Gly Leu His Asn
    370                 375                 380

Tyr Val His Tyr Ile Lys Gln Gly Arg Thr Glu Glu Thr Ser Cys Ser
```

```
385                 390                 395                 400

Arg Glu Asp Phe Tyr Lys Tyr Thr Lys Lys Ile Val Glu Gly Leu Ala
                405                 410                 415

Asp Ser Lys Asp Lys Glu Tyr Ile Leu Asn Glu Ile Glu Leu Gln Thr
            420                 425                 430

Leu Leu Pro Leu Gln Arg Ile Lys Asp Asn Gly Val Ile Pro Tyr Gln
        435                 440                 445

Leu His Leu Glu Glu Leu Lys Val Ile Leu Asp Lys Cys Gly Pro Lys
    450                 455                 460

Phe Pro Phe Leu His Thr Val Ser Asp Gly Phe Ser Val Thr Glu Lys
465                 470                 475                 480

Leu Ile Lys Met Leu Glu Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu
                485                 490                 495

Asn Thr His His Asn Ile Asp Asn Gly Gly Phe Ser Trp Ala Val Arg
            500                 505                 510

Lys Gln Ala Gly Arg Val Thr Pro Trp Asn Phe Glu Glu Lys Ile Asp
        515                 520                 525

Arg Glu Lys Ser Ala Ala Ala Phe Ile Lys Asn Leu Thr Asn Lys Cys
    530                 535                 540

Thr Tyr Leu Phe Gly Glu Asp Val Leu Pro Lys Ser Ser Leu Leu Tyr
545                 550                 555                 560

Ser Glu Phe Met Leu Leu Asn Glu Leu Asn Asn Val Arg Ile Asp Gly
                565                 570                 575

Lys Ala Leu Ala Gln Gly Val Lys Gln His Leu Ile Asp Ser Ile Phe
            580                 585                 590
```

```
Lys Gln Asp His Lys Lys Met Thr Lys Asn Arg Ile Glu Leu Phe Leu
        595                 600                 605

Lys Asp Asn Asn Tyr Ile Thr Lys Lys His Lys Pro Glu Ile Thr Gly
    610                 615                 620

Leu Asp Gly Glu Ile Lys Asn Asp Leu Thr Ser Tyr Arg Asp Met Val
625                 630                 635                 640

Arg Ile Leu Gly Asn Asn Phe Asp Val Ser Met Ala Glu Asp Ile Ile
                645                 650                 655

Thr Asp Ile Thr Ile Phe Gly Glu Ser Lys Lys Met Leu Arg Gln Thr
            660                 665                 670

Leu Arg Asn Lys Phe Gly Ser Gln Leu Asn Asp Glu Thr Ile Lys Lys
        675                 680                 685

Leu Ser Lys Leu Arg Tyr Arg Asp Trp Gly Arg Leu Ser Lys Lys Leu
    690                 695                 700

Leu Lys Gly Ile Asp Gly Cys Asp Lys Ala Gly Asn Gly Ala Pro Lys
705                 710                 715                 720

Thr Ile Ile Glu Leu Met Arg Asn Asp Ser Tyr Asn Leu Met Glu Ile
                725                 730                 735

Leu Gly Asp Lys Phe Ser Phe Met Glu Cys Ile Glu Glu Glu Asn Ala
            740                 745                 750

Lys Leu Ala Gln Gly Gln Val Val Asn Pro His Asp Ile Ile Asp Glu
        755                 760                 765

Leu Ala Leu Ser Pro Ala Val Lys Arg Ala Val Trp Gln Ala Leu Arg
    770                 775                 780

Ile Val Asp Glu Val Ala His Ile Lys Lys Ala Leu Pro Ser Arg Ile
```

```
785                 790                 795                 800

Phe Val Glu Val Ala Arg Thr Asn Lys Ser Glu Lys Lys Lys Lys Asp
                805                 810                 815

Ser Arg Gln Lys Arg Leu Ser Asp Leu Tyr Ser Ala Ile Lys Lys Asp
            820                 825                 830

Asp Val Leu Gln Ser Gly Leu Gln Asp Lys Glu Phe Gly Ala Leu Lys
        835                 840                 845

Ser Gly Leu Ala Asn Tyr Asp Asp Ala Ala Leu Arg Ser Lys Lys Leu
    850                 855                 860

Tyr Leu Tyr Tyr Thr Gln Met Gly Arg Cys Ala Tyr Thr Gly Asn Ile
865                 870                 875                 880

Ile Asp Leu Asn Gln Leu Asn Thr Asp Asn Tyr Asp Ile Asp His Ile
                885                 890                 895

Tyr Pro Arg Ser Leu Thr Lys Asp Asp Ser Phe Asp Asn Leu Val Leu
            900                 905                 910

Cys Glu Arg Thr Ala Asn Ala Lys Lys Ser Asp Ile Tyr Pro Ile Asp
        915                 920                 925

Asn Arg Ile Gln Thr Lys Gln Lys Pro Phe Trp Ala Phe Leu Lys His
    930                 935                 940

Gln Gly Leu Ile Ser Glu Arg Lys Tyr Glu Arg Leu Thr Arg Ile Ala
945                 950                 955                 960

Pro Leu Thr Ala Asp Asp Leu Ser Gly Phe Ile Ala Arg Gln Leu Val
                965                 970                 975

Glu Thr Asn Gln Ser Val Lys Ala Thr Thr Thr Leu Leu Arg Arg Leu
            980                 985                 990
```

```
Tyr Pro Asp Ile Asp Val Val Phe  Val Lys Ala Glu Asn  Val Ser Asp
        995                 1000                1005


Phe Arg  His Asn Asn Asn Phe  Ile Lys Val Arg Ser  Leu Asn His
    1010                1015                1020


His His  His Ala Lys Asp Ala  Tyr Leu Asn Ile Val  Val Gly Asn
    1025                1030                1035


Val Tyr  His Glu Lys Phe Thr  Arg Asn Phe Arg Leu  Phe Phe Lys
    1040                1045                1050


Lys Asn  Gly Ala Asn Arg Thr  Tyr Asn Leu Ala Lys  Met Phe Asn
    1055                1060                1065


Tyr Asp  Val Ile Cys Thr Asn  Ala Gln Asp Gly Lys  Ala Trp Asp
    1070                1075                1080


Val Lys  Thr Ser Met Asn Thr  Val Lys Lys Met Met  Ala Ser Asn
    1085                1090                1095


Asp Val  Arg Val Thr Arg Arg  Leu Leu Glu Gln Ser  Gly Ala Leu
    1100                1105                1110


Ala Asp  Ala Thr Ile Tyr Lys  Ala Ser Val Ala Ala  Lys Ala Lys
    1115                1120                1125


Asp Gly  Ala Tyr Ile Gly Met  Lys Thr Lys Tyr Ser  Val Phe Ala
    1130                1135                1140


Asp Val  Thr Lys Tyr Gly Gly  Met Thr Lys Ile Lys  Asn Ala Tyr
    1145                1150                1155


Ser Ile  Ile Val Gln Tyr Thr  Gly Lys Lys Gly Glu  Glu Ile Lys
    1160                1165                1170


Glu Ile  Val Pro Leu Pro Ile  Tyr Leu Ile Asn Arg  Asn Ala Thr
```

```
    1175                1180                1185

Asp Ile  Glu Leu Ile Asp Tyr  Val Lys Ser Val Ile  Pro Lys Ala
    1190                1195                1200

Lys Asp  Ile Ser Ile Lys Tyr  Arg Lys Leu Cys Ile  Asn Gln Leu
    1205                1210                1215

Val Lys  Val Asn Gly Phe Tyr  Tyr Tyr Leu Gly Gly  Lys Thr Asn
    1220                1225                1230

Asp Lys  Ile Tyr Ile Asp Asn  Ala Ile Glu Leu Val  Val Pro His
    1235                1240                1245

Asp Ile  Ala Thr Tyr Ile Lys  Leu Leu Asp Lys Tyr  Asp Leu Leu
    1250                1255                1260

Arg Lys  Glu Asn Lys Thr Leu  Lys Ala Ser Ser Ile  Thr Thr Ser
    1265                1270                1275

Ile Tyr  Asn Ile Asn Thr Ser  Thr Val Val Ser Leu  Ser Asn Lys
    1280                1285                1290

Val Gly  Ile Asp Val Phe Asp  Tyr Phe Met Ser Lys  Leu Arg Thr
    1295                1300                1305

Pro Leu  Tyr Met Lys Met Lys  Gly Asn Lys Val Asp  Glu Leu Ser
    1310                1315                1320

Ser Thr  Gly Arg Ser Lys Phe  Ile Lys Met Thr Leu  Glu Glu Gln
    1325                1330                1335

Ser Ile  Tyr Leu Leu Glu Val  Leu Asn Leu Leu Thr  Asn Ser Lys
    1340                1345                1350

Thr Thr  Phe Asp Val Lys Pro  Leu Gly Ile Thr Gly  Ser Arg Ser
    1355                1360                1365
```

```
Thr Ile  Gly Val Lys Ile His  Asn Leu Asp Glu Phe  Lys Ile Ile
    1370                1375                1380


Asn Glu  Ser Ile Thr Gly Leu  Tyr Ser Asn Glu Val  Thr Ile Val
    1385                1390                1395


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<400>  164

Met Glu Lys Gln Arg Ile Leu Gly Leu Asp Pro Gly Thr Asn Ser Leu
1               5                   10                  15


Gly Trp Ala Val Leu Asp Phe Asp Asn Ser Lys Gln Glu Tyr Asn Leu
            20                  25                  30


Val Arg Lys Gly Glu Val Ile Phe Glu Glu Gly Val Gly Lys Ser Lys
        35                  40                  45


Arg Gly Glu Phe Ser Lys Ala Ala Tyr Arg Thr Phe Tyr Lys Ser Thr
    50                  55                  60


Arg Lys His Tyr Phe Arg Arg Arg Leu Arg Lys Ile Glu Val Leu Lys
65                  70                  75                  80


Val Leu Val Lys Tyr Asp Phe Cys Pro Tyr Leu Ser Asp Asp Leu Leu
                85                  90                  95


Lys Gln Trp His Glu Lys Lys Ile Tyr Pro Ala Val Lys Glu Phe Met
            100                 105                 110


Asp Trp Gln Arg Thr Ser Asp Ala Glu Gly Lys Asn Pro Tyr Tyr Asp
        115                 120                 125


Arg His Cys Cys Leu Asn Glu Lys Leu Asp Leu Ser Leu Lys Ser Asp
    130                 135                 140
```

```
Arg Tyr Val Leu Gly Arg Ala Leu Tyr His Leu Thr Gln Arg Arg Gly
145                 150                 155                 160

Phe Lys Ser Asn Arg Leu Ile Gln Asn Asn Asp Glu Asn Glu Glu Gly
                165                 170                 175

Lys Val Lys Lys Gly Ile Ser Glu Leu Ser Thr Glu Met Gln Glu Ala
            180                 185                 190

Asn Cys Asn Tyr Leu Gly Asp Tyr Phe Tyr Lys Leu Tyr Thr Glu Lys
        195                 200                 205

Gly Asn Thr Val Gln Ile Arg Lys Arg Tyr Thr Asp Arg Glu Lys His
    210                 215                 220

Tyr Lys Asn Glu Phe Asn Ala Ile Cys Glu Lys Gln Glu Leu Asn Glu
225                 230                 235                 240

Thr Ile Val Lys Glu Leu Asp Lys Ala Ile Phe Phe Gln Arg Lys Leu
                245                 250                 255

Lys Pro Gln Arg His Gly Val Gly Lys Cys Thr Phe Glu Pro Asn Asn
            260                 265                 270

Arg Arg Cys Ala Ile Ser His Pro Asp Phe Glu Arg Phe Arg Met Leu
        275                 280                 285

Cys Phe Ile Asn Asn Ile Lys Ile Lys Thr Pro Phe Glu Glu Asn Leu
    290                 295                 300

Arg Pro Leu Asn Asn Glu Glu Lys Ala Leu Ile Glu Pro Leu Phe Tyr
305                 310                 315                 320

Arg Lys Ser Ile Lys Asn Phe Asp Phe Glu Glu Ile Ala Lys Lys Leu
                325                 330                 335
```

```
Ala Gly Lys Asn Asn Tyr Cys Tyr Ile Lys Asp Asp Ser Ser Lys Gln
            340                 345                 350

Tyr Lys Phe Asn Tyr Arg Met Ser Gln Gly Ala Ser Thr Cys Gln Thr
        355                 360                 365

Ile Ala Lys Leu Lys Ser Ile Phe Gly Glu Glu Trp Lys Asn Gly Ile
    370                 375                 380

Ala Glu Thr Tyr Thr Asn Arg Arg Lys Lys Glu Gly Leu Lys Lys Gln
385                 390                 395                 400

Ala Glu Met Val Asp Asp Ile Trp Asn Val Leu Tyr Ser Val Ser Glu
                405                 410                 415

Cys Asp Val Leu Lys Asp Phe Ala Ile Asn Lys Leu Gln Leu Asp Glu
            420                 425                 430

Lys Thr Ala Asp Asn Phe Ser Lys Thr Lys Leu Ala Gln Gly Phe Ala
        435                 440                 445

Thr Leu Ser Leu Lys Ala Ile Arg Lys Ile Leu Pro Phe Leu Glu Gln
    450                 455                 460

Gly Phe Gly Tyr Thr Glu Ala Val Phe Leu Ala Asn Ile Pro Thr Val
465                 470                 475                 480

Val Gly Lys Glu Tyr Trp Asn Asn Glu Asp Ile Arg Asn Asp Ile Met
                485                 490                 495

Glu Glu Ile Lys Thr Ile Phe Tyr His Asn Thr Leu Lys Thr Asn Asp
            500                 505                 510

Ser His Asn Thr Ile Leu Phe Cys Ile Lys Asp Ile Leu Ser Asn Asn
        515                 520                 525

Phe Asp Leu Ala Pro Gly Ala Ile Asp Lys Leu Tyr His Pro Ser Met
    530                 535                 540
```

```
Ile Asn Val Tyr Lys Asp Val Ile Pro Asn Glu Asp Gly Ile Leu Gln
545                 550                 555                 560

Leu Gly Ser Pro Lys Ile Asp Ala Val Lys Asn Pro Met Ala Met Arg
                565                 570                 575

Ser Leu His Ile Ile Arg Lys Val Val Asn Glu Leu Leu Arg Glu Gly
            580                 585                 590

Ile Ile Asn Ser Asp Thr Glu Val Arg Ile Glu Tyr Ala Arg Glu Leu
        595                 600                 605

Asn Asp Ala Asn Lys Arg His Ala Ile Ala Asp Trp Gln Lys Lys Gln
    610                 615                 620

Tyr Gly Lys His Gln Lys Tyr Arg Lys Glu Ile Lys Glu Leu Phe Lys
625                 630                 635                 640

Ala Glu Thr Gly Phe Glu Ile Glu Pro Asn Glu Thr Asp Ile Leu Lys
                645                 650                 655

Phe Glu Leu Trp Glu Glu Gln Asn His Ile Cys Leu Tyr Thr Gly Gln
            660                 665                 670

Glu Ile Gly Ile Ser Glu Phe Val Gly Glu Asn Pro Lys Tyr Asp Ile
        675                 680                 685

Glu His Thr Ile Pro Arg Ser Leu Gly Gly Asp Ser Thr Lys Met Asn
    690                 695                 700

Met Thr Leu Cys Glu Asn Lys Phe Asn Arg Glu Asn Lys Gln Lys Lys
705                 710                 715                 720

Leu Pro Ser Glu Leu Ala Asn His Ser Glu Ile Leu Glu Arg Ile Asp
                725                 730                 735
```

```
Asp Trp Lys Lys Lys Ile Tyr Ile Leu Gln Lys Lys Tyr Asp Ser Ile
            740                 745                 750

Arg Thr His Asn Gly Met Asp Lys Glu Asn Lys Asp Lys Lys Ile Val
        755                 760                 765

Ser Met Gln Val Arg Ile Ser Gly Ser Ser Ile Cys Val Tyr Ser Gln
    770                 775                 780

Asn Thr Leu Leu Trp Leu Gln Tyr Gly Tyr Asn
785                 790                 795
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Met Gly Lys Thr His Ile Ile Gly Val Gly Leu Asp Leu Gly Gly Thr
1               5                   10                  15

Tyr Thr Gly Thr Phe Ile Thr Ser His Pro Ser Asp Glu Ala Glu His
            20                  25                  30

Arg Asp His Ser Ser Ala Phe Thr Val Val Asn Ser Glu Lys Leu Ser
        35                  40                  45

Phe Ser Ser Lys Ser Arg Thr Ala Val Arg His Arg Val Arg Ser Tyr
    50                  55                  60

Lys Gly Phe Asp Leu Arg Arg Arg Leu Leu Leu Leu Val Ala Glu Tyr
65                  70                  75                  80

Gln Leu Leu Gln Lys Lys Gln Thr Leu Ala Pro Glu Glu Arg Glu Asn
                85                  90                  95

Leu Arg Ile Ala Leu Ser Gly Tyr Leu Lys Arg Lys Gly Tyr Ala Arg
            100                 105                 110
```

```
Thr Glu Ala Glu Thr Asp Thr Ser Val Leu Glu Ser Leu Asp Pro Ser
        115                 120                 125

Val Phe Ser Ser Ala Pro Ser Phe Thr Asn Phe Phe Asn Asp Ser Glu
    130                 135                 140

Pro Leu Asn Ile Gln Trp Glu Ala Ile Ala Asn Ser Pro Glu Thr Thr
145                 150                 155                 160

Lys Ala Leu Asn Lys Glu Leu Ser Gly Gln Lys Glu Ala Asp Phe Lys
                165                 170                 175

Lys Tyr Ile Lys Thr Ser Phe Pro Glu Tyr Ser Ala Lys Glu Ile Leu
            180                 185                 190

Ala Asn Tyr Val Glu Gly Arg Arg Ala Ile Leu Asp Ala Ser Lys Tyr
        195                 200                 205

Ile Ala Asn Leu Gln Ser Leu Gly His Lys His Arg Ser Lys Tyr Leu
    210                 215                 220

Ser Asp Ile Leu Gln Asp Met Lys Arg Asp Ser Arg Ile Thr Arg Leu
225                 230                 235                 240

Ser Glu Ala Phe Gly Ser Thr Asp Asn Leu Trp Arg Ile Ile Gly Asn
                245                 250                 255

Ile Ser Asn Leu Gln Glu Arg Ala Val Arg Trp Tyr Phe Asn Asp Ala
            260                 265                 270

Lys Phe Glu Gln Gly Gln Glu Gln Leu Asp Ala Val Lys Leu Lys Asn
        275                 280                 285

Val Leu Val Arg Ala Leu Lys Tyr Leu Arg Ser Asp Asp Lys Glu Trp
    290                 295                 300

Ser Ala Ser Gln Lys Gln Ile Ile Gln Ser Leu Glu Gln Ser Gly Asp
```

```
305                 310                 315                 320

Val Leu Asp Val Leu Ala Gly Leu Asp Pro Asp Arg Thr Ile Pro Pro
                325                 330                 335

Tyr Glu Asp Gln Asn Asn Arg Arg Pro Pro Glu Asp Gln Thr Leu Tyr
            340                 345                 350

Leu Asn Pro Lys Ala Leu Ser Ser Glu Tyr Gly Glu Lys Trp Lys Ser
        355                 360                 365

Trp Ala Asn Lys Phe Ala Gly Ala Tyr Pro Leu Leu Thr Glu Asp Leu
    370                 375                 380

Thr Glu Ile Leu Lys Asn Thr Asp Arg Lys Ser Arg Ile Lys Ile Arg
385                 390                 395                 400

Ser Asp Val Leu Pro Asp Ser Asp Tyr Arg Leu Ala Tyr Ile Leu Gln
                405                 410                 415

Arg Ala Phe Asp Arg Ser Ile Ala Leu Asp Glu Cys Ser Ile Arg Arg
            420                 425                 430

Thr Ala Glu Asp Phe Glu Asn Gly Val Val Ile Lys Asn Glu Lys Leu
        435                 440                 445

Glu Asp Val Leu Ser Gly His Gln Leu Glu Glu Phe Leu Glu Phe Ala
    450                 455                 460

Asn Arg Tyr Tyr Gln Glu Thr Ala Lys Ala Lys Asn Gly Leu Trp Phe
465                 470                 475                 480

Pro Glu Asn Ala Leu Leu Glu Arg Ala Asp Leu His Pro Pro Met Lys
                485                 490                 495

Asn Lys Ile Leu Asn Val Ile Val Gly Gln Ala Leu Gly Val Ser Pro
            500                 505                 510
```

```
Ala Glu Gly Thr Asp Phe Ile Glu Glu Ile Trp Asn Ser Lys Val Lys
        515                 520                 525

Gly Arg Ser Thr Val His Ser Ile Cys Asn Ala Ile Glu Asn Glu Arg
    530                 535                 540

Lys Thr Tyr Gly Pro Tyr Phe Ser Glu Asp Tyr Lys Phe Val Lys Thr
545                 550                 555                 560

Ala Leu Lys Glu Gly Lys Thr Glu Lys Glu Leu Ser Lys Lys Phe Ala
                565                 570                 575

Ala Val Ile Lys Val Leu Lys Met Val Ser Glu Val Val Pro Phe Ile
            580                 585                 590

Gly Lys Glu Leu Arg Leu Ser Asp Glu Ala Gln Ser Lys Phe Asp Asn
        595                 600                 605

Pro Tyr Ser Leu Ala Gln Leu Tyr Asn Leu Ile Glu Thr Glu Arg Asn
    610                 615                 620

Gly Phe Ser Lys Val Ser Leu Ala Ala His Leu Glu Asn Ala Trp Arg
625                 630                 635                 640

Met Thr Met Thr Asp Gly Ser Ala Gln Cys Cys Arg Leu Pro Ala Asp
                645                 650                 655

Cys Val Arg Pro Phe Asp Gly Phe Ile Arg Lys Ala Ile Asp Arg Asn
            660                 665                 670

Ser Trp Glu Val Ala Lys Arg Ile Ala Glu Glu Val Lys Lys Ser Val
        675                 680                 685

Asp Phe Thr Asn Gly Thr Val Lys Ile Pro Val Ala Ile Glu Ala Asn
    690                 695                 700

Ser Phe Asn Phe Thr Ala Ser Leu Thr Asp Leu Lys Tyr Ile Gln Leu
```

```
705                 710                 715                 720

Lys Glu Gln Lys Leu Lys Lys Lys Leu Glu Asp Ile Gln Arg Asn Glu
                725                 730                 735

Glu Asn Gln Glu Lys Arg Trp Leu Ser Lys Glu Glu Arg Ile Arg Ala
            740                 745                 750

Asp Ser His Gly Ile Cys Ala Tyr Thr Gly Arg Pro Leu Asp Asp Val
        755                 760                 765

Gly Glu Ile Asp His Ile Ile Pro Arg Ser Leu Thr Leu Lys Lys Ser
    770                 775                 780

Glu Ser Ile Tyr Asn Ser Glu Val Asn Leu Ile Phe Val Ser Ala Gln
785                 790                 795                 800

Gly Asn Gln Glu Lys Lys Asn Asn Ile Tyr Leu Leu Ser Asn Leu Ala
                805                 810                 815

Lys Asn Tyr Leu Ala Ala Val Phe Gly Ala Ser Asp Leu Ser Gln Ile
            820                 825                 830

Thr Asn Glu Ile Glu Ser Thr Val Leu Gln Leu Lys Ala Ala Gly Arg
        835                 840                 845

Leu Gly Tyr Phe Asp Leu Leu Ser Glu Lys Glu Arg Ala Cys Ala Arg
    850                 855                 860

His Ala Leu Phe Leu Asn Ser Asp Ser Glu Ala Arg Arg Ala Val Ile
865                 870                 875                 880

Asp Val Leu Gly Ser Arg Arg Lys Ala Ser Val Asn Gly Thr Gln Ala
                885                 890                 895

Trp Phe Val Arg Ser Ile Phe Ser Lys Val Arg Gln Ala Leu Ala Ala
            900                 905                 910
```

```
Trp Thr Gln Glu Thr Gly Asn Glu Leu Ile Phe Asp Ala Ile Ser Val
        915                 920                 925

Pro Ala Ala Asp Ser Ser Glu Met Arg Lys Arg Phe Ala Glu Tyr Arg
    930                 935                 940

Pro Glu Phe Arg Lys Pro Lys Val Gln Pro Val Ala Ser His Ser Ile
945                 950                 955                 960

Asp Ala Met Cys Ile Tyr Leu Ala Ala Cys Ser Asp Pro Phe Lys Thr
                965                 970                 975

Lys Arg Met Gly Ser Gln Leu Ala Ile Tyr Glu Pro Ile Asn Phe Asp
            980                 985                 990

Asn Leu Phe Thr Gly Ser Cys Gln  Val Ile Gln Asn Thr  Pro Arg Asn
        995                 1000                1005

Phe Ser  Asp Lys Thr Asn Ile  Ala Asn Ser Pro Ile  Phe Lys Glu
    1010                1015                1020

Thr Ile  Tyr Ala Glu Arg Phe  Leu Asp Ile Ile Val  Ser Arg Gly
    1025                1030                1035

Glu Ile  Phe Ile Gly Tyr Pro  Ser Asn Met Pro Phe  Glu Glu Lys
    1040                1045                1050

Pro Asn  Arg Ile Ser Ile Gly  Gly Lys Asp Pro Phe  Ser Ile Leu
    1055                1060                1065

Ser Val  Leu Gly Ala Tyr Leu  Asp Lys Ala Pro Ser  Ser Glu Lys
    1070                1075                1080

Glu Lys  Leu Thr Ile Tyr Arg  Val Val Lys Asn Lys  Ala Phe Glu
    1085                1090                1095

Leu Phe  Ser Lys Val Ala Gly  Ser Lys Phe Thr Ala  Glu Glu Asp
```

```
    1100                1105                1110

Lys Ala  Ala Lys Ile Leu Glu  Ala Leu His Phe Val  Thr Val Lys
    1115                1120                1125

Gln Asp  Val Ala Ala Thr Val  Ser Asp Leu Ile Lys  Ser Lys Lys
    1130                1135                1140

Glu Leu  Ser Lys Asp Ser Ile  Glu Asn Leu Ala Lys  Gln Lys Gly
    1145                1150                1155

Cys Leu  Lys Lys Val Glu Tyr  Ser Ser Lys Glu Phe  Lys Phe Lys
    1160                1165                1170

Gly Ser  Leu Ile Ile Pro Ala  Ala Val Glu Trp Gly  Lys Val Leu
    1175                1180                1185

Trp Asn  Val Phe Lys Glu Asn  Thr Ala Glu Glu Leu  Lys Asp Glu
    1190                1195                1200

Asn Ala  Leu Arg Lys Ala Leu  Glu Ala Ala Trp Pro  Ser Ser Phe
    1205                1210                1215

Gly Thr  Arg Asn Leu His Ser  Lys Ala Lys Arg Val  Phe Ser Leu
    1220                1225                1230

Pro Val  Val Ala Thr Gln Ser  Gly Ala Val Arg Ile  Arg Arg Lys
    1235                1240                1245

Thr Ala  Phe Gly Asp Phe Val  Tyr Gln Ser Gln Asp  Thr Asn Asn
    1250                1255                1260

Leu Tyr  Ser Ser Phe Pro Val  Lys Asn Gly Lys Leu  Asp Trp Ser
    1265                1270                1275

Ser Pro  Ile Ile His Pro Ala  Leu Gln Asn Arg Asn  Leu Thr Ala
    1280                1285                1290
```

```
Tyr Gly  Tyr Arg Phe Val Asp  His Asp Arg Ser Ile  Ser Met Ser
    1295                1300                1305


Glu Phe  Arg Glu Val Tyr Asn  Lys Asp Asp Leu Met  Arg Ile Glu
    1310                1315                1320


Leu Ala  Gln Gly Thr Ser Ser  Arg Arg Tyr Leu Arg  Val Glu Met
    1325                1330                1335


Pro Gly  Glu Lys Phe Leu Ala  Trp Phe Gly Glu Asn  Ser Ile Ser
    1340                1345                1350


Leu Gly  Ser Ser Phe Lys Phe  Ser Val Ser Glu Val  Phe Asp Asn
    1355                1360                1365


Lys Ile  Tyr Thr Glu Asn Ala  Glu Phe Thr Lys Phe  Leu Pro Lys
    1370                1375                1380


Pro Arg  Glu Asp Asn Lys His  Asn Gly Thr Ile Phe  Phe Glu Leu
    1385                1390                1395


Val Gly  Pro Arg Val Ile Phe  Asn Tyr Ile Val Gly  Gly Ala Ala
    1400                1405                1410


Ser Ser  Leu Lys Glu Ile Phe  Ser Glu Ala Gly Lys  Glu Arg Ser
    1415                1420                1425


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<213>  gamma proteobacterium

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Met Gly Gly Tyr Met Pro Gln Leu Met Arg Tyr Arg Leu Ala Leu Asp
1               5                  10                  15


Ile Gly Ser Thr Ser Ile Gly Trp Ala Met Ile Arg Leu Ser Met Gln
            20                  25                  30
```

```
Asn Glu Pro Ile Ala Ile Ile Arg Met Gly Val Arg Ile Phe Ser Asp
        35                  40                  45

Gly Arg Asn Pro Lys Asp Gly Ser Ser Leu Ala Val Thr Arg Arg Val
    50                  55                  60

Ala Arg Gln Met Arg Arg Arg Arg Asp Arg Leu Leu Lys Arg Lys Thr
65                  70                  75                  80

Arg Leu Leu Asn Ala Leu Val Gln Lys Lys Phe Phe Pro Glu Asp Ala
                85                  90                  95

Asp Ala Arg Lys Ala Leu Val Val Leu Asn Pro Tyr Glu Leu Arg Lys
            100                 105                 110

Glu Gly Leu Tyr Arg Gln Leu Ser Gly Pro Glu Phe Gly Arg Ala Leu
        115                 120                 125

Phe His Ile Ser Gln Arg Arg Gly Phe Leu Ser Asn Arg Lys Thr Asp
    130                 135                 140

Lys Lys Asp Asn Asp Ser Ser Val Leu Lys Lys Ala Ile Val Asp Leu
145                 150                 155                 160

Arg Gln Gln Leu Glu Val Glu Asn Cys Gln Thr Ile Gly Glu Trp Leu
                165                 170                 175

Phe Lys Gln Gln Gln Ser Gly Lys Ser Val Arg Ala Arg Leu Arg Gly
            180                 185                 190

Lys Thr Gln Lys Asp Lys Ala Tyr Asp Phe Tyr Ile Asp Arg Ala Met
        195                 200                 205

Ile Ala His Glu Phe Asp Thr Leu Trp Val Ser Gln Ala Lys Tyr Asp
    210                 215                 220
```

```
Pro Leu Leu Phe Asn Glu Asp Ala Arg Ala Ile Leu Arg Asp Ile Leu
225                 230                 235                 240

Leu Tyr Gln Arg Pro Leu Lys Pro Val Lys Pro Gly Arg Cys Thr Leu
                245                 250                 255

Ile Pro Asp Glu Ser Arg Ala Pro Leu Ala Leu Pro Leu Thr Gln Gln
            260                 265                 270

Ala Arg Ile Tyr Gln Glu Leu Asn His Leu Arg Ile Thr Thr Pro Ala
        275                 280                 285

Leu Gly Ala Gln Ala Leu Thr Val Ala Gln Arg Asn Thr Ile Ala Ala
    290                 295                 300

Leu Leu Glu Lys Ser Asp Val Thr Phe Val Lys Ile Ala Lys Ala Leu
305                 310                 315                 320

Gly Leu Thr Ser Thr Thr Glu Phe Asn Leu Gln Asp Ile Lys Arg Asp
                325                 330                 335

Arg Leu Lys Gly Asn Ala Thr Ala Ile Ile Leu Ala Arg Asn Gln Tyr
            340                 345                 350

Phe Gly Arg Arg Trp His Asp Phe Asn Ala Asp Leu Gln Asn Leu Ile
        355                 360                 365

Val Asp Lys Leu Val Asn Glu Gly Ser Glu Thr Ala Leu Ile Glu Trp
    370                 375                 380

Leu Lys Ala Asn Thr Asp Val Asp Glu Ser Ala Ala Glu Arg Val Ser
385                 390                 395                 400

Gly Val Thr Leu Pro Glu Gly Tyr Gly Ser Leu Ser Val Ala Ala Leu
                405                 410                 415

Arg Arg Leu Leu Pro Ala Leu Lys Glu Asp Val Val Val Tyr Ser Glu
            420                 425                 430
```

```
Ala Val Lys Arg Ala Gly Phe Asp Ser His Ser Ala Leu Ser Leu Ile
        435                 440                 445

Glu Gln Thr Gly Glu Leu Tyr Gln Glu Leu Pro Tyr Tyr Gly Glu Val
    450                 455                 460

Leu Gln Arg His Val Gly Phe Gly Ser Gly Asp Pro Asn Asp Ser Pro
465                 470                 475                 480

Glu Arg Arg Phe Gly Lys Ile Ala Asn Pro Thr Val His Ile Gly Leu
                485                 490                 495

Asn Glu Leu Arg Lys Ile Ile Asn Ala Leu Ile Lys Arg Tyr Gly Asn
            500                 505                 510

Pro Ala Glu Val Val Val Glu Leu Ala Arg Asp Leu Lys Leu Ser Arg
        515                 520                 525

Glu Lys Arg Lys Glu Ile Gln Glu Glu Gln Lys Gln Arg Gln Asp Arg
    530                 535                 540

Asn Glu Lys Arg Ile Lys Asp Ala Cys Glu Ile Leu Gly Ile Asp Pro
545                 550                 555                 560

Leu Val Ile Asp Arg Gly Lys Arg Arg Glu Ile Ser Gln Lys Met Gln
                565                 570                 575

Leu Trp Asp Glu Leu Asn Pro Lys Asp Ala Ala Asn Arg Arg Cys Pro
            580                 585                 590

Tyr Thr Gly Asp Gln Ile Ser Ile Glu Lys Leu Leu Ser Ala Glu Val
        595                 600                 605

Glu Ile Glu His Ile Leu Pro Phe Ser Lys Thr Leu Asp Asp Ser Leu
    610                 615                 620
```

```
Asn Asn Lys Thr Val Ala Met Arg Arg Ala Asn Arg Asp Lys Gly Asn
625                 630                 635                 640

Arg Thr Pro Tyr Glu Ala Phe Gly Glu Ser Leu Asn Pro Asp Tyr Asp
                645                 650                 655

Tyr Asp Ala Ile Leu Gln Arg Ala Ser Leu Met Pro Arg Glu Lys Arg
            660                 665                 670

Lys Arg Phe Ala Ser Asp Gly Tyr Gln Gln Trp Leu Arg Asp Asp Lys
        675                 680                 685

Asp Phe Leu Ser Arg Ala Leu Asn Asp Thr Ala Tyr Leu Ser Arg Ile
    690                 695                 700

Ala Lys Glu Tyr Leu Thr Leu Ile Cys Pro Pro Asn Ser Val Arg Ala
705                 710                 715                 720

Ile Pro Gly Arg Met Thr Ala Gln Leu Arg Ala Met Phe Gly Leu Asn
                725                 730                 735

Arg Leu Leu Ser Glu Gly Gly Ile Lys Asn Arg Glu Asp His Arg His
            740                 745                 750

His Ala Ile Asp Ala Ala Val Ile Gly Val Thr Asp Gln Gly Leu Leu
        755                 760                 765

Gln Lys Phe Ser Arg Ala Ser Ala Arg Thr Arg Glu Leu Gln Leu Ser
    770                 775                 780

Arg Leu Val Asp Asp Met Pro Leu Pro Trp Asp Thr Tyr Arg Glu His
785                 790                 795                 800

Val Thr Arg Ala Leu Glu His Leu Val Val Ser His Lys Pro Asp His
                805                 810                 815

Gly Tyr Gln Gly Lys Met His Glu Asp Thr Ala Trp Gly Leu Arg Asp
            820                 825                 830
```

```
Asn Gly Gln Val Thr Arg Arg Val Arg Ser Glu Asp Gly Gly Pro Arg
        835                 840                 845

Gln Arg Leu Leu Glu Asn Lys Asn Val Val Lys Ile Asn Ser Thr Arg
    850                 855                 860

Asp Phe Ser Arg His Gly Ile Asp Glu Gln Gly Gln Val Asn Ala Tyr
865                 870                 875                 880

Lys Gly Tyr Val Gly Gly Ser Asn Tyr Cys Ile Glu Ile Trp Ile Asp
                885                 890                 895

Glu Lys Gly Lys Trp Asn Ser Asp Val Val Ser Thr Phe Gln Ala Tyr
            900                 905                 910

Gln Ile Val Arg Glu Leu Gly Glu Lys Ala Ala Trp Gln Lys Leu Arg
        915                 920                 925

Asn Pro Leu Leu Ser Leu Ser Ala Lys Pro Leu Val Met Arg Leu Ile
    930                 935                 940

Ile Asp Asp Val Val Lys Met Gln Ile Ala Gly Gln Asn Lys Ile Met
945                 950                 955                 960

Arg Val Val Lys Ile Ala Gln Asn Gly Gln Ile Phe Phe Ala Glu His
                965                 970                 975

Asn Glu Ala Asn Val Asp Ala Arg Asp Lys Asp Lys Asn Asn Pro Phe
            980                 985                 990

Lys Tyr Ile Ser Lys Thr Ala Gly  Ser Leu Gln Lys Ala  Gly Gly Ile
        995                 1000                1005

His Met  Ala Ile Ser Pro Ile  Gly Asp Ala Arg Pro  Val Arg Tyr
    1010                1015                1020
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Gly Arg
1025

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Met Gly Asp Arg Lys Tyr Asn Leu Gly Leu Asp Ile Gly Thr Ser Ser
1 5 10 15

Ile Gly Phe Ala Ala Val Asp Glu Asn Asn Gln Pro Ile Arg Val Lys
20 25 30

Gly Lys Thr Ala Ile Gly Val Arg Leu Phe Glu Glu Gly Lys Thr Ala
35 40 45

Ala Asp Arg Arg Gly Phe Arg Thr Thr Arg Arg Arg Leu Ser Arg Arg
50 55 60

Arg Trp Arg Ile Asn Leu Leu Asn Glu Ile Phe Asp Ala His Leu Ala
65 70 75 80

Glu Val Asp Pro Thr Phe Leu Ala Arg Leu Lys Glu Ser Asn Arg Ser
85 90 95

Asn Leu Asp Pro Lys Lys Ser Phe Gln Gly Ser Leu Leu Phe Pro Glu
100 105 110

Arg Lys Asp Tyr Gln Phe Tyr Glu Glu Tyr Pro Thr Ile Tyr His Leu
115 120 125

Arg Lys Ala Leu Met Glu Lys Asp Arg Lys Phe Asp Phe Arg Glu Ile
130 135 140

Tyr Leu Ala Val His His Ile Ile Lys Tyr Arg Gly Asn Phe Leu Asn
145 150 155 160

```
Gly Thr Pro Met Arg Ser Phe Lys Val Glu Asn Ile Glu Leu Asp Thr
                165                 170                 175

Leu Phe Asp Gln Leu Asn Gln Leu Tyr Ala Glu Ile Val Pro Asp Asn
            180                 185                 190

Glu Leu Ala Phe Asp Leu Ala Gln Val Ala Asp Val Lys Asp Val Leu
        195                 200                 205

Ser Ser Thr Thr Ile Tyr Lys Met Asp Lys Lys Lys Gln Leu Val Lys
    210                 215                 220

Met Met Leu Leu Pro Ala Ser Asn Lys Ala Leu Gln Ser Glu Asn Lys
225                 230                 235                 240

Lys Ile Val Thr Gln Phe Val Asn Ala Ile Leu Asn Tyr Lys Phe Lys
                245                 250                 255

Leu Asp Val Leu Leu Gln Val Glu Thr Asp Ala Asp Trp Ser Leu Lys
            260                 265                 270

Leu Asn Asp Glu Gly Ala Asp Asp Lys Leu Glu Glu Phe Thr Gly Asp
        275                 280                 285

Leu Asp Glu Asn Arg Leu Glu Ile Ile Asp Leu Leu Gln Arg Leu His
    290                 295                 300

Asn Trp Phe Ser Leu Asn Glu Ile Thr Lys Asp Gly Asn Ser Leu Ser
305                 310                 315                 320

Ala Ala Met Val Glu Lys Tyr Glu Asn His His His His Leu Gly Leu
                325                 330                 335

Leu Lys Lys Val Ile Glu Asn His Pro Asp Ala Lys Lys Ala Lys Ala
            340                 345                 350

Leu Lys Glu Thr Tyr Thr Ala Tyr Val Gly Lys Thr Asp Asp Lys Thr
```

```
        355                 360                 365

Gln Asn Gln Asp Asp Phe Tyr Lys Ala Val Glu Lys Asn Leu Asp Asp
    370                 375                 380

Ser Pro Asp Ala Lys Glu Ile Lys Arg Leu Ile Gln Leu Asp Gln Phe
385                 390                 395                 400

Met Pro Lys Gln Arg Thr Gly Gln Asn Gly Ala Ile Pro His Gln Leu
                405                 410                 415

His Gln Gln Glu Leu Asp Gln Ile Ile Glu Lys Gln Ser Lys Tyr Tyr
            420                 425                 430

Pro Phe Leu Ala Glu Pro Asn Pro Asn Val Lys Arg Arg Lys Asp Ala
        435                 440                 445

Pro Tyr Lys Leu Asp Glu Leu Ile Ala Phe Lys Ile Pro Tyr Tyr Val
    450                 455                 460

Gly Pro Leu Val Thr Pro Glu Glu Gln Ala Gln Asn Gly Glu Asn Val
465                 470                 475                 480

Phe Ala Trp Met Lys Arg Lys Ala Ala Gly Pro Ile Thr Pro Trp Asn
                485                 490                 495

Phe Asp Glu Lys Val Asp Arg Met Glu Ser Ala Asn Arg Phe Ile Arg
            500                 505                 510

Arg Met Thr Thr Lys Asp Thr Tyr Leu Phe Gly Glu Asp Val Leu Pro
        515                 520                 525

Ala Glu Ser Met Ile Tyr Gln Lys Phe Val Val Leu Asn Glu Leu Asn
    530                 535                 540

Asn Leu Lys Ile Asn Gly Arg His Leu Ser Leu Lys Asp Lys Gln Asp
545                 550                 555                 560
```

```
Val Tyr Asn Asp Leu Phe Lys Gln Gln Lys Thr Val Ser Ile Lys Ala
                565                 570                 575

Leu Gln Asn Tyr Tyr Val Thr Lys Lys Lys Ala Ala Thr Ala Pro Thr
            580                 585                 590

Val Gly Gly Leu Ala Asp Pro Lys Lys Phe Leu Ser Ser Leu Ser Thr
        595                 600                 605

Tyr Ile Asp Phe Lys Asn Met Phe Gly Glu Arg Val Asn Asp Pro Gln
    610                 615                 620

Phe Gln Glu Asp Leu Glu Gln Ile Val Glu Trp Ser Thr Ile Phe Glu
625                 630                 635                 640

Asp Arg Gly Ile Phe Lys Ala Lys Leu Gln Ala Leu Gly Trp Leu Ser
                645                 650                 655

Glu Lys Gln Ile Gln Gln Leu Val Ala Lys Arg Tyr Lys Gly Trp Gly
            660                 665                 670

Arg Leu Ser Lys Lys Leu Leu Thr Gly Leu Lys Asn Ala Glu Gly Tyr
        675                 680                 685

Ser Ile Leu Asp Glu Met Trp Arg Ser Thr Gly Asn Phe Met Gln Ile
    690                 695                 700

Gln Ser Arg Pro Glu Phe Ala Ala Leu Ile Gln Gln Ala Asn Glu Lys
705                 710                 715                 720

Gln Phe Glu Gly Asn Asp Pro Asp Asn Val Trp Glu Asn Ile Glu Asn
                725                 730                 735

Ile Leu Gly Asp Ala Tyr Thr Ser Pro Gln Asn Lys Lys Ala Ile Arg
            740                 745                 750

Gln Val Val Lys Val Val Gln Asp Ile Glu Lys Ala Val Gly Asn Pro
```

```
        755                 760                 765

Pro Glu Lys Ile Ala Ile Glu Phe Thr Arg Glu Ala Ala Ala Asn Pro
    770                 775                 780

Gln Arg Thr Gln Ser Arg Leu Arg Thr Leu Glu Lys Leu Tyr Glu Ser
785                 790                 795                 800

Ala Glu Glu Val Val Asp Ala Gly Leu Thr Ala Glu Leu Ala Glu Phe
                805                 810                 815

Lys Glu Asn Lys His Val Leu Ser Asp Lys Tyr Tyr Leu Tyr Phe Thr
            820                 825                 830

Gln Leu Gly Arg Asp Val Tyr Thr Gly Asp Thr Ile Ser Leu Asp Lys
        835                 840                 845

Leu Asn Asp Tyr Asp Val Asp His Ile Leu Pro Gln Ser Phe Ile Lys
    850                 855                 860

Asp Asp Ser Leu Asp Asn Arg Val Leu Thr Ile Arg Ala Val Asn Asn
865                 870                 875                 880

Gly Lys Ser Asp Asn Val Pro Ala Lys Met Phe Gly Lys Lys Met Gly
                885                 890                 895

Ser Phe Trp Arg Tyr Leu Leu Asp Asn Gly Met Ile Ser Lys Arg Lys
            900                 905                 910

Tyr Asn Asn Leu Ile Thr Asp Pro Asp Asn Ile Ser Lys Tyr Ala Gln
        915                 920                 925

Lys Gly Phe Ile Asn Arg Gln Leu Val Glu Thr Ser Gln Val Ile Lys
    930                 935                 940

Leu Thr Ala Asn Ile Leu Asn Gly Ile Tyr Asp Lys Asp Thr Glu Ile
945                 950                 955                 960
```

```
Ile Glu Val Pro Ala Lys Met Asn Ser Gln Met Arg Lys Met Phe Asp
               965                 970                 975

Leu Val Lys Val Arg Glu Val Asn Asp Tyr His His Ala Phe Asp Ala
            980                 985                 990

Tyr Leu Thr Ile Phe Ile Gly Asn  Tyr Leu Tyr Lys Cys  Tyr Pro Lys
        995                 1000                1005

Leu Gln  Pro Tyr Phe Val Tyr  Asp Asn Phe Lys Lys  Phe Gly Asn
    1010                1015                1020

Lys Glu  Asp Ile Gly His Lys  Arg Phe Asn Phe Leu  Gly Lys Ile
    1025                1030                1035

Glu Arg  Glu Lys Lys Val Val  Ala Pro Glu Thr Gly  Glu Ile Leu
    1040                1045                1050

Trp Ser  Asn Val Ala Pro Asn  Glu Thr Ile Lys Gln  Ile Lys Lys
    1055                1060                1065

Val Tyr  Asp Tyr Lys Phe Met  Ile Val Ser Arg Glu  Ile Thr Thr
    1070                1075                1080

Arg Arg  Ala Glu Leu Phe Asn  Gln Thr Val Tyr Pro  Lys Asn Tyr
    1085                1090                1095

His Gly  Lys Leu Ile Pro Ile  Lys Glu Asp Arg Pro  Thr Asp Leu
    1100                1105                1110

Tyr Gly  Gly Tyr Ser Gly Asn  Thr Asp Ala Tyr Leu  Ala Ile Val
    1115                1120                1125

Ala Leu  Glu Asp Lys Lys Lys  Gly Lys Tyr Phe Lys  Val Val Gly
    1130                1135                1140

Ile Pro  Thr Arg Val Ala Ala  Lys Leu Glu Lys Leu  Lys Gln Gln
```

```
    1145                1150                1155

Asp Ser  Gln Gln Tyr Leu Gln  Ala Leu His Lys Val  Ile Ala Pro
    1160                1165                1170

Gln Phe  Thr Lys Ser Thr Lys  Lys Gly Ile Lys Lys  Thr Glu Phe
    1175                1180                1185

Glu Ile  Val Leu Asp Lys Val  His Tyr Arg Gln Leu  Val Gln Asp
    1190                1195                1200

Gly Pro  Val Lys Met Met Leu  Gly Ser Ser Thr Tyr  Lys Tyr Asn
    1205                1210                1215

Ala Lys  Gln Leu Val Leu Ser  Glu Lys Ala Leu Gln  Val Ile Ala
    1220                1225                1230

Asp Asp  Arg Lys Phe Asp Glu  Thr Gln Lys Asp Asp  Asn Leu Ile
    1235                1240                1245

Ala Val  Tyr Asp Glu Ile Leu  Ser Ile Val Asn Gln  Ser Phe Asp
    1250                1255                1260

Leu Tyr  Asp Ile Asn Gly Phe  Arg Lys Lys Leu Asn  Asp Asn Arg
    1265                1270                1275

Asp Gln  Phe Ile Asp Leu Pro  Ala Glu Thr Lys Tyr  Glu Gly Arg
    1280                1285                1290

Lys Val  Val Ala His Gly Lys  Arg Glu Met Ile Leu  Glu Ile Leu
    1295                1300                1305

Lys Gly  Leu His Ala Asn Ala  Ala Phe Gly Asn Leu  Lys Pro Ile
    1310                1315                1320

Gly Phe  Ser Thr Ala Phe Gly  Gln Leu Gln Val Pro  Asn Gly Ile
    1325                1330                1335
```

```
Ile Leu  Ser Lys Asn Ala Ile  Leu Ile His Gln Ser  Pro Ser Gly
    1340                1345                1350


Leu Phe  Glu Arg Lys Ile Lys  Leu Ser Asp Leu
    1355                1360


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<400>  168

Met Lys Asn Leu Lys Glu Tyr Tyr Ile Gly Leu Asp Ile Gly Thr Ala
1               5                   10                  15


Ser Val Gly Trp Ala Val Thr Asp Glu Ser Tyr Asn Ile Pro Lys Phe
            20                  25                  30


Asn Gly Lys Lys Met Trp Gly Val Arg Leu Phe Asp Asp Ala Lys Thr
        35                  40                  45


Ala Glu Glu Arg Arg Thr Gln Arg Gly Ser Arg Arg Arg Leu Asn Arg
    50                  55                  60


Arg Lys Glu Arg Ile Asn Leu Leu Gln Asp Leu Phe Ala Thr Glu Ile
65                  70                  75                  80


Ser Lys Val Asp Pro Asn Phe Phe Leu Arg Leu Asp Asn Ser Asp Leu
                85                  90                  95


Tyr Arg Glu Asp Lys Asp Glu Lys Leu Lys Ser Lys Tyr Thr Leu Phe
            100                 105                 110


Asn Asp Lys Asp Phe Lys Asp Arg Asp Tyr His Lys Lys Tyr Pro Thr
        115                 120                 125


Ile His His Leu Ile Met Asp Leu Ile Glu Asp Glu Gly Lys Lys Asp
    130                 135                 140
```

```
Ile Arg Leu Leu Tyr Leu Ala Cys His Tyr Leu Leu Lys Asn Arg Gly
145                 150                 155                 160

His Phe Ile Phe Glu Gly Gln Lys Phe Asp Thr Lys Asn Ser Phe Asp
                165                 170                 175

Lys Ser Ile Asn Asp Leu Lys Ile His Leu Arg Asp Glu Tyr Asn Ile
            180                 185                 190

Asp Leu Glu Phe Asn Asn Glu Asp Leu Ile Glu Ile Ile Thr Asp Thr
        195                 200                 205

Thr Leu Asn Lys Thr Asn Lys Lys Lys Glu Leu Lys Asn Ile Val Gly
    210                 215                 220

Asp Thr Lys Phe Leu Lys Ala Ile Ser Ala Ile Met Ile Gly Ser Ser
225                 230                 235                 240

Gln Lys Leu Val Asp Leu Phe Glu Asp Gly Glu Phe Glu Glu Thr Thr
                245                 250                 255

Val Lys Ser Val Asp Phe Ser Thr Thr Ala Phe Asp Asp Lys Tyr Ser
            260                 265                 270

Glu Tyr Glu Glu Ala Leu Gly Asp Thr Ile Ser Leu Leu Asn Ile Leu
        275                 280                 285

Lys Ser Ile Tyr Asp Ser Ser Ile Leu Glu Asn Leu Leu Lys Asp Ala
    290                 295                 300

Asp Lys Ser Lys Asp Gly Asn Lys Tyr Ile Ser Lys Ala Phe Val Lys
305                 310                 315                 320

Lys Phe Asn Lys His Gly Lys Asp Leu Lys Thr Leu Lys Arg Ile Ile
                325                 330                 335
```

```
Lys Lys Tyr Leu Pro Ser Glu Tyr Ala Asn Ile Phe Arg Asn Lys Ser
            340                 345                 350

Ile Asn Asp Asn Tyr Val Ala Tyr Thr Lys Ser Asn Ile Thr Ser Asn
        355                 360                 365

Lys Arg Thr Lys Ala Ser Lys Phe Thr Lys Gln Glu Asp Phe Tyr Lys
    370                 375                 380

Phe Ile Lys Lys His Leu Asp Thr Ile Lys Glu Thr Lys Leu Asn Ser
385                 390                 395                 400

Ser Glu Asn Glu Asp Leu Lys Leu Ile Asp Glu Met Leu Thr Asp Ile
                405                 410                 415

Glu Phe Lys Thr Phe Ile Pro Lys Leu Lys Ser Ser Asp Asn Gly Val
            420                 425                 430

Ile Pro Tyr Gln Leu Lys Leu Met Glu Leu Lys Lys Ile Leu Asp Asn
        435                 440                 445

Gln Ser Lys Tyr Tyr Asp Phe Leu Asn Glu Ser Asp Glu Tyr Gly Thr
    450                 455                 460

Val Lys Asp Lys Val Glu Ser Ile Met Glu Phe Arg Ile Pro Tyr Tyr
465                 470                 475                 480

Val Gly Pro Leu Asn Pro Asp Ser Lys Tyr Ala Trp Ile Lys Arg Glu
                485                 490                 495

Asn Thr Lys Ile Thr Pro Trp Asn Phe Lys Asp Ile Val Asp Leu Asp
            500                 505                 510

Ser Ser Arg Glu Glu Phe Ile Asp Arg Leu Ile Gly Arg Cys Thr Tyr
        515                 520                 525

Leu Lys Glu Glu Lys Val Leu Pro Lys Ala Ser Leu Ile Tyr Asn Glu
    530                 535                 540
```

```
Phe Met Val Leu Asn Glu Leu Asn Asn Leu Lys Leu Asn Glu Phe Leu
545                 550                 555                 560


Ile Thr Glu Glu Met Lys Lys Ala Ile Phe Glu Glu Leu Phe Lys Thr
                565                 570                 575


Lys Lys Lys Val Thr Leu Lys Ala Val Ser Asn Leu Leu Lys Lys Glu
            580                 585                 590


Phe Asn Leu Thr Gly Asp Ile Leu Leu Ser Gly Thr Asp Gly Asp Phe
        595                 600                 605


Lys Gln Gly Leu Asn Ser Tyr Ile Asp Phe Lys Asn Ile Ile Gly Asp
    610                 615                 620


Lys Val Asp Arg Asp Asp Tyr Arg Ile Lys Ile Glu Glu Ile Ile Lys
625                 630                 635                 640


Leu Ile Val Leu Tyr Glu Asp Asp Lys Thr Tyr Leu Lys Lys Lys Ile
                645                 650                 655


Lys Ser Ala Tyr Lys Asn Asp Phe Thr Asp Asp Glu Ile Lys Lys Ile
            660                 665                 670


Ala Ala Leu Asn Tyr Lys Asp Trp Gly Arg Leu Ser Lys Arg Phe Leu
        675                 680                 685


Thr Gly Ile Glu Gly Val Asp Lys Thr Thr Gly Glu Lys Gly Ser Ile
    690                 695                 700


Ile Tyr Phe Met Arg Glu Tyr Asn Leu Asn Leu Met Glu Leu Met Ser
705                 710                 715                 720


Gly His Tyr Thr Phe Thr Glu Glu Val Glu Lys Leu Asn Pro Val Glu
                725                 730                 735
```

```
Asn Arg Glu Leu Cys Tyr Glu Met Val Asp Glu Leu Tyr Leu Ser Pro
            740                 745                 750

Ser Val Lys Arg Met Leu Trp Gln Ser Leu Arg Val Val Asp Glu Ile
        755                 760                 765

Lys Arg Ile Ile Gly Lys Asp Pro Lys Lys Ile Phe Ile Glu Met Ala
    770                 775                 780

Arg Ala Lys Glu Ala Lys Asn Ser Arg Lys Glu Ser Arg Lys Asn Lys
785                 790                 795                 800

Leu Leu Glu Phe Tyr Lys Phe Gly Lys Lys Ala Phe Ile Asn Glu Ile
                805                 810                 815

Gly Glu Glu Arg Tyr Asn Tyr Leu Leu Asn Glu Ile Asn Ser Glu Glu
            820                 825                 830

Glu Ser Lys Phe Arg Trp Asp Asn Leu Tyr Leu Tyr Tyr Thr Gln Leu
        835                 840                 845

Gly Arg Cys Met Tyr Ser Leu Glu Pro Ile Asp Leu Ala Asp Leu Lys
    850                 855                 860

Ser Asn Asn Ile Tyr Asp Gln Asp His Ile Tyr Pro Lys Ser Lys Ile
865                 870                 875                 880

Tyr Asp Asp Ser Leu Glu Asn Arg Val Leu Val Lys Lys Asn Leu Asn
                885                 890                 895

His Glu Lys Gly Asn Gln Tyr Pro Ile Pro Glu Lys Val Leu Asn Lys
            900                 905                 910

Asn Ala Tyr Gly Phe Trp Lys Ile Leu Phe Asp Lys Gly Leu Ile Gly
        915                 920                 925

Gln Lys Lys Tyr Thr Arg Leu Thr Arg Arg Thr Pro Phe Glu Glu Arg
    930                 935                 940
```

```
Glu Leu Ala Glu Phe Ile Glu Arg Gln Ile Val Glu Thr Arg Gln Ala
945                 950                 955                 960


Thr Lys Glu Thr Ala Asn Leu Leu Lys Asn Ile Cys Gln Asp Ser Glu
                965                 970                 975


Ile Val Tyr Ser Lys Ala Glu Asn Ala Ser Arg Phe Arg Gln Glu Phe
            980                 985                 990


Asp Ile Ile Lys Cys Arg Thr Val  Asn Asp Leu His His  Met His Asp
        995                 1000                1005


Ala Tyr  Leu Asn Ile Val Val  Gly Asn Val Tyr Asn  Thr Lys Phe
    1010                1015                1020


Thr Lys  Asn Pro Leu Asn Phe  Ile Lys Asp Lys Asp  Asn Val Arg
    1025                1030                1035


Ser Tyr  Asn Leu Glu Asn Met  Phe Lys Tyr Asp Val  Val Arg Gly
    1040                1045                1050


Ser Tyr  Thr Ala Trp Ile Ala  Asp Asp Ser Glu Gly  Asn Val Lys
    1055                1060                1065


Ala Ala  Thr Ile Lys Lys Val  Lys Arg Glu Leu Glu  Gly Lys Asn
    1070                1075                1080


Tyr Arg  Phe Thr Arg Met Ser  Tyr Ile Gly Thr Gly  Gly Leu Tyr
    1085                1090                1095


Asp Gln  Asn Leu Met Arg Lys  Gly Lys Gly Gln Ile  Pro Gln Lys
    1100                1105                1110


Glu Asn  Thr Asn Lys Ser Asn  Ile Glu Lys Tyr Gly  Gly Tyr Asn
    1115                1120                1125
```

```
Lys Ala  Ser Ser Ala Tyr Phe  Ala Leu Ile Glu Ser  Asp Gly Lys
    1130                1135                1140

Ala Gly  Arg Glu Arg Thr Leu  Glu Thr Ile Pro Ile  Met Val Tyr
    1145                1150                1155

Asn Gln  Glu Lys Tyr Gly Asn  Thr Glu Ala Val Asp  Lys Tyr Leu
    1160                1165                1170

Lys Asp  Asn Leu Glu Leu Gln  Asp Pro Lys Ile Leu  Lys Asp Lys
    1175                1180                1185

Ile Lys  Ile Asn Ser Leu Ile  Lys Leu Asp Gly Phe  Leu Tyr Asn
    1190                1195                1200

Ile Lys  Gly Lys Thr Gly Asp  Ser Leu Ser Ile Ala  Gly Ser Val
    1205                1210                1215

Gln Leu  Ile Val Asn Lys Glu  Glu Gln Lys Leu Ile  Lys Lys Met
    1220                1225                1230

Asp Lys  Phe Leu Val Lys Lys  Lys Asp Asn Lys Asp  Ile Lys Val
    1235                1240                1245

Thr Ser  Phe Asp Asn Ile Lys  Glu Glu Glu Leu Ile  Lys Leu Tyr
    1250                1255                1260

Lys Thr  Leu Ser Asp Lys Leu  Asn Asn Gly Ile Tyr  Ser Asn Lys
    1265                1270                1275

Arg Asn  Asn Gln Ala Lys Asn  Ile Ser Glu Ala Leu  Asp Lys Phe
    1280                1285                1290

Lys Glu  Ile Ser Ile Glu Glu  Lys Ile Asp Val Leu  Asn Gln Ile
    1295                1300                1305

Ile Leu  Leu Phe Gln Ser Tyr  Asn Asn Gly Cys Asn  Leu Lys Ser
    1310                1315                1320
```

```
Ile Gly  Leu Ser Ala Lys Thr  Gly Val Val Phe Ile  Pro Lys Lys
    1325                1330                1335


Leu Asn  Tyr Lys Glu Cys Lys  Leu Ile Asn Gln Ser  Ile Thr Gly
    1340                1345                1350


Leu Phe  Glu Asn Glu Val Asp  Leu Leu Asn Leu
    1355                1360
```

<210> 169
<211> 1089
<212> PRT
<213> Corynebacterium matruchotii

<400> 169

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Met Asn Ser Ala Asn Val Asn Tyr Arg Val Gly Ile Asp Val Gly Ser
1               5                   10                  15


Tyr Ser Leu Gly Met Ala Ala Ile Ala Ile Asp Asp Asp Gly Lys Pro
            20                  25                  30


Thr Glu Ile Leu Ser Ala Ile Ser Leu Ile His Asp Ser Gly Val Asp
        35                  40                  45


Pro Asp Ser Ala Lys Ser Ala Ala Thr Arg Leu Ala Thr Ser Gly Ile
    50                  55                  60


Ala Arg Arg Thr Arg Arg Leu Tyr Arg Arg Lys Arg Lys Arg Leu Ala
65                  70                  75                  80


Lys Leu Asp Lys Phe Ile Ser Ser Gln Gly Trp Pro Leu Lys Glu Phe
                85                  90                  95


Glu Lys Tyr Glu Asp Pro Phe Tyr Pro Trp Arg Val Arg Ala Glu Leu
            100                 105                 110


Ala Thr Thr Ala Ile Thr Asp Gln Gln Glu Leu Gly Glu Lys Leu Ser
```

```
        115                 120                 125

Ile Ala Leu Arg His Ile Ala Arg His Arg Gly Trp Arg Asn Pro Tyr
    130                 135                 140

Ser Lys Val Thr Ala Leu Tyr Thr Val Thr Glu Pro Ser Asp Ala Phe
145                 150                 155                 160

Leu Ala Met Gln Glu Glu Cys Ala Lys Gln Leu Gly Arg Thr Ile Pro
                165                 170                 175

Glu Thr Ile Thr Val Gly Gln Leu Val Thr Gly Met Asn Leu Gly Lys
            180                 185                 190

Thr Arg Leu Arg Gly Glu Asn Ser Leu Leu Ala Ala Arg Pro Arg Gln
        195                 200                 205

Ser Asp Asn Ala Asn Glu Ile His Thr Ile Ala Lys Val Gln Gly Leu
    210                 215                 220

Ser Asn Glu Leu Val Arg Gln Ile Ile Asp His Val Phe Ala Ala Glu
225                 230                 235                 240

Ser Pro Lys Gly Ser Ala Ala Glu Gln Val Gly Lys Asp Pro Leu Gln
                245                 250                 255

Pro Thr Lys Lys Arg Ala Leu Lys Ala Ser Asp Ala Phe Gln Gln Tyr
            260                 265                 270

Arg Ile Ala Ala Leu Ile Gly Asn Leu Arg Ile Arg Gly Gly Lys Gly
        275                 280                 285

Asn Arg Arg Leu Thr Thr Glu Glu Thr Arg Leu Val Phe Asp Tyr Leu
    290                 295                 300

Arg Ser Leu Pro Ala Lys Gln Glu Pro Thr Trp Gln Leu Val Ala Glu
305                 310                 315                 320
```

```
Gln Leu Lys Ile Asp Arg Gly Asn Leu Val Gly Thr Ala Ile Met Thr
               325                 330                 335

Asp Asp Gly Glu Arg Ala Gly Ala Lys Pro Pro Val His Asp Thr Asn
            340                 345                 350

Arg Ile Met Glu Asn Thr Lys Ile Lys Pro Leu Ala Thr Trp Trp Lys
        355                 360                 365

Ser Ala Asp Ala Asp Ala Arg Ala Ala Met Val Lys Ala Leu Ser Asn
    370                 375                 380

Ala Glu Val Asp Asp Phe Asp Ser Gln Ala Gly Ala Gln Val Gln Glu
385                 390                 395                 400

Phe Phe Phe Gly Ile Ser Asp Glu Asp Gln Glu Lys Leu Asp Gly Leu
               405                 410                 415

His Leu Pro Ile Gly Arg Ala Ala Tyr Ser Glu Asp Thr Leu Asp Arg
            420                 425                 430

Leu Thr Lys Arg Met Ile Gly Glu Gly Met Asp Leu Tyr Glu Ala Arg
        435                 440                 445

Gln Ala Glu Phe Lys Ile Ser Asn Asp Trp Ala Pro Pro Ala Pro Glu
    450                 455                 460

Ile Gly Glu Arg Val Gly Asn Pro Ala Val Asp Arg Val Leu Lys Ala
465                 470                 475                 480

Thr Ala Arg Trp Leu Asn Ala Ala Glu Arg Gln Trp Gly Ala Pro Lys
               485                 490                 495

Ser Val Asn Ile Glu His Val Arg Ala Ala Phe Met Ser Glu Ser Ser
            500                 505                 510

Ala Arg Glu Leu Asp Arg Asp Asn Gln Gln Arg Ala Lys Arg Asn Val
```

```
        515                 520                 525

Lys Val Val Ala Glu Met Gln Glu Lys Leu Gly Ile Glu Gly Arg Pro
    530                 535                 540

Ser Arg Ala Asp Val Trp Arg Phe Gln Ser Ile Gln Arg Gln Asn Gly
545                 550                 555                 560

Lys Cys Ala Tyr Cys Gly Ala Glu Ile Ser Phe Lys Asn Ser Glu Met
                565                 570                 575

Asp His Ile Ile Pro Gln Ala Gly Glu Gly Ser Thr Asn Thr Arg Asp
            580                 585                 590

Asn Leu Val Ala Val Cys Arg Glu Cys Asn Ser Ser Lys Ser Asn Ile
        595                 600                 605

Ala Phe Ala Val Trp Ala Glu Asn Thr Ser Arg Pro Gly Val Ser Val
    610                 615                 620

Gln Lys Ala Ile Glu Arg Thr His His Trp Val Thr Asp Ser Gly Leu
625                 630                 635                 640

Arg Lys Pro Glu Phe Asp Lys Phe Arg Lys Gln Val Cys Asp Arg Leu
                645                 650                 655

Arg Arg Lys Ala Thr Asp Glu Pro Ile Asp Ala Arg Ser Leu Glu Ser
            660                 665                 670

Val Ala Trp Met Ala Asn Glu Leu Arg Ser Arg Ile Ala Gln Lys Phe
        675                 680                 685

Lys Asp Gly Asp Thr Lys Val Arg Val Tyr Lys Gly Ala Leu Thr Ala
    690                 695                 700

Glu Ala Arg Arg Ala Ser Gly Ile Ser Gly Lys Leu Glu Phe Val Asp
705                 710                 715                 720
```

```
Gly Lys Gly Lys Ser Arg Leu Asp Arg Arg His His Ala Val Asp Ala
               725                 730                 735

Ala Val Val Ala Phe Thr Ser Asn Tyr Val Ala Glu Thr Leu Ala Leu
            740                 745                 750

Arg Ser Asn Met Lys Phe Asp Gln Glu Leu Arg Arg Lys Ala Pro Gln
        755                 760                 765

Trp Arg Glu Phe Thr Gly Ser Asp His Val His Gln Val Glu Trp Thr
    770                 775                 780

Lys Trp Lys Tyr Arg Met Gln Ala Leu Ala Glu Leu Leu Asn Asn Ala
785                 790                 795                 800

Leu Val Gln Asp Arg Ile Val Val Met His Asn Leu Arg Leu Arg Leu
               805                 810                 815

Gly Asn Gly Ala Ala His Glu Asp Thr Ile Gly Lys Leu Thr Arg Leu
            820                 825                 830

Lys Val Gly Asp Ala Ile Ser Thr Thr Asp Ile Asp Arg Ala Ser Ser
        835                 840                 845

Glu Ala Leu Trp Cys Ala Leu Thr Arg Asp Pro Asp Tyr Asp Pro Lys
    850                 855                 860

Thr Gly Leu Pro Glu Asn Pro Asn Arg Thr Ile Arg Ile His Gly Thr
865                 870                 875                 880

His Leu Thr Ala Ser Asp Glu Ile Thr Val Phe Pro Val Ala Ala Ala
               885                 890                 895

Ser Ile Pro Ile Arg Asp Gly Phe Ala Lys Leu Gly Ser Asn Tyr His
            900                 905                 910

His Val Arg Leu Phe Arg Val Pro Ser Gly Lys Lys Tyr Lys Tyr Cys
```

```
        915                 920                 925

Leu Met Gln Val Tyr Thr Val Asp Leu Leu Lys Phe Arg Lys Glu Asp
    930                 935                 940

Leu Phe Thr Val Glu Leu Lys Pro Gln Thr Ile Ser Val Arg Thr Cys
945                 950                 955                 960

Glu Ala Leu Leu Arg Lys Ala Leu Ala Asn Gly Thr Ala Glu Tyr Leu
                965                 970                 975

Gly Trp Leu Val Ser Asp Asp Glu Leu Leu Ile Asp Thr Ser Ser Phe
            980                 985                 990

Asp Thr Pro Gly Ile Val Lys Leu  Arg Glu Glu Tyr Gly  Pro Val Asn
        995                 1000                1005

Arg Trp  Arg Leu Ala Gly Leu  Thr Ser Val Thr Arg  Leu Asn Leu
    1010                1015                1020

Arg Pro  Leu Tyr Leu Ser Lys  Glu Gly Leu Lys Pro  Asn Val Asn
    1025                1030                1035

Pro Glu  Ile Lys Lys Ile Ile  Asp Asn Arg Ser Trp  Ile Ile Thr
    1040                1045                1050

Val Asn  Lys Leu Phe Ser Ser  Gly His Val Lys Ile  Ile Arg Arg
    1055                1060                1065

Asp Ala  Leu Gly Arg Pro Arg  Leu His Ser Ala Ala  His Leu Pro
    1070                1075                1080

Ile Cys  Trp Glu Val Lys
    1085
```

<210> 170
<211> 1134
<212> PRT

<213> Streptococcus mitis

<400> 170

```
Met Asn Gly Leu Val Leu Gly Leu Asp Ile Gly Ile Ala Ser Glu Gly
1               5                  10                  15


Val Gly Ile Leu Glu Lys Asn Ser Gly Lys Ile Ile His Ala Asn Ser
            20                  25                  30


Arg Leu Phe Pro Ala Ala Thr Ala Asp Asn Asn Val Glu Arg Arg Lys
        35                  40                  45


Asn Arg Gln Ala Arg Arg Leu Asn Arg Arg Lys Lys His Arg Gly Val
    50                  55                  60


Arg Phe Gln Asp Leu Phe Glu Asp Tyr Gly Leu Leu Thr Asp Phe Ser
65                  70                  75                  80


Lys Val Ser Ile Asn Leu Asn Pro Tyr Arg Leu Arg Val Asp Gly Leu
                85                  90                  95


Asn Gln Gln Leu Thr Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Ile
            100                 105                 110


Val Lys Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Glu Asp Gly
        115                 120                 125


Gly Ala Val Ser Ser Asp Tyr Gly Lys Ala Val Glu Glu Asn Arg Lys
    130                 135                 140


Leu Leu Ala Glu Gln Thr Pro Gly Gln Ile Gln Leu Glu Arg Phe Glu
145                 150                 155                 160


Lys Tyr Gly Gln Val Arg Gly Asp Phe Thr Val Val Glu Asn Gly Glu
                165                 170                 175


Lys Leu Arg Leu Ile Asn Val Phe Ser Thr Ser Ala Tyr Lys Lys Glu
            180                 185                 190
```

```
Ala Glu Arg Ile Leu Arg Lys Gln Gln Glu Phe Asn Asn Gln Ile Thr
        195                 200                 205

Asp Glu Phe Ile Glu Asp Tyr Leu Lys Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240

Phe Arg Thr Asp Gly Thr Thr Leu Asp Asn Ile Phe Gly Ile Leu Ile
                245                 250                 255

Gly Lys Cys Thr Phe Tyr Pro Glu Glu Tyr Arg Ala Ser Lys Ala Ser
            260                 265                 270

Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285

Val Pro Thr Glu Thr Lys Lys Leu Ser Glu Glu Gln Lys Lys Val Ile
    290                 295                 300

Val Glu Tyr Ala Lys Glu Ala Lys Thr Leu Gly Ala Ser Thr Leu Leu
305                 310                 315                 320

Lys Tyr Ile Ala Lys Met Ile Asp Ala Ser Val Asp Gln Ile Arg Gly
                325                 330                 335

Tyr Arg Val Asp Val Asn Asn Lys Pro Glu Met His Thr Phe Glu Val
            340                 345                 350

Tyr Arg Lys Met Gln Ser Leu Glu Thr Ile Ser Val Gly Glu Leu Ser
        355                 360                 365

Arg Asn Val Leu Asp Glu Leu Ala His Ile Leu Thr Leu Asn Thr Glu
    370                 375                 380
```

```
Arg Glu Gly Met Glu Glu Ala Ile Asn Thr Lys Leu Lys Asp Ser Phe
385                 390                 395                 400

Ser Gln Asp Gln Val Leu Glu Leu Val Gln Phe Arg Lys Asn Asn Ser
                405                 410                 415

Ser Leu Phe Ser Lys Gly Trp His Asn Phe Ser Leu Lys Leu Met Met
            420                 425                 430

Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr Ile
        435                 440                 445

Leu Thr Arg Leu Gly Lys Gln Lys Ser Lys Glu Thr Ser Lys Arg Thr
    450                 455                 460

Lys Tyr Ile Asp Glu Lys Glu Leu Thr Glu Glu Ile Tyr Asn Pro Val
465                 470                 475                 480

Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Ile Asn Glu Ala Thr
                485                 490                 495

Lys Lys His Gly Ile Phe Asp Asn Ile Val Ile Glu Met Ala Arg Glu
            500                 505                 510

Asn Asn Glu Glu Asp Ala Lys Lys Asp Tyr Ile Lys Arg Gln Lys Ala
        515                 520                 525

Asn Gln Asp Glu Lys Asn Ala Ala Met Glu Lys Ala Ala Phe Gln Tyr
    530                 535                 540

Asn Gly Lys Lys Glu Leu Pro Asp Asn Ile Phe His Gly His Lys Glu
545                 550                 555                 560

Leu Ala Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Lys Cys Leu
                565                 570                 575

Tyr Thr Gly Lys Thr Ile Pro Ile Ser Asp Leu Ile Tyr Asn Gln Tyr
            580                 585                 590
```

```
Lys Tyr Glu Ile Asp His Ile Leu Pro Leu Ser Leu Ser Phe Asp Asp
        595                 600                 605

Ser Leu Ser Asn Lys Val Leu Ala Leu Ala Thr Ala Asn Gln Glu Lys
    610                 615                 620

Gly Gln Arg Thr Pro Phe Gln Ala Leu Asp Ser Met Asp Asp Ala Trp
625                 630                 635                 640

Ser Tyr Arg Glu Phe Lys Ser Tyr Val Lys Asp Leu Lys Ser Leu Ser
                645                 650                 655

Asn Lys Lys Lys Asp Tyr Leu Leu Thr Glu Glu Asp Ile Ser Lys Ile
            660                 665                 670

Glu Val Lys Gln Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg Tyr
        675                 680                 685

Ser Ser Arg Val Val Leu Asn Ala Leu Gln Asp Phe Tyr Lys Ser His
    690                 695                 700

Gln Phe Asp Thr Thr Ile Ser Val Val Arg Gly Gln Phe Thr Ser Gln
705                 710                 715                 720

Leu Arg Arg Lys Trp Gly Leu Glu Lys Ser Arg Glu Thr Tyr His His
                725                 730                 735

His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Arg Leu
            740                 745                 750

Trp Lys Lys Gln Asn Asn Pro Leu Ile Thr Tyr Lys Glu Gly Gln Phe
        755                 760                 765

Val Asp Ser Gln Thr Gly Glu Ile Ile Ser Leu Thr Asp Asp Glu Tyr
    770                 775                 780
```

```
Lys Glu Leu Val Phe Lys Ala Pro Tyr Asp His Phe Val Asp Thr Leu
785                 790                 795                 800


Ser Ser Lys Thr Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln Val Asp
                805                 810                 815


Ser Lys Phe Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg
            820                 825                 830


Lys Ala Lys Leu Asp Lys Glu Lys Lys Glu Tyr Thr Tyr Thr Leu Gly
        835                 840                 845


Lys Ile Lys Asp Ile Tyr Ser Leu Gly Thr Lys Thr Pro Ser Lys Thr
    850                 855                 860


Gly Phe Tyr Lys Phe Leu Asp Leu Tyr Asn Lys Asp Lys Ser Gln Phe
865                 870                 875                 880


Leu Met Phe Gln Lys Asp Arg Lys Thr Trp Asp Glu Val Ile Glu Lys
                885                 890                 895


Ile Met Glu Gln Tyr Arg Pro Phe Lys Glu Tyr Asp Lys Thr Gly Lys
            900                 905                 910


Leu Val Asp Phe Asn Pro Phe Glu Lys Tyr Arg Gln Glu Asn Glu Pro
        915                 920                 925


Ile Arg Lys Tyr Ser Lys Lys Gly Asn Gly Pro Glu Ile Lys Ser Leu
    930                 935                 940


Lys Tyr Tyr Asp Ile Leu Leu Gly Lys His Lys Asn Ile Thr Pro Glu
945                 950                 955                 960


Gly Ser Arg Asn Thr Val Ala Leu Leu Ser Leu Asn Pro Trp Arg Thr
                965                 970                 975


Asp Val Tyr Tyr Asn Met Glu Thr Lys Lys Tyr Glu Phe Leu Gly Leu
            980                 985                 990
```

```
Lys Tyr Ala Asp Leu Pro Phe Glu  Glu Gly Gly Ala Tyr  Gly Ile Ser
        995                 1000                1005


Thr Glu  Thr Tyr Asn Glu Leu  Arg Glu Lys Glu Gly  Ile Gly Lys
    1010                1015                1020


Asn Ser  Glu Phe Lys Phe Thr  Leu Tyr Lys Asn Asp  Leu Ile Leu
    1025                1030                1035


Ile Lys  Asp Thr Glu Thr Asn  Cys Gln Gln Ile Phe  Arg Phe Trp
    1040                1045                1050


Ser Arg  Thr Gly Lys Asp Asn  Pro Lys Ser Phe Glu  Lys His Lys
    1055                1060                1065


Ile Glu  Leu Lys Pro Tyr Glu  Lys Ala Arg Phe Glu  Lys Gly Glu
    1070                1075                1080


Glu Leu  Glu Val Leu Gly Lys  Val Pro Pro Ser Ser  Asn Gln Leu
    1085                1090                1095


Gln Lys  Asn Met Gln Ile Glu  Asn Leu Ser Ile Tyr  Lys Val Lys
    1100                1105                1110


Thr Asp  Val Leu Gly Asn Lys  His Phe Ile Lys Lys  Glu Gly Asp
    1115                1120                1125


Lys Pro  Lys Leu Lys Phe
    1130


<210>  171
<211>  1373
<212>  PRT
<213>  Streptococcus bovis

<400>  171

Met Thr Lys Lys Asn Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser
```

```
1               5                   10                  15

Val Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys
            20                  25                  30

Met Lys Val Leu Gly Asn Thr Asp Lys Lys Tyr Ile Lys Lys Asn Leu
        35                  40                  45

Leu Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg
    50                  55                  60

Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu
65                  70                  75                  80

Arg Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Thr Lys Val Asp Glu
                85                  90                  95

Ser Phe Phe Gln Arg Leu Asp Glu Ser Phe Leu Arg Trp Asp Asp Asp
            100                 105                 110

Asn Lys Lys Leu Gly Arg Tyr Pro Ile Phe Gly Asn Lys Ala Asp Val
        115                 120                 125

Val Lys Tyr His Gln Glu Phe Pro Thr Ile Tyr His Leu Arg Lys His
    130                 135                 140

Leu Ala Asp Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala
145                 150                 155                 160

Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Glu
                165                 170                 175

Leu Asn Ala Glu Asn Thr Asp Val Gln Lys Ile Phe Ala Asp Phe Val
            180                 185                 190

Gly Val Tyr Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr
        195                 200                 205
```

```
Val Asp Ala Ala Ser Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg
    210                 215                 220

Leu Glu Asn Leu Ile Lys Tyr Tyr Pro Thr Glu Lys Lys Asn Thr Leu
225                 230                 235                 240

Phe Gly Asn Leu Ile Ala Leu Ala Leu Gly Leu Gln Pro Asn Phe Lys
                245                 250                 255

Met Asn Phe Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp
            260                 265                 270

Ser Tyr Glu Glu Asp Leu Gly Glu Leu Leu Gly Lys Ile Gly Asp Asp
        275                 280                 285

Tyr Ala Asp Leu Phe Thr Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu
    290                 295                 300

Leu Ser Gly Ile Leu Ile Val Asp Asp Asn Ser Thr Lys Ala Pro Leu
305                 310                 315                 320

Ser Ala Ser Met Ile Lys Arg Tyr Val Glu His Gln Glu Asp Leu Glu
                325                 330                 335

Lys Leu Lys Glu Phe Ile Lys Ala Asn Lys Ser Glu Leu Tyr His Asp
            340                 345                 350

Ile Phe Lys Asp Lys Asn Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn
        355                 360                 365

Gly Val Lys Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Asn Thr Leu Ser
    370                 375                 380

Lys Ile Ala Gly Ser Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp
385                 390                 395                 400

Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln
```

```
                405                 410                 415

Ile His Leu Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Asp Tyr
            420                 425                 430

Tyr Pro Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr
        435                 440                 445

Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Asp Ser Arg
    450                 455                 460

Phe Ser Trp Ala Glu Tyr His Ser Asp Glu Lys Ile Thr Pro Trp Asn
465                 470                 475                 480

Phe Asp Lys Val Ile Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr
                485                 490                 495

Arg Met Thr Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro
            500                 505                 510

Lys His Ser His Val Tyr Glu Thr Tyr Ala Val Tyr Asn Glu Leu Thr
        515                 520                 525

Lys Ile Lys Tyr Val Asn Glu Gln Gly Lys Asp Ser Phe Phe Asp Ser
    530                 535                 540

Asn Met Lys Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys
545                 550                 555                 560

Val Thr Lys Glu Lys Leu Leu Asn Tyr Leu Asn Lys Glu Phe Pro Glu
                565                 570                 575

Tyr Arg Ile Lys Asp Leu Ile Gly Leu Asp Lys Glu Asn Lys Ser Phe
            580                 585                 590

Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys
        595                 600                 605
```

```
Ala Phe Leu Asp Asp Lys Val Asn Glu Glu Val Ile Glu Asp Ile Ile
    610                 615                 620

Lys Thr Leu Thr Leu Phe Glu Asp Lys Asp Met Ile His Glu Arg Leu
625                 630                 635                 640

Gln Lys Tyr Ser Asp Ile Phe Thr Ala Asp Gln Leu Lys Lys Leu Glu
                645                 650                 655

Arg Arg His Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn
            660                 665                 670

Gly Ile Arg Asn Lys Glu Asn Asn Lys Thr Ile Leu Asp Tyr Leu Ile
        675                 680                 685

Asp Asp Gly Ser Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp
    690                 695                 700

Thr Leu Pro Phe Lys Gln Ile Ile Gln Lys Ser Gln Val Val Gly Asp
705                 710                 715                 720

Val Asp Asp Ile Glu Ala Val Val His Asp Leu Pro Gly Ser Pro Ala
                725                 730                 735

Ile Lys Lys Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val
            740                 745                 750

Lys Val Met Gly Asp Asn Pro Asp Asn Ile Val Ile Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Asn Arg Gly Arg Ser Gln Ser Gln Gln Arg Leu
    770                 775                 780

Lys Lys Leu Gln Asn Ser Leu Lys Glu Leu Gly Ser Asn Ile Leu Asn
785                 790                 795                 800

Glu Glu Lys Pro Ser Tyr Ile Glu Asp Lys Val Glu Asn Ser His Leu
```

```
                805                 810                 815

Gln Asn Asp Gln Leu Phe Leu Tyr Tyr Ile Gln Asn Gly Lys Asp Met
            820                 825                 830

Tyr Thr Gly Asp Glu Leu Asp Ile Asp His Leu Ser Asp Tyr Asp Ile
        835                 840                 845

Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp Ser Ile Asp Asn
    850                 855                 860

Arg Val Leu Thr Ser Ser Ala Lys Asn Arg Gly Lys Ser Asp Asp Val
865                 870                 875                 880

Pro Ser Leu Asp Ile Val Arg Ala Arg Lys Ala Glu Trp Val Arg Leu
                885                 890                 895

Tyr Lys Ser Gly Leu Ile Ser Lys Arg Lys Phe Asp Asn Leu Thr Lys
            900                 905                 910

Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Gly Phe Ile Lys
        915                 920                 925

Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln Ile
    930                 935                 940

Leu Asp Ala Arg Phe Asn Thr Glu Ser Asp Glu Asn Asp Lys Val Ile
945                 950                 955                 960

Arg Asp Val Lys Val Ile Thr Leu Lys Ser Asn Leu Val Ser Gln Phe
                965                 970                 975

Arg Lys Asp Phe Glu Phe Tyr Lys Val Arg Glu Ile Asn Asp Tyr His
            980                 985                 990

His Ala His Asp Ala Tyr Leu Asn  Ala Val Val Gly Thr  Ala Leu Leu
        995                 1000                1005
```

```
Lys Lys  Tyr Pro Lys Leu Ala  Ser Glu Phe Val Tyr  Gly Glu Tyr
    1010                1015                1020

Lys Lys  Tyr Asp Ile Arg Lys  Phe Ile Thr Asn Ser  Ser Asp Lys
    1025                1030                1035

Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Leu Met  Asn Phe Phe
    1040                1045                1050

Lys Arg  Val Ile Arg Tyr Ser  Asn Gly Lys Val Ile  Val Arg Pro
    1055                1060                1065

Val Val  Glu Tyr Ser Lys Asp  Thr Glu Asp Ile Ala  Trp Asp Lys
    1070                1075                1080

Lys Ser  Asn Phe Arg Thr Ile  Cys Lys Val Leu Ser  Tyr Pro Gln
    1085                1090                1095

Val Asn  Ile Val Lys Lys Val  Glu Thr Gln Thr Gly  Gly Phe Ser
    1100                1105                1110

Lys Glu  Ser Ile Leu Pro Lys  Gly Asp Ser Asp Lys  Leu Ile Pro
    1115                1120                1125

Arg Lys  Thr Lys Lys Ala Tyr  Trp Asp Thr Lys Lys  Tyr Gly Gly
    1130                1135                1140

Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val Phe Val  Val Ala Asp
    1145                1150                1155

Val Glu  Lys Gly Lys Ala Lys  Lys Leu Lys Thr Val  Lys Glu Leu
    1160                1165                1170

Val Gly  Ile Ser Ile Met Glu  Arg Ser Phe Phe Glu  Glu Asn Pro
    1175                1180                1185

Val Glu  Phe Leu Glu Asn Lys  Gly Tyr His Asn Ile  Arg Glu Asp
```

```
    1190                1195                1200

Lys Leu  Ile Lys Leu Pro Lys  Tyr Ser Leu Phe Glu  Phe Glu Gly
    1205                1210                1215

Gly Lys  Arg Arg Leu Leu Ala  Ser Ala Ser Glu Leu  Gln Lys Gly
    1220                1225                1230

Asn Glu  Met Val Ile Pro Gly  His Leu Val Lys Leu  Leu Tyr His
    1235                1240                1245

Ala Gln  Arg Ile Asn Ser Phe  Asn Ser Thr Lys Tyr  Leu Asp Tyr
    1250                1255                1260

Val Ser  Ala His Lys Lys Glu  Phe Glu Lys Val Leu  Ser Cys Val
    1265                1270                1275

Glu Asp  Phe Ala Asn Leu Tyr  Val Asp Val Glu Lys  Asn Leu Ser
    1280                1285                1290

Lys Ile  Arg Ala Val Ala Asp  Ser Met Asp Asn Phe  Ser Ile Glu
    1295                1300                1305

Glu Ile  Ser Asn Ser Phe Ile  Asn Leu Leu Thr Leu  Thr Ala Leu
    1310                1315                1320

Gly Ala  Pro Ala Asp Phe Asn  Phe Leu Gly Glu Lys  Ile Pro Arg
    1325                1330                1335

Lys Arg  Tyr Thr Ser Thr Lys  Glu Cys Leu Asn Ala  Thr Leu Ile
    1340                1345                1350

His Gln  Ser Ile Thr Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser
    1355                1360                1365

Lys Ile  Gly Glu Glu
    1370
```

<210> 172
<211> 1099
<212> PRT
<213> Corynebacterium accolens

<400> 172

Met Ser Leu Leu Tyr Arg Val Gly Ile Asp Val Gly Thr Tyr Ser Leu
1 5 10 15

Gly Cys Thr Ala Ile Glu Val Asp Asp Asn Asp Gln Pro Val Ser Ile
20 25 30

Leu Ser Ser Val Ser Leu Ile His Asp Ser Gly Leu Asp Pro Asp Gln
35 40 45

Gln Lys Arg Ala Val Thr Arg Leu Ala Ser Ser Gly Val Ala Arg Arg
50 55 60

Thr Arg Arg Leu Tyr Arg Arg Arg Arg Arg Arg Met Val Lys Leu Glu
65 70 75 80

Asn Phe Leu Thr Ala Gln Gly Trp Glu Thr Leu Pro Phe Glu Arg Tyr
85 90 95

Ser Asp Pro Tyr Leu Pro Trp His Ala Arg Val Ala Leu Val Asn Gly
100 105 110

Tyr Ile Ser Asp Asp Thr Gln Arg Gly Gln Tyr Leu Ser Ile Ala Phe
115 120 125

Arg His Ile Ala Asn His Arg Gly Trp Arg Asn Pro Tyr Trp Lys Val
130 135 140

Ser Ser Leu Tyr Ser Pro Asp Lys Pro Ser Asp Ala Phe Glu Gln Ile
145 150 155 160

Arg Lys Glu Leu Glu Ala Ser Thr Gly Arg Gln Ile Pro Glu Thr Ala
165 170 175

```
Thr Val Gly Gln Leu Ile Ser Phe Ala Gln Phe Gly Lys Asp Arg Leu
            180                 185                 190

Arg Gly Gly Gly Lys Gln Lys Asp Lys Lys Lys Pro Gln Glu Gln Val
        195                 200                 205

Asn Gln Ala Val Ile Ser Ala Arg Leu His Gln Ile Asp His Ala Arg
    210                 215                 220

Glu Ile Asn Glu Ile Cys Arg Val Gln Lys Ile Asp Asp Thr Leu Arg
225                 230                 235                 240

Lys Gln Ile Leu Asp Leu Val Phe Ala Ala Glu Ser Pro Lys Gly Ala
                245                 250                 255

Gln Lys Gly Arg Val Gly Lys Asp Pro Leu Gln Pro Lys Leu Phe Arg
            260                 265                 270

Ala Leu Lys Ala Ser Asp Ala Phe Gln Gln Tyr Arg Ile Ala Ala Leu
        275                 280                 285

Thr Gly Asn Leu Arg Ile Tyr Arg Asn Gly Val Thr Val Pro Leu Asp
    290                 295                 300

Arg Asp Glu Lys Leu Ile Val Phe Asn Tyr Leu Val Asn Leu Pro Lys
305                 310                 315                 320

Lys Glu Glu Pro Ser Trp Leu Lys Ile Ala Glu Ile Leu Asn Ile Asp
                325                 330                 335

Arg Gly Gln Leu Arg Gly Thr Ala Thr Met Thr Asp Asp Gly Glu Arg
            340                 345                 350

Ala Gly Ala Thr Pro Pro Val His Asp Thr Asn Arg Thr Ile Leu Asp
        355                 360                 365
```

```
Ser Lys Val Lys Pro Leu Ala His Trp Trp Glu Asn Ala Ser Asp Asp
    370                 375                 380

Glu Arg Ala Ala Met Leu Lys Ser Leu Ser Asn Ser Glu Val Glu Asp
385                 390                 395                 400

Phe Asp Ser Pro Ala Gly Ala Gln Val Gln Ala Phe Phe Ala Asp Leu
                405                 410                 415

Asp Glu Thr Glu Gln Glu Lys Leu Asp Ser Leu His Leu Pro Met Gly
            420                 425                 430

Arg Ala Ala Tyr Ser Glu Asp Thr Leu Met Arg Leu Thr Asn Arg Met
        435                 440                 445

Leu Asp Glu Asn Leu Asp Leu Tyr Glu Ala Arg Leu Ala Glu Phe Gly
    450                 455                 460

Ile Pro Lys Asp Trp Ala Pro Pro Ala Pro Arg Ile Gly Glu Pro Val
465                 470                 475                 480

Gly Asn Pro Ala Val Asp Arg Val Leu Lys Gly Val Ala Arg Trp Leu
                485                 490                 495

Glu Ala Ala Ala Asp Glu Trp Gly Ala Pro Lys Ser Val Val Ile Glu
            500                 505                 510

His Val Arg Asp Gly Phe Val Ser Lys Ser Lys Ala Ile Glu Ile Asp
        515                 520                 525

Arg Ala Asn Asn Asn Arg His Lys Arg Asn Arg Glu Leu Phe Gln Lys
    530                 535                 540

Met Gln Glu Asn Leu Gly Ile Glu Gly Lys Val Arg Ser Ser Asp Leu
545                 550                 555                 560

Trp Arg Tyr Gln Ser Val Gln Arg Gln Asn Cys Gln Cys Ala Tyr Cys
                565                 570                 575
```

```
Gly Ser Pro Ile Thr Tyr Thr Thr Cys Glu Met Asp His Ile Val Pro
            580                 585                 590

Arg Ala Gly Glu Gly Ser Thr Asn Thr Arg Asp Asn Leu Val Ala Thr
        595                 600                 605

Cys His Arg Cys Asn Leu Ala Lys Lys Asn Ile Pro Phe Ala Val Trp
    610                 615                 620

Ala Glu Lys Ser Thr Ile Pro Gly Val Ser Val Lys Glu Ala Leu Asp
625                 630                 635                 640

Arg Thr Arg His Trp Ser Glu Asp Ser Gly Met Ser Lys Lys Asp Phe
                645                 650                 655

Gln Lys Phe Arg Lys Asn Val Cys Glu Arg Leu Asn Arg Thr Val Val
            660                 665                 670

Asp Glu Pro Leu Asp Ala Arg Ser Met Glu Ser Val Ala Trp Met Ala
        675                 680                 685

Asn Glu Leu Arg Gly Arg Val Ala Gln Arg Phe Gln Glu Glu Asn Thr
    690                 695                 700

Thr Val Asn Val Tyr Arg Gly Ala Leu Thr Ala Glu Ala Arg Arg Ala
705                 710                 715                 720

Ala Gly Ile Thr Asp Lys Leu Arg Phe Ile Asp Gly Thr Gly Lys Ser
                725                 730                 735

Arg Leu Asp Arg Arg His His Ala Val Asp Ala Ala Val Val Ala Phe
            740                 745                 750

Ile His Asn Tyr Val Ala Glu Thr Leu Ala Ile Arg Ser Asn Lys Lys
        755                 760                 765
```

```
Arg Glu Ala Gln Leu Leu Gln Gly Thr Ser Gln Trp Lys Glu Phe Thr
    770                 775                 780

Gly Ser Asp Asp Lys His Arg Ala Val Trp Asn Ala Trp Ile Pro Lys
785                 790                 795                 800

Met Gln Lys Leu Ala Val Leu Leu Gln Ile Ala Leu Asp Glu Asp Arg
                805                 810                 815

Ile Val Val Thr Ser Asn Leu Arg Leu Arg Leu Gly Asn Gly Arg Ala
            820                 825                 830

His Glu Asp Thr Ile Ser Glu Leu Lys Thr Ile Arg Val Gly Asp Ala
        835                 840                 845

Ile Ser Val Thr Asp Ile Asp Arg Ala Ser Ser Glu Ala Leu Trp Cys
    850                 855                 860

Ala Leu Thr Arg Glu Pro Asp Phe Asp Glu Lys Asp Gly Leu Pro Glu
865                 870                 875                 880

Asn Pro Asn Arg Arg Ile Arg Val His Gly Thr Trp Tyr Asp Ala Glu
                885                 890                 895

Asp Glu Ile Glu Val Phe Pro Val Gly Ala Gly Ala Ile Lys Val Arg
            900                 905                 910

Gly Gly Tyr Ala Lys Leu Ser Arg Phe His His Ala Arg Val Tyr Lys
        915                 920                 925

Ile Pro Gly Lys Lys Ala Pro Ile Tyr Cys Met Leu Arg Val Tyr Asn
    930                 935                 940

Thr Asp Leu Val Gln His Arg His Glu Asp Leu Phe Ser Val Glu Leu
945                 950                 955                 960

Lys Pro Gln Thr Met Ser Val Arg Gln Ala Glu Pro Lys Leu Arg Lys
                965                 970                 975
```

```
Ala Leu Ala Glu Asn Thr Ala Glu Tyr Leu Gly Trp Leu Val Thr Asp
            980                 985                 990


Asp Glu Leu Ile Ile Asp Thr Ser  Thr Phe Arg Thr Gly  Leu Ile Glu
        995                 1000                1005


Glu Met  Gln Ser Glu Phe Gly  Leu Val Arg Arg Trp  Arg Leu Asp
    1010                1015                1020


Gly Phe  Asp Ser Pro Ser Leu  Leu Thr Leu Arg Pro  Leu His Met
    1025                1030                1035


Ser Ala  Glu Gly Leu Pro Asp  Asp Cys Ala Leu Gly  Ser Arg Lys
    1040                1045                1050


Ile Ile  Asp Thr Lys Gly Trp  Arg Val Ser Ile Asn  Lys Val Phe
    1055                1060                1065


Asn Ala  Gly Asn Thr Thr Val  Val Arg Arg Asp Ala  Leu Gly Arg
    1070                1075                1080


Ala Arg  Leu Thr Ser Asn Ala  His Leu Pro Ile Ser  Trp Lys Glu
    1085                1090                1095


Glu
```

<210> 173
<211> 1054
<212> PRT
<213> Actinobacillus pleuropneumoniae

<400> 173

```
Met Lys Leu Thr Pro Leu Asn Tyr Ile Leu Gly Leu Asp Leu Gly Ile
1               5                   10                  15


Ala Ser Val Gly Trp Ala Val Val Glu Ile Asp Glu Gln Glu Asn Pro
```

```
            20                  25                  30

Leu Gly Leu Ile Asp Val Gly Val Arg Thr Phe Asp Arg Ala Glu Val
        35                  40                  45

Ala Lys Thr Gly Glu Ser Leu Ala Leu Ala Arg Arg Leu Ala Arg Ser
    50                  55                  60

Ser Arg Arg Leu Val Lys Arg Arg Ala Asp Arg Ile Lys Lys Val Lys
65                  70                  75                  80

Arg Leu Leu Lys Ser Glu Asn Ile Leu Leu Ser Ala Asp Glu Gln Leu
                85                  90                  95

Pro Asn Asp Val Trp Gln Leu Arg Val Lys Gly Leu Asp Gln Lys Leu
            100                 105                 110

Glu Arg Gln Glu Trp Ala Ala Val Leu Leu His Leu Leu Lys His Arg
        115                 120                 125

Gly Tyr Leu Ser Gln Arg Lys Asn Glu Ser Lys Ser Glu Asn Lys Glu
    130                 135                 140

Leu Gly Ala Leu Arg Ser Gly Val Ala Ala Asn His Gln Ile Leu Gln
145                 150                 155                 160

Ser Ala Glu Tyr Arg Thr Pro Ala Glu Ile Ala Val Lys Lys Phe His
                165                 170                 175

Val Glu Glu Gly His Ile Arg Asn Gln Arg Gly Ala Tyr Thr His Thr
            180                 185                 190

Phe Ser Arg Leu Asp Leu Leu Ala Glu Ile Glu Leu Leu Phe Thr Arg
        195                 200                 205

Gln Thr Glu Leu Gly Asn Pro His Thr Ser Ala Lys Leu Leu Glu Asn
    210                 215                 220
```

```
Leu Thr Ala Leu Leu Met Trp Gln Lys Pro Ala Leu Ala Gly Glu Ala
225                 230                 235                 240


Ile Leu Lys Met Leu Gly Lys Cys Thr Phe Glu Pro Thr Glu Tyr Lys
                245                 250                 255


Ala Ala Lys Asn Ser Tyr Ser Ala Glu Arg Phe Val Trp Leu Thr Lys
            260                 265                 270


Leu Asn Asn Leu Arg Ile Leu Glu Gln Gly Ala Glu Arg Ala Leu Thr
        275                 280                 285


Asp Asn Glu Arg Phe Ala Leu Leu Asp Gln Pro Tyr Glu Lys Ala Lys
    290                 295                 300


Phe Thr Tyr Ala Gln Ala Arg Thr Met Leu Ala Leu Pro Asp Glu Ala
305                 310                 315                 320


Ile Phe Lys Gly Val Arg Tyr Gln Gly Glu Asp Lys Lys Ala Val Glu
                325                 330                 335


Thr Lys Thr Ile Leu Met Glu Met Lys Ala Tyr His Gln Ile Arg Lys
            340                 345                 350


Ala Leu Glu Asn Ala Asp Leu Lys Ala Glu Trp Asn Glu Leu Lys Asn
        355                 360                 365


Asn Ser Glu Leu Leu Asp Asp Ile Gly Thr Ala Phe Ser Leu His Lys
    370                 375                 380


Thr Asp Glu Asp Ile Cys Arg Tyr Leu Asp Gly Lys Leu Ser Glu Ser
385                 390                 395                 400


Ile Leu Asn Ala Leu Leu Glu Asn Leu Asn Phe Asp Lys Phe Ile Gln
                405                 410                 415


Leu Ser Leu Lys Ala Leu Gln Gln Ile Leu Pro Leu Met Leu Gln Gly
```

```
            420                 425                 430

Gln Arg Tyr Asp Glu Ala Val Ser Ala Ile Tyr Gly Asp His Tyr Gly
        435                 440                 445

Lys Lys Ser Ala Glu Ile Asn Arg Leu Leu Pro Thr Ile Pro Ala Asp
    450                 455                 460

Glu Ile Arg Asn Pro Val Val Leu Arg Thr Leu Thr Gln Ala Arg Lys
465                 470                 475                 480

Val Ile Asn Ala Val Val Arg Leu Tyr Gly Ser Pro Ala Arg Ile His
                485                 490                 495

Ile Glu Thr Gly Arg Glu Val Gly Lys Ser Tyr Gln Asp Arg Lys Lys
            500                 505                 510

Leu Glu Lys Gln Gln Glu Asp Asn Arg Lys His Arg Glu Ser Ala Val
        515                 520                 525

Gln Lys Phe Lys Glu Tyr Phe Pro Asn Phe Val Gly Glu Pro Lys Gly
    530                 535                 540

Lys Asp Ile Leu Lys Met Arg Leu Tyr Glu Leu Gln Gln Ala Lys Cys
545                 550                 555                 560

Leu Tyr Ser Gly Lys Ser Leu Glu Leu His Arg Leu Leu Glu Lys Gly
                565                 570                 575

Tyr Val Glu Val Asp His Ala Leu Pro Phe Ser Arg Thr Trp Asp Asp
            580                 585                 590

Ser Phe Asn Asn Lys Val Leu Val Leu Ala Asn Glu Asn Gln Asn Lys
        595                 600                 605

Gly Asn Leu Thr Pro Tyr Glu Trp Leu Asp Gly Lys Asn Asn Ser Glu
    610                 615                 620
```

```
Pro Trp Gln Asn Phe Val Ala Arg Val Gln Thr Ser Gly Phe Ser His
625                 630                 635                 640

Thr Lys Lys Gln Arg Ile Leu Ser His Lys Leu Asp Glu Lys Gly Phe
                645                 650                 655

Ile Glu Arg Asn Leu Asn Asp Thr Arg Tyr Val Val Arg Phe Leu Cys
            660                 665                 670

Asn Phe Ile Ala Asp Asn Met Leu Leu Thr Gly Lys Gly Lys Arg Lys
        675                 680                 685

Val Phe Ala Ser Asn Gly Gln Ile Thr Ala Leu Leu Arg Gly Arg Trp
    690                 695                 700

Gly Leu Gln Lys Val Arg Asp Asp Asn Asp Arg His His Ala Leu Asp
705                 710                 715                 720

Ala Val Val Val Ala Cys Ser Thr Val Ala Met Gln Gln Lys Ile Thr
                725                 730                 735

Arg Phe Val Arg Tyr Glu Glu Gly Asn Val Phe Ser Gly Glu Arg Ile
            740                 745                 750

Asp Arg Glu Thr Gly Glu Ile Ile Pro Leu His Phe Pro Ser Pro Trp
        755                 760                 765

Ala Phe Phe Arg Glu Asn Val Glu Ile Arg Ile Phe Ser Glu Asn Pro
    770                 775                 780

Lys Leu Glu Leu Glu Asn Arg Leu Pro Asp Tyr Pro Gln Tyr Asn His
785                 790                 795                 800

Glu Phe Val Gln Pro Leu Phe Val Ser Arg Met Pro Thr Arg Lys Met
                805                 810                 815

Thr Gly Gln Gly His Met Glu Thr Val Lys Ser Ala Lys Arg Leu Asp
```

```
            820                 825                 830

Glu Gly Leu Ser Val Leu Lys Val Pro Leu Thr Gln Leu Lys Leu Asn
        835                 840                 845

Asp Leu Glu Arg Met Val Asn Arg Glu Arg Glu Met Ala Leu Tyr Glu
    850                 855                 860

Ser Leu Lys Val Arg Leu Glu Gln Phe Asp Asn Asp Pro Ala Lys Ala
865                 870                 875                 880

Phe Ala Glu Pro Phe Tyr Lys Lys Gly Gly Ala Leu Val Lys Ala Val
                885                 890                 895

Arg Val Glu Gln Thr Gln Lys Ser Gly Val Leu Val Arg Asp Gly Asn
            900                 905                 910

Gly Val Ala Asp Asn Ala Ser Met Val Arg Val Asp Val Phe Thr Lys
        915                 920                 925

Ala Gly Lys Tyr Phe Leu Val Pro Ile Tyr Thr Trp Gln Val Ala Lys
    930                 935                 940

Gly Ile Leu Pro Asn Lys Ala Val Thr Ala Asn Val Asp Glu Ile Asp
945                 950                 955                 960

Trp Leu Glu Met Asp Glu Ser Tyr Gln Phe Ile Phe Thr Met Tyr Pro
                965                 970                 975

Asn Asp Leu Val Lys Val Lys Leu Lys Lys Glu Glu Phe Phe Gly Tyr
            980                 985                 990

Tyr Gly Gly Leu Asp Arg Ala Thr  Gly Ala Ile Val Ile  Lys Glu His
        995                 1000                1005

Asp Leu  Glu Lys Ser Lys Gly  Arg Gln Gly Ile Tyr  Arg Ile Gly
    1010                1015                1020
```

Val Lys Leu Ala Leu Ser Phe Glu Lys Tyr Gln Val Asp Glu Leu
    1025   1030   1035

Gly Lys Asn Ile Arg Pro Cys Arg Pro Thr Lys Arg Gln His Val
    1040   1045   1050

Arg

<210> 174
<211> 1369
<212> PRT
<213> Lactobacillus iners

<400> 174

Met Asn Asn Asn Tyr Tyr Leu Gly Leu Asp Leu Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ala Val Thr Asp Asp His Tyr Asn Ile Ile Lys Phe His Gly
            20   25   30

Lys His Met Trp Gly Met Arg Leu Phe Glu Glu Ala Glu Thr Ala Lys
        35   40   45

Asp Arg Arg Leu His Arg Gln Ala Arg Arg Arg Arg Gln Arg Leu Val
    50   55   60

Glu Arg Ile Asn Leu Leu Glu Glu Leu Phe Asp Lys Glu Ile Ser Lys
65   70   75   80

Val Asp Gln Gly Phe Phe Ala Arg Lys Lys Glu Ser Asp Leu His Phe
                85   90   95

Glu Asp Lys Thr Thr Lys Ser Glu Tyr Ala Leu Phe Asn Asp Lys Ser
            100   105   110

Tyr Thr Asp Arg Asp Tyr Tyr Lys Gln Tyr Pro Thr Ile Phe His Leu
        115   120   125

```
Ile Met Asp Leu Ile Glu Asn Asp Lys Lys Arg Asp Ile Arg Leu Val
    130                 135                 140

Tyr Leu Ala Cys His Tyr Leu Ile Lys His Arg Gly His Phe Ile Phe
145                 150                 155                 160

Asp Gly Lys Asn Phe Thr Val Asp Asn Ser Phe Glu Asn Leu Leu Asp
                165                 170                 175

Lys Leu Ile Thr Tyr Leu Lys Asp Asn Asp Asp Ile Thr Leu Ser Phe
            180                 185                 190

Pro Lys Asp Gln Leu Ile Asn Ile Phe Lys Asn Ser Asn Leu Asn Ser
        195                 200                 205

Thr Glu Lys Ser Asp Gln Leu Lys Pro Phe Phe Gly Arg Thr Asn Leu
    210                 215                 220

Glu Lys Gly Ile Ile Lys Leu Leu Ser Gly Gly Lys Gln Asp Leu Ser
225                 230                 235                 240

Asn Met Phe Arg Asp Glu Thr Leu Lys Asn Ser Asn Tyr Lys Asn Leu
                245                 250                 255

Lys Phe Ser Asp Asn Arg Phe Asp Asp Glu Arg Asp Gly Tyr Ala Ala
            260                 265                 270

Asp Leu Gly Asp Arg Ile Asp Leu Leu Ile Leu Leu Lys Gln Ile Tyr
        275                 280                 285

Asp Ala Ser Ile Leu Glu Ser Met Met Ser Gln Ala Arg Val Ser Ile
    290                 295                 300

Asp Gly His Lys Tyr Ile Ser Ser Ala Lys Val Cys Ala Tyr Glu Lys
305                 310                 315                 320
```

```
His Lys Ser Asp Leu Lys Arg Leu Lys Ser Leu Ile Lys Lys Tyr Leu
                325                 330                 335

Pro Ser Glu Tyr Asn Asn Ile Phe Arg Lys Ile Thr Glu Lys Asp Asn
            340                 345                 350

Tyr Val Ala Tyr Ser Lys Ser Asn Ile Thr Asn Asn Lys Arg Glu Lys
        355                 360                 365

Ala Leu Lys Tyr Val Lys Tyr Val Asp Phe Thr Lys Tyr Leu Thr Lys
    370                 375                 380

Lys Leu Lys Thr Ile Lys Thr Gln Asp Ala Glu Asp Asp Gln Glu Ile
385                 390                 395                 400

Phe Glu Ile Lys Gly Glu Leu Glu Lys Gln Ser Phe Leu Pro Lys Gln
                405                 410                 415

Arg Thr Leu Asp Asn Ser Ile Ile Pro Tyr Gln Leu His Leu Met Glu
            420                 425                 430

Leu Lys Lys Ile Leu Asp Asn Gln Ser Lys Tyr Tyr Asp Phe Leu Leu
        435                 440                 445

Ala Lys Asp Asp Gln Glu Gly Ile Thr Val Lys Asp Lys Ile Ile Ser
    450                 455                 460

Leu Leu Thr Phe Arg Leu Pro Tyr Tyr Ile Gly Pro Val Asn Pro Ala
465                 470                 475                 480

Val His Gly Lys Phe Ala Trp Val Lys Arg Leu Ala Asn Gly Lys Val
                485                 490                 495

Thr Pro Trp Asn Tyr Lys Glu Lys Ile Asp Ile Asp Ala Ser His Glu
            500                 505                 510

Glu Phe Ile Lys Thr Lys Leu Ser Lys Cys Ser Phe Leu Ile Gly Cys
        515                 520                 525
```

```
Asp Val Leu Pro Lys Asn Ser Leu Leu Tyr Gln Lys Tyr Met Val Leu
    530                 535                 540

Ser Glu Leu Asn Thr Ile Lys Phe Asn Gly Val Asn Ile Ser Glu Lys
545                 550                 555                 560

Leu Lys Asp Asp Ile Tyr Gln Asn Leu Phe Lys Asn Ile Gln Lys Val
                565                 570                 575

Thr Lys Lys Arg Leu Gln Asn Tyr Ile Lys Glu His Glu Asn Ile Ile
            580                 585                 590

Gly Asp Val Ile Val Thr Gly Ile Asp Asn Ala Phe Lys Gln Gly Leu
        595                 600                 605

Val Ser Tyr Leu Lys Phe Lys Lys Ile Ile Gly Asp Lys Val Asp Asp
    610                 615                 620

Asp Arg Tyr Gln Lys Val Leu Glu Lys Ile Ile Arg Asp Ile Thr Leu
625                 630                 635                 640

Tyr Asp Glu Cys Ala Gly Lys Lys Ile Lys Lys Glu Tyr Lys Asp Ser
                645                 650                 655

Asp Leu Phe Thr Glu Asp Glu Leu Asn Lys Ile Val Lys Leu Thr Phe
            660                 665                 670

Asn Asp Trp Gly Arg Leu Ser Ala Glu Leu Leu Asp Gln Leu Glu Gly
        675                 680                 685

Glu Asp Thr Val Ser Gly Glu Thr Gly Lys Ile Ile Glu Phe Met Gln
    690                 695                 700

Lys His Asn Tyr Asn Leu Met Gln Leu Met Ser Lys Lys Phe Thr Phe
705                 710                 715                 720
```

```
Lys Ser Lys Ile Asp Glu Ile Asn Lys Ser Tyr Tyr Gln His Asp Lys
                725                 730                 735

Phe Asn Tyr Lys Ser Met Ile Asp Ser Leu Tyr Val Ser Pro Ala Thr
            740                 745                 750

Lys Arg Ile Leu Trp Gln Ser Leu Lys Val Val His Glu Ile Ser Lys
        755                 760                 765

Ile Met Lys His Asp Pro Glu Lys Ile Phe Ile Glu Met Ala Arg Ser
    770                 775                 780

Lys Glu Asp His Pro Lys Arg Lys Leu Ser Arg Lys Ala Asp Leu Lys
785                 790                 795                 800

Gln Val Tyr Lys Asp Ser Lys Lys Gln Ile Ile Ser Ile Ile Gly Lys
                805                 810                 815

Asp Lys Tyr Gln Asp Leu Ser Asn Glu Leu Asp Asn Lys Asp Asp Arg
            820                 825                 830

Asp Leu Arg Trp Asp Asn Leu Tyr Leu Tyr Tyr Thr Gln Leu Gly Arg
        835                 840                 845

Ser Met Tyr Ser Leu Lys Pro Ile Asp Ile Ser Glu Leu Met Asn Lys
    850                 855                 860

Asn Leu Tyr Asp Gln Asp His Ile Phe Pro Lys Ser Lys Lys Tyr Asp
865                 870                 875                 880

Asp Ser Ile Glu Asn Arg Val Leu Val Glu Lys Glu Leu Asn Val Lys
                885                 890                 895

Lys Ser Asp Ile Tyr Pro Ile Ser Asp Ala Asn Ile Ile Pro Gln Lys
            900                 905                 910

Ile Lys Gly Gln Val Glu Ser Phe Trp Lys Met Leu Tyr Asp His Lys
        915                 920                 925
```

```
Leu Ile Gly Asp Lys Lys Tyr Ala Arg Leu Ile Arg Ser Lys Ala Phe
    930                 935                 940

Thr Asp Asp Glu Leu Ala Gly Phe Ile Ala Arg Gln Leu Val Glu Thr
945                 950                 955                 960

Arg Gln Ala Thr Lys Glu Thr Ala Asp Leu Leu Lys Arg Leu Cys Pro
                965                 970                 975

Lys Ser Arg Ile Val Tyr Ala Lys Ala Gln Asn Ala Ser Ile Phe Arg
            980                 985                 990

Gln Lys Phe Asp Ile Pro Lys Ser  Arg Thr Ile Asn Asp  Leu His His
        995                 1000                1005

Ala Gln  Asp Ala Tyr Leu Asn  Ile Val Val Gly Asn  Ile Phe Asp
    1010                1015                1020

Thr Lys  Phe Thr Gln Asp Pro  Arg Asn Phe Ile Lys  Asn Thr Lys
    1025                1030                1035

Asp Ser  Arg Asn Tyr Asn Leu  Glu Lys Ile Tyr Asp  Tyr Asn Val
    1040                1045                1050

Glu Arg  Asn Asn Tyr Val Ala  Trp Ile Ala Pro Asp  Gly Glu Thr
    1055                1060                1065

Asn Gly  Thr Ile Ala Asn Val  Lys Cys Asn Leu Ser  Thr Lys Asp
    1070                1075                1080

Phe Arg  Val Thr Arg Pro Ser  Phe Tyr Lys Lys Gly  Ala Leu Phe
    1085                1090                1095

Asn Gln  Asn Leu Ser Arg Lys  Gly Ser Asn Leu Ala  Pro Ile Lys
    1100                1105                1110
```

```
Glu His  Ser Pro Lys Ser Asn  Pro Leu Lys Tyr Gly  Gly Tyr Ser
    1115                1120                1125

Gly Lys  Asn Asn Ser Phe Phe  Val Val Val Ala Gly  Lys Asp Asn
    1130                1135                1140

Lys Gly  Lys Asp Ile Val Lys  Leu Ile Pro Val Asn  Thr Leu Ile
    1145                1150                1155

Tyr Asn  Lys Met Leu His Cys  Asp Tyr Lys Ala Lys  Gln Glu Leu
    1160                1165                1170

Leu Thr  Ser Tyr Val Ala Asn  Asn Phe Ala Ile Asn  Asn Phe Arg
    1175                1180                1185

Ile Val  Lys Asp Asp Ile Lys  Met Tyr Ser Leu Val  Lys Ile Asp
    1190                1195                1200

Gly Ala  Tyr Tyr Tyr Leu Val  Gly Gly Thr Asp Glu  Arg Ile Glu
    1205                1210                1215

Val Lys  Asn Ala Met Gln Leu  Leu Leu Ser Lys Asp  Ser Ile Lys
    1220                1225                1230

Ala Val  Lys Ile Leu Glu Lys  Glu Ser Lys Asp Gln  Phe Ala Asn
    1235                1240                1245

Ile Lys  Asn Tyr Lys Asp Ile  Asp Ile Lys Leu Gly  Arg Thr Phe
    1250                1255                1260

Asn Glu  Val Val Ser Lys Tyr  Thr Asn Ser Val Phe  Gly Lys Ser
    1265                1270                1275

Met Leu  Ile Ser Asp Lys Tyr  Arg Lys Asp Ile Phe  Lys Ser Val
    1280                1285                1290

Glu Lys  Ser Ile Leu Glu Phe  Asn His Leu Asp Thr  Ile Gly Lys
    1295                1300                1305
```

Ala Asp Asn Leu Leu Lys Phe Val Thr Leu Met Arg Pro Ser Gly
    1310   1315   1320

Ser Ala His Ser Leu Lys Met Val Gly Leu Ile Glu Arg Ile Arg
    1325   1330   1335

Lys Ser Asn Val Ile Ser Asn Phe Asn Glu Phe Lys Leu Ile Asn
    1340   1345   1350

Gln Ser Val Thr Gly Leu Phe Glu Asn Glu Glu Asp Leu Leu Lys
    1355   1360   1365

Leu

<210> 175
<211> 1420
<212> PRT
<213> Bifidobacterium bifidum

<400> 175

Met Ser Arg Lys Asn Tyr Val Asp Asp Tyr Ala Ile Ser Leu Asp Ile
1   5   10   15

Gly Asn Ala Ser Val Gly Trp Ser Ala Phe Thr Pro Asn Tyr Arg Leu
            20   25   30

Val Arg Ala Lys Gly His Glu Leu Ile Gly Val Arg Leu Phe Asp Pro
        35   40   45

Ala Asp Thr Ala Glu Ser Arg Arg Met Ala Arg Thr Thr Arg Arg Arg
    50   55   60

Tyr Ser Arg Arg Arg Trp Arg Leu Arg Leu Leu Asp Ala Leu Phe Asp
65   70   75   80

Gln Ala Leu Ser Glu Ile Asp Pro Ser Phe Leu Ala Arg Arg Lys Tyr

```
                85                  90                  95

Ser Trp Val His Pro Asp Asp Glu Asn Asn Ala Asp Cys Trp Tyr Gly
            100                 105                 110

Ser Val Leu Phe Asp Ser Asn Glu Gln Asp Lys Arg Phe Tyr Glu Lys
        115                 120                 125

Tyr Pro Thr Ile Tyr His Leu Arg Lys Ala Leu Met Glu Asp Asp Ser
    130                 135                 140

Gln His Asp Ile Arg Glu Ile Tyr Leu Ala Ile His His Met Val Lys
145                 150                 155                 160

Tyr Arg Gly Asn Phe Leu Val Glu Gly Thr Leu Glu Ser Ser Asn Ala
                165                 170                 175

Phe Lys Glu Asp Glu Leu Leu Lys Leu Leu Gly Arg Ile Thr Arg Tyr
            180                 185                 190

Glu Met Ser Glu Gly Glu Gln Asn Ser Asp Ile Glu Gln Asp Asp Glu
        195                 200                 205

Asn Lys Leu Val Ala Pro Ala Asn Gly Gln Leu Ala Asp Ala Leu Cys
    210                 215                 220

Ala Thr Arg Gly Ser Arg Ser Met Arg Val Asp Asn Ala Leu Glu Ala
225                 230                 235                 240

Leu Ser Ala Val Asn Asp Leu Ser Arg Glu Gln Arg Ala Ile Val Lys
                245                 250                 255

Ala Ile Phe Ala Gly Leu Glu Gly Asn Lys Leu Asp Leu Ala Lys Ile
            260                 265                 270

Phe Val Ser Lys Glu Phe Ser Ser Glu Asn Lys Lys Ile Leu Gly Ile
        275                 280                 285
```

```
Tyr Phe Asn Lys Ser Asp Tyr Glu Glu Lys Cys Val Gln Ile Val Asp
    290                 295                 300

Ser Gly Leu Leu Asp Asp Glu Glu Arg Glu Phe Leu Asp Arg Met Gln
305                 310                 315                 320

Gly Gln Tyr Asn Ala Ile Ala Leu Lys Gln Leu Leu Gly Arg Ser Thr
                325                 330                 335

Ser Val Ser Asp Ser Lys Cys Ala Ser Tyr Asp Ala His Arg Ala Asn
            340                 345                 350

Trp Asn Leu Ile Lys Leu Gln Leu Arg Thr Lys Glu Asn Glu Lys Asp
        355                 360                 365

Ile Asn Glu Asn Tyr Gly Ile Leu Val Gly Trp Lys Ile Asp Ser Gly
    370                 375                 380

Gln Arg Lys Ser Val Arg Gly Glu Ser Ala Tyr Glu Asn Met Arg Lys
385                 390                 395                 400

Lys Ala Asn Val Phe Phe Lys Lys Met Ile Glu Thr Ser Asp Leu Ser
                405                 410                 415

Glu Thr Asp Lys Asn Arg Leu Ile His Asp Ile Glu Glu Asp Lys Leu
            420                 425                 430

Phe Pro Ile Gln Arg Asp Ser Asp Asn Gly Val Ile Pro His Gln Leu
        435                 440                 445

His Gln Asn Glu Leu Lys Gln Ile Ile Lys Lys Gln Gly Lys Tyr Tyr
    450                 455                 460

Pro Phe Leu Leu Asp Ala Phe Glu Lys Asp Gly Lys Gln Ile Asn Lys
465                 470                 475                 480

Ile Glu Gly Leu Leu Thr Phe Arg Val Pro Tyr Phe Val Gly Pro Leu
```

```
                485                 490                 495

Val Val Pro Glu Asp Leu Gln Lys Ser Asp Asn Ser Glu Asn His Trp
            500                 505                 510

Met Val Arg Lys Lys Lys Gly Glu Ile Thr Pro Trp Asn Phe Asp Glu
        515                 520                 525

Met Val Asp Lys Asp Ala Ser Gly Arg Lys Phe Ile Glu Arg Leu Val
    530                 535                 540

Gly Thr Asp Ser Tyr Leu Leu Gly Glu Pro Thr Leu Pro Lys Asn Ser
545                 550                 555                 560

Leu Leu Tyr Gln Glu Tyr Glu Val Leu Asn Glu Leu Asn Asn Val Arg
                565                 570                 575

Leu Ser Val Arg Thr Gly Asn His Trp Asn Asp Lys Arg Arg Met Arg
            580                 585                 590

Leu Gly Arg Glu Glu Lys Thr Leu Leu Cys Gln Arg Leu Phe Met Lys
        595                 600                 605

Gly Gln Thr Val Thr Lys Arg Thr Ala Glu Asn Leu Leu Arg Lys Glu
    610                 615                 620

Tyr Gly Arg Thr Tyr Glu Leu Ser Gly Leu Ser Asp Glu Ser Lys Phe
625                 630                 635                 640

Thr Ser Ser Leu Ser Thr Tyr Gly Lys Met Cys Arg Ile Phe Gly Glu
                645                 650                 655

Lys Tyr Val Asn Glu His Arg Asp Leu Met Glu Lys Ile Val Glu Leu
            660                 665                 670

Gln Thr Val Phe Glu Asp Lys Glu Thr Leu Leu His Gln Leu Arg Gln
        675                 680                 685
```

```
Leu Glu Gly Ile Ser Glu Ala Asp Cys Ala Leu Leu Val Asn Thr His
    690                 695                 700

Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Leu Thr Thr Lys Ala
705                 710                 715                 720

Gly Glu Cys Lys Ile Ser Asp Asp Phe Ala Pro Arg Lys His Ser Ile
                725                 730                 735

Ile Glu Ile Met Arg Ala Glu Asp Arg Asn Leu Met Glu Ile Ile Thr
            740                 745                 750

Asp Lys Gln Leu Gly Phe Ser Asp Trp Ile Glu Gln Glu Asn Leu Gly
        755                 760                 765

Ala Glu Asn Gly Ser Ser Leu Met Glu Val Val Asp Asp Leu Arg Val
    770                 775                 780

Ser Pro Lys Val Lys Arg Gly Ile Ile Gln Ser Ile Arg Leu Ile Asp
785                 790                 795                 800

Asp Ile Ser Lys Ala Val Gly Lys Arg Pro Ser Arg Ile Phe Leu Glu
                805                 810                 815

Leu Ala Asp Asp Ile Gln Pro Ser Gly Arg Thr Ile Ser Arg Lys Ser
            820                 825                 830

Arg Leu Gln Asp Leu Tyr Arg Asn Ala Asn Leu Gly Lys Glu Phe Lys
        835                 840                 845

Gly Ile Ala Asp Glu Leu Asn Ala Cys Ser Asp Lys Asp Leu Gln Asp
    850                 855                 860

Asp Arg Leu Phe Leu Tyr Tyr Thr Gln Leu Gly Lys Asp Met Tyr Thr
865                 870                 875                 880

Gly Glu Glu Leu Asp Leu Asp Arg Leu Ser Ser Ala Tyr Asp Ile Asp
```

```
               885                 890                 895

His Ile Ile Pro Gln Ala Val Thr Gln Asn Asp Ser Ile Asp Asn Arg
            900                 905                 910

Val Leu Val Ala Arg Ala Glu Asn Ala Arg Lys Thr Asp Ser Phe Thr
        915                 920                 925

Tyr Met Pro Gln Ile Ala Asp Arg Met Arg Asn Phe Trp Gln Ile Leu
    930                 935                 940

Leu Asp Asn Gly Leu Ile Ser Arg Val Lys Phe Glu Arg Leu Thr Arg
945                 950                 955                 960

Gln Asn Glu Phe Ser Glu Arg Glu Lys Glu Arg Phe Val Gln Arg Ser
                965                 970                 975

Leu Val Glu Thr Arg Gln Ile Met Lys Asn Val Ala Thr Leu Met Arg
            980                 985                 990

Gln Arg Tyr Gly Asn Ser Ala Ala  Val Ile Gly Leu Asn  Ala Glu Leu
        995                 1000                1005

Thr Lys  Glu Met His Arg Tyr  Leu Gly Phe Ser His  Lys Asn Arg
    1010                1015                1020

Asp Ile  Asn Asp Tyr His His  Ala Gln Asp Ala Leu  Cys Val Gly
    1025                1030                1035

Ile Ala  Gly Gln Phe Ala Ala  Asn Arg Gly Phe Phe  Ala Asp Gly
    1040                1045                1050

Glu Val  Ser Asp Gly Ala Gln  Asn Ser Tyr Asn Gln  Tyr Leu Arg
    1055                1060                1065

Asp Tyr  Leu Arg Gly Tyr Arg  Glu Lys Leu Ser Ala  Glu Asp Arg
    1070                1075                1080
```

```
Lys Gln  Gly Arg Ala Phe Gly  Phe Ile Val Gly Ser  Met Arg Ser
    1085                1090                1095

Gln Asp  Glu Gln Lys Arg Val  Asn Pro Arg Thr Gly  Glu Val Val
    1100                1105                1110

Trp Ser  Glu Glu Asp Lys Asp  Tyr Leu Arg Lys Val  Met Asn Tyr
    1115                1120                1125

Arg Lys  Met Leu Val Thr Gln  Lys Val Gly Asp Asp  Phe Gly Ala
    1130                1135                1140

Leu Tyr  Asp Glu Thr Arg Tyr  Ala Ala Thr Asp Pro  Lys Gly Ile
    1145                1150                1155

Lys Gly  Ile Pro Phe Asp Gly  Ala Lys Gln Asp Thr  Ser Leu Tyr
    1160                1165                1170

Gly Gly  Phe Ser Ser Ala Lys  Pro Ala Tyr Ala Val  Leu Ile Glu
    1175                1180                1185

Ser Lys  Gly Lys Thr Arg Leu  Val Asn Val Thr Met  Gln Glu Tyr
    1190                1195                1200

Ser Leu  Leu Gly Asp Arg Pro  Ser Asp Asp Glu Leu  Arg Lys Val
    1205                1210                1215

Leu Ala  Lys Lys Lys Ser Glu  Tyr Ala Lys Ala Asn  Ile Leu Leu
    1220                1225                1230

Arg His  Val Pro Lys Met Gln  Leu Ile Arg Tyr Gly  Gly Gly Leu
    1235                1240                1245

Met Val  Ile Lys Ser Ala Gly  Glu Leu Asn Asn Ala  Gln Gln Leu
    1250                1255                1260

Trp Leu  Pro Tyr Glu Glu Tyr  Cys Tyr Phe Asp Asp  Leu Ser Gln
```

```
    1265                1270                1275

Gly Lys  Gly Ser Leu Glu Lys  Asp Asp Leu Lys Lys  Leu Leu Asp
    1280                1285                1290

Ser Ile  Leu Gly Ser Val Gln  Cys Leu Tyr Pro Trp  His Arg Phe
    1295                1300                1305

Thr Glu  Glu Glu Leu Ala Asp  Leu His Val Ala Phe  Asp Lys Leu
    1310                1315                1320

Pro Glu  Asp Glu Lys Lys Asn  Val Ile Thr Gly Ile  Val Ser Ala
    1325                1330                1335

Leu His  Ala Asp Ala Lys Thr  Ala Asn Leu Ser Ile  Val Gly Met
    1340                1345                1350

Thr Gly  Ser Trp Arg Arg Met  Asn Asn Lys Ser Gly  Tyr Thr Phe
    1355                1360                1365

Ser Asp  Glu Asp Glu Phe Ile  Phe Gln Ser Pro Ser  Gly Leu Phe
    1370                1375                1380

Glu Lys  Arg Val Thr Val Gly  Glu Leu Lys Arg Lys  Ala Lys Lys
    1385                1390                1395

Glu Val  Asn Ser Lys Tyr Arg  Thr Asn Glu Lys Arg  Leu Pro Thr
    1400                1405                1410

Leu Ser  Gly Ala Ser Gln Pro
    1415                1420
```

<210> 176
<211> 1092
<212> PRT
<213> Ilyobacter polytropus

<400> 176

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Met Lys Tyr Ser Ile Gly Leu Asp Ile Gly Ile Ala Ser Val Gly Trp
1               5                  10                  15

Ser Val Ile Asn Lys Asp Lys Glu Arg Ile Glu Asp Met Gly Val Arg
            20                  25                  30

Ile Phe Gln Lys Ala Glu Asn Pro Lys Asp Gly Ser Ser Leu Ala Ser
        35                  40                  45

Ser Arg Arg Glu Lys Arg Gly Ser Arg Arg Arg Asn Arg Arg Lys Lys
    50                  55                  60

His Arg Leu Asp Arg Ile Lys Asn Ile Leu Cys Glu Ser Gly Leu Val
65                  70                  75                  80

Lys Lys Asn Glu Ile Glu Lys Ile Tyr Lys Asn Ala Tyr Leu Lys Ser
                85                  90                  95

Pro Trp Glu Leu Arg Ala Lys Ser Leu Glu Ala Lys Ile Ser Asn Lys
            100                 105                 110

Glu Ile Ala Gln Ile Leu Leu His Ile Ala Lys Arg Arg Gly Phe Lys
        115                 120                 125

Ser Phe Arg Lys Thr Asp Arg Asn Ala Asp Asp Thr Gly Lys Leu Leu
    130                 135                 140

Ser Gly Ile Gln Glu Asn Lys Lys Ile Met Glu Glu Lys Gly Tyr Leu
145                 150                 155                 160

Thr Ile Gly Asp Met Val Ala Lys Asp Pro Lys Phe Asn Thr His Val
                165                 170                 175

Arg Asn Lys Ala Gly Ser Tyr Leu Phe Ser Phe Ser Arg Lys Leu Leu
            180                 185                 190

Glu Asp Glu Val Arg Lys Ile Gln Ala Lys Gln Lys Glu Leu Gly Asn
        195                 200                 205
```

```
Thr His Phe Thr Asp Asp Val Leu Glu Lys Tyr Ile Glu Val Phe Asn
    210                 215                 220

Ser Gln Arg Asn Phe Asp Glu Gly Pro Ser Lys Pro Ser Pro Tyr Tyr
225                 230                 235                 240

Ser Glu Ile Gly Gln Ile Ala Lys Met Ile Gly Asn Cys Thr Phe Glu
                245                 250                 255

Ser Ser Glu Lys Arg Thr Ala Lys Asn Thr Trp Ser Gly Glu Arg Phe
            260                 265                 270

Val Phe Leu Gln Lys Leu Asn Asn Phe Arg Ile Val Gly Leu Ser Gly
        275                 280                 285

Lys Arg Pro Leu Thr Glu Glu Glu Arg Asp Ile Val Glu Lys Glu Val
    290                 295                 300

Tyr Leu Lys Lys Glu Val Arg Tyr Glu Lys Leu Arg Lys Ile Leu Tyr
305                 310                 315                 320

Leu Lys Glu Glu Glu Arg Phe Gly Asp Leu Asn Tyr Ser Lys Asp Glu
                325                 330                 335

Lys Gln Asp Lys Lys Thr Glu Lys Thr Lys Phe Ile Ser Leu Ile Gly
            340                 345                 350

Asn Tyr Thr Ile Lys Lys Leu Asn Leu Ser Glu Lys Leu Lys Ser Glu
        355                 360                 365

Ile Glu Glu Asp Lys Ser Lys Leu Asp Lys Ile Ile Glu Ile Leu Thr
    370                 375                 380

Phe Asn Lys Ser Asp Lys Thr Ile Glu Ser Asn Leu Lys Lys Leu Glu
385                 390                 395                 400
```

```
Leu Ser Arg Glu Asp Ile Glu Ile Leu Leu Ser Glu Glu Phe Ser Gly
                405                 410                 415

Thr Leu Asn Leu Ser Leu Lys Ala Ile Lys Lys Ile Leu Pro Tyr Leu
            420                 425                 430

Glu Lys Gly Leu Ser Tyr Asn Glu Ala Cys Glu Lys Ala Asp Tyr Asp
        435                 440                 445

Tyr Lys Asn Asn Gly Ile Lys Phe Lys Arg Gly Glu Leu Leu Pro Val
    450                 455                 460

Val Asp Lys Asp Leu Ile Ala Asn Pro Val Val Leu Arg Ala Ile Ser
465                 470                 475                 480

Gln Thr Arg Lys Val Val Asn Ala Ile Ile Arg Lys Tyr Gly Thr Pro
                485                 490                 495

His Thr Ile His Val Glu Val Ala Arg Asp Leu Ala Lys Ser Tyr Asp
            500                 505                 510

Asp Arg Gln Thr Ile Ile Lys Glu Asn Lys Lys Arg Glu Leu Glu Asn
        515                 520                 525

Glu Lys Thr Lys Lys Phe Ile Ser Glu Glu Phe Gly Ile Lys Asn Val
    530                 535                 540

Lys Gly Lys Leu Leu Leu Lys Tyr Arg Leu Tyr Gln Glu Gln Glu Gly
545                 550                 555                 560

Arg Cys Ala Tyr Ser Arg Lys Glu Leu Ser Leu Ser Glu Val Ile Leu
                565                 570                 575

Asp Glu Ser Met Thr Asp Ile Asp His Ile Ile Pro Tyr Ser Arg Ser
            580                 585                 590

Met Asp Asp Ser Tyr Ser Asn Lys Val Leu Val Leu Ser Gly Glu Asn
        595                 600                 605
```

```
Arg Lys Lys Ser Asn Leu Leu Pro Lys Glu Tyr Phe Asp Arg Gln Gly
    610                 615                 620

Arg Asp Trp Asp Thr Phe Val Leu Asn Val Lys Ala Met Lys Ile His
625                 630                 635                 640

Pro Arg Lys Lys Ser Asn Leu Leu Lys Glu Lys Phe Thr Arg Glu Asp
                645                 650                 655

Asn Lys Asp Trp Lys Ser Arg Ala Leu Asn Asp Thr Arg Tyr Ile Ser
            660                 665                 670

Arg Phe Val Ala Asn Tyr Leu Glu Asn Ala Leu Glu Tyr Arg Asp Asp
        675                 680                 685

Ser Pro Lys Lys Arg Val Phe Met Ile Pro Gly Gln Leu Thr Ala Gln
    690                 695                 700

Leu Arg Ala Arg Trp Arg Leu Asn Lys Val Arg Glu Asn Gly Asp Leu
705                 710                 715                 720

His His Ala Leu Asp Ala Ala Val Val Ala Val Thr Asp Gln Lys Ala
                725                 730                 735

Ile Asn Asn Ile Ser Asn Ile Ser Arg Tyr Lys Glu Leu Lys Asn Cys
            740                 745                 750

Lys Asp Val Ile Pro Ser Ile Glu Tyr His Ala Asp Glu Glu Thr Gly
        755                 760                 765

Glu Val Tyr Phe Glu Glu Val Lys Asp Thr Arg Phe Pro Met Pro Trp
    770                 775                 780

Ser Gly Phe Asp Leu Glu Leu Gln Lys Arg Leu Glu Ser Glu Asn Pro
785                 790                 795                 800
```

```
Arg Glu Glu Phe Tyr Asn Leu Leu Ser Asp Lys Arg Tyr Leu Gly Trp
                805                 810                 815

Phe Asn Tyr Glu Glu Gly Phe Ile Glu Lys Leu Arg Pro Val Phe Val
            820                 825                 830

Ser Arg Met Pro Asn Arg Gly Val Lys Gly Gln Ala His Gln Glu Thr
        835                 840                 845

Ile Arg Ser Ser Lys Lys Ile Ser Asn Gln Ile Ala Val Ser Lys Lys
    850                 855                 860

Pro Leu Asn Ser Ile Lys Leu Lys Asp Leu Glu Lys Met Gln Gly Arg
865                 870                 875                 880

Asp Thr Asp Arg Lys Leu Tyr Glu Ala Leu Lys Asn Arg Leu Glu Glu
                885                 890                 895

Tyr Asp Asp Lys Pro Glu Lys Ala Phe Ala Glu Pro Phe Tyr Lys Pro
            900                 905                 910

Thr Asn Ser Gly Lys Arg Gly Pro Leu Val Arg Gly Ile Lys Val Glu
        915                 920                 925

Glu Lys Gln Asn Val Gly Val Tyr Val Asn Gly Gly Gln Ala Ser Asn
    930                 935                 940

Gly Ser Met Val Arg Ile Asp Val Phe Arg Lys Asn Gly Lys Phe Tyr
945                 950                 955                 960

Thr Val Pro Ile Tyr Val His Gln Thr Leu Leu Lys Glu Leu Pro Asn
                965                 970                 975

Arg Ala Ile Asn Gly Lys Pro Tyr Lys Asp Trp Asp Leu Ile Asp Gly
            980                 985                 990

Ser Phe Glu Phe Leu Tyr Ser Phe  Tyr Pro Asn Asp Leu  Ile Glu Ile
        995                 1000                1005
```

```
Glu Phe  Gly Lys Ser Lys Ser  Ile Lys Asn Asp Asn  Lys Leu Thr
    1010                1015                1020


Lys Thr  Glu Ile Pro Glu Val  Asn Leu Ser Glu Val  Leu Gly Tyr
    1025                1030                1035


Tyr Arg  Gly Met Asp Thr Ser  Thr Gly Ala Ala Thr  Ile Asp Thr
    1040                1045                1050


Gln Asp  Gly Lys Ile Gln Met  Arg Ile Gly Ile Lys  Thr Val Lys
    1055                1060                1065


Asn Ile  Lys Lys Tyr Gln Val  Asp Val Leu Gly Asn  Val Tyr Lys
    1070                1075                1080


Val Lys  Arg Glu Lys Arg Gln  Thr Phe
    1085                1090
```

<210> 177
<211> 994
<212> PRT
<213> Streptococcus downei

<400> 177

```
Met Glu Asn Gln Arg Gly Lys Arg Gln Arg Ile Thr His Gln Glu Pro
1               5                   10                  15


Tyr Ser Ile Gly Leu Asp Ile Gly Thr Ala Ser Val Gly Ser Ala Val
            20                  25                  30


Ile Asn Asn Asp Leu Thr Val Pro Gln Lys Arg Phe Lys Val Arg Asp
        35                  40                  45


Ile Asn Gly Asn Val Ile Lys Thr Ile Lys Lys Asn Met Ser Ser Val
    50                  55                  60


Leu Ile Phe Asp Glu Ala Asn Pro Ala Lys Gly Ala Arg Thr Lys Arg
```

```
65                  70                  75                  80

Thr Ser Arg Arg Arg Tyr Thr Arg Arg Asn Phe Arg Leu Leu Glu Leu
                85                  90                  95

Lys Lys Leu Phe Glu Lys Glu Ile Glu Lys Ile Asp Pro Asn Phe Phe
            100                 105                 110

His Arg Ile Lys Glu Asp Ser Phe Phe Asn Trp Asn Asp Lys Glu Phe
        115                 120                 125

Asp Lys His Pro Leu Phe Gly Asn Leu Lys Glu Glu Lys Lys Phe His
    130                 135                 140

Asn Asn Tyr Pro Thr Val Phe His Leu Arg Asn Glu Ile Gly Lys Asn
145                 150                 155                 160

Ser Ser Lys Lys Phe Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
                165                 170                 175

Ile Ile Lys Tyr Arg Gly His Phe Leu Asp Glu Thr Phe Asp Pro Asp
            180                 185                 190

Ala Ser Val Ser Val Glu Lys Arg Leu Asn Asp Phe Ile Val Glu Tyr
        195                 200                 205

Asn Glu Leu Phe Asp Lys Asp Leu Arg Ser Glu Ala Lys Phe Ser Glu
    210                 215                 220

Ile Leu Met Ser Asp Ser Ser Asn Ser Val Lys Ile Glu Ser Thr Leu
225                 230                 235                 240

Ser Leu Tyr Pro Ser Glu Lys Asn Thr Ile Phe Gln Val Phe Leu Lys
                245                 250                 255

Leu Ile Val Gly Asn Gln Gly Asp Phe Asn Lys Phe Phe Lys Asp Glu
            260                 265                 270
```

```
Leu Glu Ser Ser Ser His Ser Gly Lys Leu Val Phe Ser Ser Asp Glu
        275                 280                 285

Val Glu Asp Glu Lys Glu Glu Leu Ile Ser Ile Ile Gly Glu Asp Tyr
    290                 295                 300

Leu Asp Ile Ile Asn Leu Cys Gln Ser Leu Tyr Ser Thr Val Ala Leu
305                 310                 315                 320

Ala Lys Ile Ile Ser Thr Asp Thr Gly Glu Ser Asn Thr Pro Leu Ser
                325                 330                 335

Ala Ser Met Val Lys Arg Tyr Asn Glu His Lys Gly Asp Leu Ala Asn
            340                 345                 350

Leu Lys Gly Ile Val Lys His Phe Ile Pro Glu Lys Tyr Glu Glu Val
        355                 360                 365

Phe Gly Glu His Ser Lys Thr Gly Tyr Thr Ala Tyr Ile Arg Asn Pro
    370                 375                 380

Asn Lys Met Pro Glu Lys Lys Phe Tyr Asp Tyr Leu Tyr His Glu Gly
385                 390                 395                 400

Glu Lys Gly Lys Ile Ser Gly Ile Leu Ser Asp Ser Arg Ile Tyr Glu
                405                 410                 415

Leu Pro Ala Val Gln Lys Phe Ile Leu Lys Ile Glu Gln Lys Ser Phe
            420                 425                 430

Leu Lys Lys Gln Arg Thr Lys Glu Asn Gly Leu Ile Pro Tyr Gln Leu
        435                 440                 445

His Leu Lys Glu Leu Lys Ile Ile Ile Glu Asn Gln Ser Glu Tyr Tyr
    450                 455                 460

Pro Phe Leu His Glu Ile Glu Glu Lys Leu Glu Lys Leu Leu Thr Phe
```

```
465                 470                 475                 480

Arg Ile Pro Tyr Phe Val Gly Pro Leu Ala Gln Thr Lys Tyr Ile Asn
                485                 490                 495

Pro Arg Phe Asn Trp Leu Val Arg Lys Ser Glu Asp His Ile Lys Pro
            500                 505                 510

Trp Asn Phe Ser Glu Ile Val Asp Glu Glu Lys Ser Ala Thr Lys Phe
        515                 520                 525

Ile Glu Lys Leu Ile Ser Asn Asp Gln Phe Leu Phe Gly Glu Lys Val
    530                 535                 540

Leu Pro Lys Arg Ser Ile Ile Tyr Gln Gln Phe Leu Ile Phe Asn Glu
545                 550                 555                 560

Leu Thr Lys Val Ser Tyr Gln Ile Lys Asp Gly Pro Ser Arg Asn Phe
                565                 570                 575

Asp Ser Glu Thr Lys Glu Glu Ile Phe Asn Ser Leu Phe Lys Lys Asn
            580                 585                 590

Lys Leu Gly Cys Val Thr Val Val Asp Leu Lys Asn Tyr Ile Lys Asn
        595                 600                 605

Asp Gln Cys Leu Ser Glu Lys Glu Asp Ile Gln Ile Glu Gly Ile Lys
    610                 615                 620

Lys Lys Phe Asn Ser Ser Tyr Ser Thr Tyr Ala Asp Leu Ser Glu Ile
625                 630                 635                 640

Ser Gly Leu Lys Glu Leu Leu Asp Asp Asp Thr Gln Leu Asp Leu Val
                645                 650                 655

Glu Glu Ile Ile Arg Ile Leu Thr Val Phe Glu Asp Lys Lys Met Arg
            660                 665                 670
```

```
Thr Lys Gln Leu Glu Lys Leu Asn Leu Pro Ala Asn Val Asp Ile Glu
        675                 680                 685

Lys Leu Cys Lys Lys His Tyr Lys Gly Trp Ala Asn Val Ser Arg Gln
    690                 695                 700

Leu Ile Asp Gly Ile Ala Asp Arg Ser Arg Gly Phe Lys Lys Thr Ile
705                 710                 715                 720

Leu Asp Tyr Leu Lys Asp Asp Asp Ile Pro Asn Asn Asp Ala Phe Ser
                725                 730                 735

Thr Lys Val Gln Lys Ser Leu Asn Arg Asn Phe Ala Gln Leu Ile Thr
            740                 745                 750

Asp Lys Ser Leu Asp Phe Ala Arg Lys Leu Asp Glu Ser Tyr Lys Ile
        755                 760                 765

Asp Val Lys Lys Asp Tyr Pro Ser Leu Val Glu Asp Ile Pro Gly Ser
    770                 775                 780

Pro Ala Ile Arg Arg Ala Ile Leu Gln Ser Leu Tyr Thr Val Asp Glu
785                 790                 795                 800

Ile Ile Gly Val Met Gly Arg Met Pro Lys Asn Ile Val Ile Glu Met
                805                 810                 815

Ala Arg Thr Asn Glu Val Ser Asp Ser Pro Lys Thr Arg Lys Glu Arg
            820                 825                 830

Ile Lys Lys Leu Ile Lys Glu Thr Glu Asn Asp Ala Asp Ala Leu Asn
        835                 840                 845

Phe Gly Ile Ser Lys Val Ser Glu Ile Phe Asp Glu Val Lys Lys Asp
    850                 855                 860

Glu Asn Leu Phe Lys Glu Leu Glu Val Tyr Leu Tyr Phe Leu Gln Glu
```

865 870 875 880

Gly Lys Asp Met Tyr Gly Thr Glu Thr Arg Glu Gly His Arg Gln Pro
885 890 895

Lys Glu Ile Asn Phe Tyr Asp Val Lys Asn Ser Thr Gly Lys Tyr His
900 905 910

Ile Asp His Ile Ile Pro Gln Ser Leu Tyr Ser Gly Asn Pro Leu Asp
915 920 925

Asn Ile Val Leu Thr Glu Ser Thr Asn Asn Lys Ile Lys Asp Lys Asp
930 935 940

Val Pro Asp Glu Ala Thr Val Tyr Glu Met Lys Asn Phe Trp Leu Tyr
945 950 955 960

Leu Met Lys Lys Gly Ala Ile Ser Lys Lys Lys Phe Ser Phe Leu Thr
965 970 975

Lys Ile Glu Gln Gly Gly Leu Ser Asn Glu Asp Lys Phe Gly Phe Ile
980 985 990

Asn Arg

<210> 178
<211> 1052
<212> PRT
<213> Aminomonas paucivorans

<400> 178

Met Ile Gly Glu His Val Arg Gly Gly Cys Leu Phe Asp Asp His Trp
1 5 10 15

Thr Pro Asn Trp Gly Ala Phe Arg Leu Pro Asn Thr Val Arg Thr Phe
20 25 30

```
Thr Lys Ala Glu Asn Pro Lys Asp Gly Ser Ser Leu Ala Glu Pro Arg
        35                  40                  45

Arg Gln Ala Arg Gly Leu Arg Arg Arg Leu Arg Arg Lys Thr Gln Arg
    50                  55                  60

Leu Glu Asp Leu Arg Arg Leu Leu Ala Lys Glu Gly Val Leu Ser Leu
65                  70                  75                  80

Ser Asp Leu Glu Thr Leu Phe Arg Glu Thr Pro Ala Lys Asp Pro Tyr
                85                  90                  95

Gln Leu Arg Ala Glu Gly Leu Asp Arg Pro Leu Ser Phe Pro Glu Trp
            100                 105                 110

Val Arg Val Leu Tyr His Ile Thr Lys His Arg Gly Phe Gln Ser Asn
        115                 120                 125

Arg Arg Asn Pro Val Glu Asp Gly Gln Glu Arg Ser Arg Gln Glu Glu
    130                 135                 140

Glu Gly Lys Leu Leu Ser Gly Val Gly Glu Asn Glu Arg Leu Leu Arg
145                 150                 155                 160

Glu Gly Gly Tyr Arg Thr Ala Gly Glu Met Leu Ala Arg Asp Pro Lys
                165                 170                 175

Phe Gln Asp His Arg Arg Asn Arg Ala Gly Asp Tyr Ser His Thr Leu
            180                 185                 190

Ser Arg Ser Leu Leu Leu Glu Glu Ala Arg Arg Leu Phe Gln Ser Gln
        195                 200                 205

Arg Thr Leu Gly Asn Pro His Ala Ser Ser Asn Leu Glu Glu Ala Phe
    210                 215                 220

Leu His Leu Val Ala Phe Gln Asn Pro Phe Ala Ser Gly Glu Asp Ile
225                 230                 235                 240
```

```
Arg Asn Lys Ala Gly His Cys Ser Leu Glu Pro Asp Gln Ile Arg Ala
                245                 250                 255

Pro Arg Arg Ser Ala Ser Ala Glu Thr Phe Met Leu Leu Gln Lys Thr
            260                 265                 270

Gly Asn Leu Arg Leu Ile His Arg Arg Thr Gly Glu Glu Arg Pro Leu
        275                 280                 285

Thr Asp Lys Glu Arg Glu Gln Ile His Leu Leu Ala Trp Lys Gln Glu
    290                 295                 300

Lys Val Thr His Lys Thr Leu Arg Arg His Leu Glu Ile Pro Glu Glu
305                 310                 315                 320

Trp Leu Phe Thr Gly Leu Pro Tyr His Arg Ser Gly Asp Lys Ala Glu
                325                 330                 335

Glu Lys Leu Phe Val His Leu Ala Gly Ile His Glu Ile Arg Lys Ala
            340                 345                 350

Leu Asp Lys Gly Pro Asp Pro Ala Val Trp Asp Thr Leu Arg Ser Arg
        355                 360                 365

Arg Asp Leu Leu Asp Ser Ile Ala Asp Thr Leu Thr Phe Tyr Lys Asn
    370                 375                 380

Glu Asp Glu Ile Leu Pro Arg Leu Glu Ser Leu Gly Leu Ser Pro Glu
385                 390                 395                 400

Asn Ala Arg Ala Leu Ala Pro Leu Ser Phe Ser Gly Thr Ala His Leu
                405                 410                 415

Ser Leu Ser Ala Leu Gly Lys Leu Leu Pro His Leu Glu Glu Gly Lys
            420                 425                 430
```

```
Ser Tyr Thr Gln Ala Arg Ala Asp Ala Gly Tyr Ala Ala Pro Pro Pro
        435                 440                 445

Asp Arg His Pro Lys Leu Pro Pro Leu Glu Glu Ala Asp Trp Arg Asn
    450                 455                 460

Pro Val Val Phe Arg Ala Leu Thr Gln Thr Arg Lys Val Val Asn Ala
465                 470                 475                 480

Leu Val Arg Arg Tyr Gly Pro Pro Trp Cys Ile His Leu Glu Thr Ala
                485                 490                 495

Arg Glu Leu Ser Gln Pro Ala Lys Val Arg Arg Arg Ile Glu Thr Glu
            500                 505                 510

Gln Gln Ala Asn Glu Lys Lys Lys Gln Gln Ala Glu Arg Glu Phe Leu
        515                 520                 525

Asp Ile Val Gly Thr Ala Pro Gly Pro Gly Asp Leu Leu Lys Met Arg
    530                 535                 540

Leu Trp Arg Glu Gln Gly Gly Phe Cys Pro Tyr Cys Glu Glu Tyr Leu
545                 550                 555                 560

Asn Pro Thr Arg Leu Ala Glu Pro Gly Tyr Ala Glu Met Asp His Ile
                565                 570                 575

Leu Pro Tyr Ser Arg Ser Leu Asp Asn Gly Trp His Asn Arg Val Leu
            580                 585                 590

Val His Gly Lys Asp Asn Arg Asp Lys Gly Asn Arg Thr Pro Phe Glu
        595                 600                 605

Ala Phe Gly Gly Asp Thr Ala Arg Trp Asp Arg Leu Val Ala Trp Val
    610                 615                 620

Gln Ala Ser His Leu Ser Ala Pro Lys Lys Arg Asn Leu Leu Arg Glu
625                 630                 635                 640
```

```
Asp Phe Gly Glu Glu Ala Glu Arg Glu Leu Lys Asp Arg Asn Leu Thr
                645                 650                 655

Asp Thr Arg Phe Ile Thr Lys Thr Ala Ala Thr Leu Leu Arg Asp Arg
            660                 665                 670

Leu Thr Phe His Pro Glu Ala Pro Lys Asp Pro Val Met Thr Leu Asn
        675                 680                 685

Gly Arg Leu Thr Ala Phe Leu Arg Lys Gln Trp Gly Leu His Lys Asn
    690                 695                 700

Arg Lys Asn Gly Asp Leu His His Ala Leu Asp Ala Ala Val Leu Ala
705                 710                 715                 720

Val Ala Ser Arg Ser Phe Val Tyr Arg Leu Ser Ser His Asn Ala Ala
                725                 730                 735

Trp Gly Glu Leu Pro Arg Gly Arg Glu Ala Glu Asn Gly Phe Ser Leu
            740                 745                 750

Pro Tyr Pro Ala Phe Arg Ser Glu Val Leu Ala Arg Leu Cys Pro Thr
        755                 760                 765

Arg Glu Glu Ile Leu Leu Arg Leu Asp Gln Gly Gly Val Gly Tyr Asp
    770                 775                 780

Glu Ala Phe Arg Asn Gly Leu Arg Pro Val Phe Val Ser Arg Ala Pro
785                 790                 795                 800

Ser Arg Arg Leu Arg Gly Lys Ala His Met Glu Thr Leu Arg Ser Pro
                805                 810                 815

Lys Trp Lys Asp His Pro Glu Gly Pro Arg Thr Ala Ser Arg Ile Pro
            820                 825                 830
```

```
Leu Lys Asp Leu Asn Leu Glu Lys Leu Glu Arg Met Val Gly Lys Asp
        835                 840                 845

Arg Asp Arg Lys Leu Tyr Glu Ala Leu Arg Glu Arg Leu Ala Ala Phe
    850                 855                 860

Gly Gly Asn Gly Lys Lys Ala Phe Val Ala Pro Phe Arg Lys Pro Cys
865                 870                 875                 880

Arg Ser Gly Glu Gly Pro Leu Val Arg Ser Leu Arg Ile Phe Asp Ser
                885                 890                 895

Gly Tyr Ser Gly Val Glu Leu Arg Asp Gly Gly Glu Val Tyr Ala Val
            900                 905                 910

Ala Asp His Glu Ser Met Val Arg Val Asp Val Tyr Ala Lys Lys Asn
        915                 920                 925

Arg Phe Tyr Leu Val Pro Val Tyr Val Ala Asp Val Ala Arg Gly Ile
    930                 935                 940

Val Lys Asn Arg Ala Ile Val Ala His Lys Ser Glu Glu Glu Trp Asp
945                 950                 955                 960

Leu Val Asp Gly Ser Phe Asp Phe Arg Phe Ser Leu Phe Pro Gly Asp
                965                 970                 975

Leu Val Glu Ile Glu Lys Lys Asp Gly Ala Tyr Leu Gly Tyr Tyr Lys
            980                 985                 990

Ser Cys His Arg Gly Asp Gly Arg  Leu Leu Leu Asp Arg  His Asp Arg
        995                 1000                1005

Met Pro  Arg Glu Ser Asp Cys  Gly Thr Phe Tyr Val  Ser Thr Arg
    1010                1015                1020

Lys Asp  Val Leu Ser Met Ser  Lys Tyr Gln Val Asp  Pro Leu Gly
    1025                1030                1035
```

Glu Ile Arg Leu Val Gly Ser Glu Lys Pro Pro Phe Val Leu
    1040   1045   1050

<210> 179
<211> 1023
<212> PRT
<213> Helicobacter cinaedi

<400> 179

Met Lys Ile Tyr Ser Phe Asp Ile Gly Val Ala Ser Ile Gly Trp Ala
1   5   10   15

Phe Ile Glu Asn Glu Val Leu Gln Asp Cys Gly Ile Arg Ile Phe Thr
            20   25   30

Lys Ala Glu Asn Pro Lys Asn Gly Ala Ser Leu Ala Leu Pro Arg Arg
        35   40   45

Glu Ala Arg Gly Val Arg Lys Arg Leu Ala Arg Arg Arg Gly Arg Leu
    50   55   60

Asn Thr Ile Lys Gln Leu Leu Cys Lys Glu Phe Gly Leu Gln Leu Glu
65   70   75   80

Asp Tyr Leu Ser Asn Asp Gly Glu Leu Pro Lys Ala Tyr Thr Ala Ser
                85   90   95

Lys Ala Asn Pro Leu Lys Ser Pro Tyr Glu Leu Arg Thr Leu Ala Leu
            100   105   110

Ser Gln Lys Leu Asp Ser Lys Asp Leu Val Arg Val Ile Leu His Ile
        115   120   125

Ala Lys His Arg Gly Tyr Gly Asn Lys His Ala Lys Asp Ser Lys Asp
    130   135   140

Thr Glu Ser Gly Lys Val Lys Lys Ala Ile Glu Phe Asn Arg Lys Thr

```
145                 150                 155                 160

Leu Ala Glu Lys Gly Tyr Arg Ser Val Gly Glu Tyr Leu Tyr Arg Glu
                165                 170                 175

Phe Phe Gln Gln Ser Arg Ile Ser Gln Asn Asn Gly Ala Thr Glu Phe
            180                 185                 190

Ile Asn Val Arg Asn Lys Ala Gly Asn Tyr Glu His Cys Val Ala Gln
        195                 200                 205

Asp Met Leu Lys Glu Glu Leu Glu Ser Ile Leu Asn Ala Gln Arg Gln
    210                 215                 220

Phe Gly Phe Ser Leu Lys Gln Asp Phe Glu Asn Lys Leu Leu Thr Lys
225                 230                 235                 240

Ile Phe Glu Gln Arg Pro Leu Lys Ser Phe Ala Asp Lys Val Gly Asn
                245                 250                 255

Cys Cys Phe Ile Ala Gly Glu Lys Arg Ala Pro Lys Asp Ser Pro Ser
            260                 265                 270

Ala Ile Glu Phe Ile Ala Leu Ser Arg Thr Ile Asn Thr Leu Ile Asn
        275                 280                 285

Leu Ser Lys Glu Ser Gly Glu Ile Tyr Asn Arg Ala Ile Ile Leu Gln
    290                 295                 300

Ile Val Glu Ser Thr Leu Lys Lys Gly Glu Ile Ser Tyr Lys Glu Leu
305                 310                 315                 320

Arg Glu Ile Ile Arg Leu Asp Glu Arg Leu Arg Phe Lys Asp Pro Arg
                325                 330                 335

Leu Asp Tyr Ser Arg Glu Ile Lys Glu Ala Glu Lys Val Lys Phe Leu
            340                 345                 350
```

```
Glu Phe Lys Gln Leu Lys Gly Phe Lys Lys Ala Leu Gly Glu Ser Phe
        355                 360                 365

Thr Thr Leu Ala Ile Ser Gln Leu Asp Glu Ile Ala Glu His Ile Ala
    370                 375                 380

Leu Ile Lys Asp Arg Val Lys Leu Asn Glu Lys Leu Glu Ser Tyr Ala
385                 390                 395                 400

Leu Thr Lys Glu Gln Arg Glu Ala Leu Ser Asn Leu Ser Phe Ser Ala
                405                 410                 415

His Ile Asn Leu Ser Leu Gln Ala Leu Lys Gln Ile Leu Pro Phe Met
            420                 425                 430

Arg Gly Asp Asn Gly Glu Gln Cys Leu Asp Tyr Asp Glu Ser Val Glu
        435                 440                 445

Lys Ala Gly Leu Lys Ala Leu Ser Lys Asp Thr Leu Lys Gly Gln Met
    450                 455                 460

Leu Pro Pro Leu Asn Glu Phe Glu Pro Tyr Leu Ser Asn Pro Val Val
465                 470                 475                 480

Ala Arg Ala Leu Ala Glu Tyr Arg Lys Val Leu Asn Val Leu Leu Lys
                485                 490                 495

Gln Tyr Gly Ser Pro His Lys Ile His Ile Glu Tyr Ala Arg Glu Ala
            500                 505                 510

Lys Leu Ser Ser Thr Glu Arg Gln Lys Tyr Glu Lys Glu Gln Lys Asp
        515                 520                 525

Asn Tyr Ala Ala Asn Gln Ala Ala His Lys Lys Cys Gln Glu Leu Gly
    530                 535                 540

Leu Glu Pro Ser Ser Thr Asn Leu Leu Lys Leu Lys Leu Trp Gln Glu
```

```
545                 550                 555                 560

Gln Gly Gly Leu Cys Leu Tyr Ser Gly Ala Lys Ile Thr Ile Ser Tyr
                565                 570                 575

Leu Gln Asp Pro Thr Ala Leu Gln Val Asp His Ile Tyr Pro Tyr Ser
            580                 585                 590

Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Cys Leu Val Leu Thr Lys
        595                 600                 605

Ala Asn Gln Glu Lys Gly Asn Arg Thr Pro Phe Glu Ala Phe Gly Thr
    610                 615                 620

Asp Ser Ala Lys Trp Gly Val Ile Thr Thr Leu Ala Gln Lys Leu Pro
625                 630                 635                 640

His Lys Lys Arg Arg Arg Ile Leu Asn Thr Ala Phe Asn Asp Lys Glu
                645                 650                 655

Ala Gly Phe Lys Leu Arg Asn Leu Asn Asp Thr Ser Tyr Ile Ala Arg
            660                 665                 670

Leu Val Ala Asp Tyr Thr Glu Thr Tyr Leu Glu Phe Leu Pro Leu Val
        675                 680                 685

Glu Ser Glu Asn Thr Thr Leu Ser Lys Gly Gln Lys Gly Ser Lys Lys
    690                 695                 700

His Ile Ala Ile Val Asn Gly Val Leu Thr Ser Thr Met Arg Tyr Tyr
705                 710                 715                 720

Leu Gly Phe Ala Ser Lys Asp Arg Asp Asn His Leu His His Ala Leu
                725                 730                 735

Asp Ala Val Ile Ile Gly Phe Met Asn Asp Ser Val Ile Lys Ala Phe
            740                 745                 750
```

```
Ser Asp Phe Lys Lys Thr Gln Glu Thr Ser Lys Ala Ala Tyr Tyr Ala
        755                 760                 765

His Thr Leu Ser Lys Gln Glu Tyr Lys Lys Gln Arg Ala Phe Ile Gln
    770                 775                 780

Leu Pro Ser Gly Glu Asn Phe Arg Val Ser Val Leu Glu Lys Val Glu
785                 790                 795                 800

Ser Val Phe Val Ser Lys Pro Pro Arg Lys Arg Val Arg Gly Ala Leu
                805                 810                 815

His Glu Ala Thr Phe Tyr Ser Pro Asn Asp Pro Lys Leu Leu Lys Asn
            820                 825                 830

Tyr Gly Gly Thr Lys Gly Val Glu Arg Ala Leu Ala Leu Gly Lys Met
        835                 840                 845

Arg Lys Val Gly Ala Lys Ile Val Ser Asn Gly Ala Met Val Arg Val
    850                 855                 860

Asp Ile Phe Arg His Lys Ser Ser Gly Lys Phe Tyr Gly Val Pro Val
865                 870                 875                 880

Tyr Thr Met Asp Phe Ala Leu Gly Ile Leu Pro Asn Lys Ala Val Val
                885                 890                 895

Val Gly Lys Asp Gln Asn Gly Val Ile Lys Asp Trp Leu Glu Met Asp
            900                 905                 910

Ser Ser Tyr Glu Phe Ile Phe Ser Leu Tyr Lys Asp Asp Val Ile Leu
        915                 920                 925

Val Gln Lys Lys Glu Met Gln Arg Pro Glu Leu Cys Tyr Phe Val Ser
    930                 935                 940

Phe Asp Thr Ser Gly Ala Ser Ile Lys Val Ala Lys His Asp Asn Asn
```

945 950 955 960

Phe Ser Thr Leu Thr Glu Asn Gln Lys Leu Leu Phe Ser Asn Ala Thr
965 970 975

Lys Glu Glu Val Val Gly Lys Ser Ile Gly Ile Gln Asn Leu Lys Val
980 985 990

Phe Glu Lys Trp Gln Val Ser Val Leu Gly Glu Val Lys Arg Thr Gln
995 1000 1005

Ser Tyr Pro Arg Glu Asn Ile Ser Leu Ala Ser Lys Ala Lys Lys
1010 1015 1020

<210> 180
<211> 874
<212> PRT
<213> Listeria seeligeri

<400> 180

Leu Ala Asn Gly Gln Ser Glu Phe Ser Trp Leu Thr Arg Lys Ala Asp
1 5 10 15

Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu Lys Val Asp Phe Gly Lys
20 25 30

Ser Ala Ile Asp Phe Ile Glu Lys Met Thr Asn Lys Asp Thr Tyr Leu
35 40 45

Pro Lys Glu Asn Val Leu Pro Lys His Ser Met Cys Tyr Gln Lys Tyr
50 55 60

Met Val Tyr Asn Glu Leu Thr Lys Ile Arg Tyr Thr Asp Asp Gln Gly
65 70 75 80

Lys Thr His Tyr Phe Ser Gly Gln Glu Lys Gln Gln Ile Phe Asn Asp
85 90 95

```
Leu Phe Lys Gln Lys Arg Lys Val Lys Lys Lys Asp Leu Glu Leu Phe
            100                 105                 110

Leu Tyr Asn Met Asn His Val Glu Ser Pro Thr Val Glu Gly Val Glu
        115                 120                 125

Asp Ala Phe Asn Ser Ser Phe Thr Thr Tyr His Asp Leu Gln Lys Val
    130                 135                 140

Gly Val Pro Gln Glu Ile Leu Asp Asp Pro Leu Asn Thr Glu Met Leu
145                 150                 155                 160

Glu Glu Ile Ile Lys Ile Leu Thr Val Phe Glu Asp Lys Arg Met Ile
                165                 170                 175

Asn Glu Arg Leu Gln Glu Phe Ser Asn Val Leu Asp Glu Ala Val Leu
            180                 185                 190

Lys Lys Leu Glu Arg Arg His Tyr Thr Gly Trp Gly Arg Leu Ser Ala
        195                 200                 205

Lys Leu Leu Ile Gly Ile Arg Asp Lys Glu Ser His Leu Thr Ile Leu
    210                 215                 220

Asp Tyr Leu Met Asn Asp Asp Lys His Asn Arg Asn Leu Met Gln Leu
225                 230                 235                 240

Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile Ile Glu Lys Glu Gln
                245                 250                 255

Val Ser Thr Ala Asp Lys Asp Ile Gln Ser Ile Val Ala Asp Leu Ala
            260                 265                 270

Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val
        275                 280                 285

Asp Glu Leu Val Gly Ile Met Gly Tyr Pro Pro Gln Thr Ile Val Val
    290                 295                 300
```

```
Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Lys Gly Lys Asn Asn Ser
305                 310                 315                 320

Lys Pro Arg Phe Thr Ser Leu Glu Lys Ala Ile Lys Glu Leu Gly Ser
                325                 330                 335

Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln Gly Leu Lys Asn Asp
            340                 345                 350

Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly
        355                 360                 365

Gln Glu Leu Asp Ile His Asn Leu Ser Asn Tyr Asp Ile Asp His Val
    370                 375                 380

Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile Asp Asn Arg Val Leu
385                 390                 395                 400

Ala Ser Ser Ala Ala Asn Arg Glu Lys Gly Asp Asn Val Pro Ser Leu
                405                 410                 415

Glu Val Val Arg Lys Arg Lys Val Tyr Trp Glu Lys Leu Tyr Gln Ala
            420                 425                 430

Lys Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu Thr Lys Ala Glu Arg
        435                 440                 445

Gly Gly Leu Thr Glu Ala Asp Lys Ala Arg Phe Ile His Arg Gln Leu
    450                 455                 460

Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala Asn Ile Leu His Gln
465                 470                 475                 480

Arg Phe Asn Cys Lys Lys Asp Glu Ser Gly Asn Val Ile Glu Gln Val
                485                 490                 495
```

```
Arg Ile Val Thr Leu Lys Ala Ala Leu Val Ser Gln Phe Arg Lys Gln
            500                 505                 510

Phe Gln Leu Tyr Lys Val Arg Glu Val Asn Asp Tyr His His Ala His
        515                 520                 525

Asp Ala Tyr Leu Asn Cys Val Val Ala Asn Thr Leu Leu Lys Val Tyr
    530                 535                 540

Pro Gln Leu Glu Pro Glu Phe Val Tyr Gly Asp Tyr His Gln Phe Asp
545                 550                 555                 560

Trp Phe Lys Ala Asn Lys Ala Thr Ala Lys Lys Gln Phe Tyr Thr Asn
                565                 570                 575

Ile Met Leu Phe Phe Ala Lys Lys Asp Arg Ile Ile Asp Glu Asn Gly
            580                 585                 590

Glu Ile Leu Trp Asp Lys Lys Tyr Leu Asp Thr Ile Lys Lys Val Leu
        595                 600                 605

Asn Tyr Arg Gln Met Asn Ile Val Lys Lys Thr Glu Ile Gln Lys Gly
    610                 615                 620

Glu Phe Ser Asn Ala Thr Ala Asn Pro Lys Gly Asn Ser Ser Lys Leu
625                 630                 635                 640

Ile Pro Arg Lys Ala Asp Trp Asp Pro Ile Lys Tyr Gly Gly Phe Asp
                645                 650                 655

Gly Ser Asn Met Ala Tyr Ala Ile Val Ile Glu His Glu Lys Arg Lys
            660                 665                 670

Lys Lys Thr Val Ile Lys Lys Glu Leu Ile Gln Ile Asn Ile Met Glu
        675                 680                 685

Arg Thr Ala Phe Glu Lys Asp Gln Lys Glu Phe Leu Glu Gly Lys Gly
    690                 695                 700
```

```
Tyr Arg Asn Pro Lys Val Ile Thr Lys Ile Pro Lys Tyr Thr Leu Tyr
705                 710                 715                 720


Glu Cys Glu Asn Gly Arg Arg Arg Met Leu Gly Ser Ala Asn Glu Ala
                725                 730                 735


Gln Lys Gly Asn Gln Met Val Leu Pro Asn His Leu Met Thr Leu Leu
            740                 745                 750


Tyr His Ala Lys Asn Cys Glu Ala Ser Asp Gly Lys Ser Leu Ala Tyr
        755                 760                 765


Ile Glu Ser His Arg Glu Met Phe Ala Glu Leu Leu Asp Ser Ile Ser
    770                 775                 780


Glu Phe Ala Ser Arg Tyr Thr Leu Ala Asp Ala Asn Leu Glu Lys Ile
785                 790                 795                 800


Asn Thr Ile Phe Glu Gln Asn Lys Ser Gly Asp Val Lys Val Ile Ala
                805                 810                 815


Gln Ser Phe Val Asn Leu Leu Glu Phe Asn Ala Met Gly Ala Pro Ala
            820                 825                 830


Ser Phe Lys Tyr Phe Glu Thr Asn Ile Glu Arg Lys Arg Tyr Asn Asn
        835                 840                 845


Leu Lys Glu Leu Leu Asn Ala Thr Ile Ile Tyr Gln Ser Ile Thr Gly
    850                 855                 860


Leu Tyr Glu Ala Arg Lys Arg Leu Asp Asp
865                 870


<210>  181
<211>  1082
<212>  PRT
<213>  Neisseria lactamica
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<400> 181

```
Met Ala Ala Phe Lys Pro Asn Pro Met Asn Tyr Ile Leu Gly Leu Asp
1               5                  10                  15

Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Lys Glu
            20                  25                  30

Glu Asn Pro Ile Arg Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
        35                  40                  45

Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Met Ala Arg Arg Leu
    50                  55                  60

Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65                  70                  75                  80

Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Asp Ala Asp
                85                  90                  95

Phe Asp Glu Asn Gly Leu Val Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100                 105                 110

Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Cys Leu Glu Trp Ser
        115                 120                 125

Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160

Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190
```

```
Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Asn Leu Leu Phe Glu Lys Gln Lys Glu Phe Ser Asn
    210                 215                 220

Pro His Val Ser Asp Ser Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Ala Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Pro Thr Leu Met Glu Met Lys Ala
            340                 345                 350

Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Asn Leu Ser Thr Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Lys Asp Ile Thr Gly Arg Leu Lys
```

```
385                 390                 395                 400

Asp Arg Val Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Cys Lys Lys Asn Ala Glu Glu Lys Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Cys Val Val Arg Arg Tyr Gly
                485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Val
                565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590
```

```
Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655

Phe Asp Glu Glu Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp His Ile Leu Leu Thr
        675                 680                 685

Gly Lys Gly Lys Arg Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700

Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala Glu Asn Asp
705                 710                 715                 720

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
                725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765

Lys Ala His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
```

785 790 795 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
805 810 815

Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
820 825 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
835 840 845

Ser Ala Lys Arg Leu Asp Glu Gly Ile Ser Val Leu Arg Val Pro Leu
850 855 860

Thr Gln Leu Lys Leu Lys Gly Leu Glu Lys Met Val Asn Arg Glu Arg
865 870 875 880

Glu Pro Lys Leu Tyr Asp Ala Leu Lys Ala Gln Leu Glu Thr His Lys
885 890 895

Asp Asn Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
900 905 910

Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Ile Glu Gln Val
915 920 925

Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
930 935 940

Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Gly Gly Lys Tyr Tyr
945 950 955 960

Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
965 970 975

Arg Ala Val Val Ala Phe Lys Asp Glu Glu Asp Trp Thr Val Met Asp
980 985 990

```
Asp Ser Phe Glu Phe Arg Phe Val  Leu Tyr Ala Asn Asp  Leu Ile Lys
        995                 1000                1005


Leu Thr  Ala Lys Lys Asn Glu  Phe Leu Gly Tyr Phe  Val Ser Leu
    1010                1015                1020


Asn Arg  Ala Thr Gly Ala Ile  Asp Ile Arg Thr His  Asp Thr Asp
    1025                1030                1035


Ser Thr  Lys Gly Lys Asn Gly  Ile Phe Gln Ser Val  Gly Val Lys
    1040                1045                1050


Thr Ala  Leu Ser Phe Gln Lys  Asn Gln Ile Asp Glu  Leu Gly Lys
    1055                1060                1065


Glu Ile  Arg Pro Cys Arg Leu  Lys Lys Arg Pro Pro  Val Arg
    1070                1075                1080
```

<210> 182
<211> 1326
<212> PRT
<213> Streptococcus pseudoporcinus

<400> 182

```
Met Leu Gly Thr Val Leu Phe Asp Ser Gly Glu Thr Ala Gln Ala Arg
1               5                   10                  15


Arg Leu Lys Arg Thr Asn Arg Arg Arg Tyr Thr Arg Arg Arg Tyr Arg
            20                  25                  30


Leu Cys Gln Leu Gln Asn Ile Phe Ala Thr Glu Met Val Lys Val Asp
        35                  40                  45


Asp Thr Phe Phe Gln Arg Leu Ser Glu Ser Phe Phe Tyr Tyr Gln Asp
    50                  55                  60


Lys Ala Phe Asp Lys His Pro Ile Phe Gly Asn Ser Lys Glu Glu Arg
65                  70                  75                  80
```

```
Ala Tyr His Lys Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Asp Leu
                85                  90                  95

Ala Asp Arg Asp Gln Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu
            100                 105                 110

Ser His Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Leu
        115                 120                 125

Asn Ser Glu Asn Thr Asp Val Gln Lys Leu Phe Ile Ala Leu Val Thr
    130                 135                 140

Val Tyr Asn Leu Leu Phe Glu Glu Glu Pro Ile Ala Gly Glu Thr Cys
145                 150                 155                 160

Asp Ala Lys Ala Leu Leu Thr Ala Lys Thr Ser Lys Ser Lys Arg Leu
                165                 170                 175

Glu Ser Leu Ile Ser Glu Phe Pro Gly Gln Lys Lys Asn Gly Leu Phe
            180                 185                 190

Gly Asn Leu Leu Ala Leu Ala Leu Gly Leu Arg Pro Asn Phe Lys Ser
        195                 200                 205

Asn Phe Gly Leu Ser Glu Asp Ala Lys Leu Gln Ile Thr Lys Asp Thr
    210                 215                 220

Tyr Glu Glu Glu Leu Asp Asn Leu Leu Ala Glu Ile Gly Asp His Tyr
225                 230                 235                 240

Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu
                245                 250                 255

Ser Asp Ile Leu Thr Leu Ser Asp Glu Asn Thr Arg Ala Pro Leu Ser
            260                 265                 270
```

```
Ala Ser Met Ile Lys Arg Tyr Glu Glu His Gln Glu Asp Leu Ala Leu
        275                 280                 285

Leu Lys Lys Leu Val Lys Glu Gln Met Pro Glu Lys Tyr Trp Glu Ile
    290                 295                 300

Phe Ser Asn Ala Lys Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Gly Lys
305                 310                 315                 320

Val Ser Gln Glu Asp Phe Tyr Arg Tyr Ile Lys Pro Ile Leu Ser Arg
                325                 330                 335

Leu Lys Gly Gly Asp Glu Phe Leu Ala Lys Ile Asp Arg Asp Asp Phe
            340                 345                 350

Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile
        355                 360                 365

His Leu Lys Glu Leu His Ala Ile Leu Arg Arg Gln Glu Lys Tyr Tyr
    370                 375                 380

Pro Phe Leu Ala Glu Gln Lys Glu Lys Ile Glu Gln Leu Leu Cys Phe
385                 390                 395                 400

Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Lys Gly Gly Asn Ser Ser
                405                 410                 415

Phe Ala Trp Leu Lys Arg Arg Ser Asp Glu Pro Ile Thr Pro Trp Asn
            420                 425                 430

Phe Lys Asp Val Val Asp Glu Glu Ala Ser Ala Gln Ala Phe Ile Glu
        435                 440                 445

Gly Met Thr Asn Tyr Asp Thr Tyr Leu Pro Glu Glu Lys Val Leu Pro
    450                 455                 460

Lys His Ser Pro Leu Tyr Glu Met Phe Thr Val Tyr Asn Glu Leu Thr
465                 470                 475                 480
```

```
Lys Val Lys Tyr Ile Ala Glu Asn Met Thr Lys Pro Leu Tyr Leu Ser
               485                 490                 495

Ala Glu Gln Lys Glu Ala Ile Ile Asp His Leu Phe Lys Gln Thr Arg
            500                 505                 510

Lys Val Thr Val Lys Asp Leu Lys Glu Lys Tyr Phe Ser Gln Ile Glu
        515                 520                 525

Gly Leu Glu Asn Val Asp Val Thr Gly Val Glu Gly Ala Phe Asn Ala
    530                 535                 540

Ser Leu Gly Thr Tyr Asn Asp Leu Leu Lys Ile Ile Lys Asp Lys Ala
545                 550                 555                 560

Phe Leu Asp Asp Glu Ala Asn Ala Glu Ile Leu Glu Glu Ile Val Leu
               565                 570                 575

Ile Leu Thr Leu Phe Gln Asp Glu Lys Leu Ile Glu Lys Arg Leu Ala
            580                 585                 590

Lys Tyr Ala Asn Leu Phe Glu Lys Ser Val Leu Lys Lys Leu Arg Lys
        595                 600                 605

Arg His Tyr Arg Gly Trp Gly Arg Leu Ser Arg Gln Leu Ile Asp Gly
    610                 615                 620

Met Lys Asp Lys Ala Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ala
625                 630                 635                 640

Asp Asp Phe Ala Asn Arg Asn Phe Ile Gln Leu Ile Asn Asp Ser Ser
               645                 650                 655

Leu Asp Phe Glu Lys Leu Ile Asp Asp Ala Gln Lys Lys Ala Ile Lys
            660                 665                 670
```

```
Arg Glu Ser Leu Thr Glu Ala Val Ala Asn Leu Ala Gly Ser Pro Ala
        675                 680                 685

Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys Val Val Asp Glu Ile Val
    690                 695                 700

Lys Val Met Gly His Asn Pro Asp Asn Ile Val Ile Glu Met Ser Arg
705                 710                 715                 720

Glu Asn Gln Thr Thr Ala Gln Gly Leu Lys Asn Ala Arg Gln Arg Leu
                725                 730                 735

Lys Lys Ile Lys Glu Val His Lys Lys Thr Gly Ser Arg Ile Leu Glu
            740                 745                 750

Asp Asn Ser Glu Arg Ile Thr Asn Leu Thr Leu Gln Asp Asn Arg Leu
        755                 760                 765

Tyr Leu Tyr Leu Leu Gln Asp Gly Lys Asp Met Tyr Thr Gly Gln Asp
    770                 775                 780

Leu Asp Ile Asn Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro
785                 790                 795                 800

Gln Ser Phe Ile Lys Asp Asn Ser Ile Asp Asn Leu Val Leu Thr Thr
                805                 810                 815

Gln Lys Ala Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Ile Glu Val
            820                 825                 830

Val Arg Asp Met Lys Asp Arg Val Trp Arg Arg Gln Leu Ala Asn Gly
        835                 840                 845

Ala Ile Ser Arg Gln Lys Phe Asp His Leu Thr Lys Ala Glu Arg Gly
    850                 855                 860

Gly Leu Ala Asp Ser Asp Lys Ala Arg Phe Leu Arg Arg Gln Leu Val
865                 870                 875                 880
```

```
Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln Leu Leu Asp Ser Arg
                885                 890                 895

Phe Asn Ser Lys Ser Asn Gln Asn Lys Lys Leu Ala Arg Asn Val Lys
            900                 905                 910

Ile Ile Thr Leu Lys Ser Lys Ile Val Ser Asp Phe Arg Lys Asp Phe
        915                 920                 925

Gly Leu Tyr Lys Leu Arg Glu Val Asn Asn Tyr His His Ala His Asp
    930                 935                 940

Ala Tyr Leu Asn Ala Val Val Gly Thr Ala Leu Leu Lys Lys Tyr Pro
945                 950                 955                 960

Lys Leu Glu Ala Glu Phe Val Tyr Gly Asp Tyr Lys His Phe Asp Leu
                965                 970                 975

Val Lys Leu Ile Ser Lys Ser Asp Pro Ser Leu Gly Lys Ala Thr Ala
            980                 985                 990

Lys Val Phe Phe Tyr Ser Asn Ile  Met Asn Phe Phe Lys  Glu Glu Leu
        995                 1000                1005

Ser Leu  Ala Asp Gly Thr Leu  Met Lys Arg Pro Val  Ile Glu Thr
    1010                1015                1020

Asn Thr  Glu Thr Gly Glu Val  Val Trp Asp Lys Val  Lys Asp Phe
    1025                1030                1035

Lys Thr  Ile Arg Lys Val Leu  Ser Tyr Pro Gln Val  Asn Ile Val
    1040                1045                1050

Lys Lys  Thr Glu Ile Gln Ser  Gly Ala Phe Ser Lys  Glu Ser Val
    1055                1060                1065
```

```
Leu Ser  Lys Gly Asn Ser Asp  Lys Leu Ile Glu Arg  Lys Lys Gly
    1070                1075                1080

Trp Asp  Pro Lys Lys Tyr Gly  Gly Phe Asp Ser Pro  Asn Thr Ala
    1085                1090                1095

Tyr Ser  Ile Phe Val Val Ala  Lys Val Ala Lys Arg  Lys Ala Gln
    1100                1105                1110

Lys Leu  Lys Thr Val Lys Glu  Ile Val Gly Ile Thr  Ile Met Glu
    1115                1120                1125

Gln Ala  Glu Tyr Glu Lys Asp  Asn Ile Ala Phe Leu  Glu Lys Lys
    1130                1135                1140

Gly Tyr  Gln Asp Ile Gln Glu  Lys Leu Leu Ile Lys  Leu Pro Lys
    1145                1150                1155

Tyr Ser  Leu Phe Glu Leu Glu  Asn Gly Arg Arg Arg  Leu Leu Ala
    1160                1165                1170

Ser Ala  Asn Glu Phe Gln Lys  Gly Asn Glu Leu Ala  Leu Ser Gly
    1175                1180                1185

Lys Tyr  Met Lys Phe Leu Tyr  Leu Ala Ser Arg Tyr  Asp Lys Leu
    1190                1195                1200

Ser Ser  Lys Ile Glu Ser Glu  Gln Gln Lys Lys Leu  Phe Val Glu
    1205                1210                1215

Gln His  Leu His Tyr Phe Asp  Glu Ile Leu Asp Ile  Val Val Lys
    1220                1225                1230

His Ala  Thr Cys Tyr Ile Lys  Ala Glu Asn Asn Leu  Lys Lys Ile
    1235                1240                1245

Ile Ser  Leu Tyr Lys Lys Lys  Glu Ala Tyr Ser Ile  Asn Glu Gln
    1250                1255                1260
```

```
Ala Leu  Asn Met Leu Asn Leu  Phe Ile Phe Thr Ser  Leu Gly Ala
    1265                1270                1275


Pro Ser  Thr Phe Val Phe Phe  Asp Glu Thr Ile Asp  Arg Lys Arg
    1280                1285                1290


Tyr Thr  Thr Ser Ser Asp Val  Leu Asn Gly Ile Leu  Ile Gln Gln
    1295                1300                1305


Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile Asp Leu  Ser Arg Phe
    1310                1315                1320


Gly Gly  Asp
    1325
```

<210> 183
<211> 1150
<212> PRT
<213> Enterococcus faecalis

<400> 183

```
Met Tyr Ser Ile Gly Leu Asp Leu Gly Ile Ser Ser Val Gly Trp Ser
1               5                   10                  15


Val Ile Asp Glu Arg Thr Gly Asn Val Ile Asp Leu Gly Val Arg Leu
            20                  25                  30


Phe Ser Ala Lys Asn Ser Glu Lys Asn Leu Glu Arg Arg Thr Asn Arg
        35                  40                  45


Gly Gly Arg Arg Leu Ile Arg Arg Lys Thr Asn Arg Leu Lys Asp Ala
    50                  55                  60


Lys Lys Ile Leu Ala Ala Val Gly Phe Tyr Glu Asp Lys Ser Leu Lys
65                  70                  75                  80


Asn Ser Cys Pro Tyr Gln Leu Arg Val Lys Gly Leu Thr Glu Pro Leu
```

```
                85                  90                  95

Ser Arg Gly Glu Ile Tyr Lys Val Thr Leu His Ile Leu Lys Lys Arg
            100                 105                 110

Gly Ile Ser Tyr Leu Asp Glu Val Asp Thr Glu Ala Ala Lys Glu Ser
        115                 120                 125

Gln Asp Tyr Lys Glu Gln Val Arg Lys Asn Ala Gln Leu Leu Thr Lys
    130                 135                 140

Tyr Thr Pro Gly Gln Ile Gln Leu Gln Arg Leu Lys Glu Asn Asn Arg
145                 150                 155                 160

Val Lys Thr Gly Ile Asn Ala Gln Gly Asn Tyr Gln Leu Asn Val Phe
                165                 170                 175

Lys Val Ser Ala Tyr Ala Asn Glu Leu Ala Thr Ile Leu Lys Thr Gln
            180                 185                 190

Gln Ala Phe Tyr Pro Asn Glu Leu Thr Asp Asp Trp Ile Ala Leu Phe
        195                 200                 205

Val Gln Pro Gly Ile Ala Glu Glu Ala Gly Leu Ile Tyr Arg Lys Arg
    210                 215                 220

Pro Tyr Tyr His Gly Pro Gly Asn Glu Ala Asn Asn Ser Pro Tyr Gly
225                 230                 235                 240

Arg Trp Ser Asp Phe Gln Lys Thr Gly Glu Pro Ala Thr Asn Ile Phe
                245                 250                 255

Asp Lys Leu Ile Gly Lys Asp Phe Gln Gly Glu Leu Arg Ala Ser Gly
            260                 265                 270

Leu Ser Leu Ser Ala Gln Gln Tyr Asn Leu Leu Asn Asp Leu Thr Asn
        275                 280                 285
```

```
Leu Lys Ile Asp Gly Glu Val Pro Leu Ser Ser Glu Gln Lys Glu Tyr
    290                 295                 300

Ile Leu Thr Glu Leu Met Thr Lys Glu Phe Thr Arg Phe Gly Val Asn
305                 310                 315                 320

Asp Val Val Lys Leu Leu Gly Val Lys Lys Glu Arg Leu Ser Gly Trp
                325                 330                 335

Arg Leu Asp Lys Lys Gly Lys Pro Glu Ile His Thr Leu Lys Gly Tyr
            340                 345                 350

Arg Asn Trp Arg Lys Ile Phe Ala Glu Ala Gly Ile Asp Leu Ala Thr
        355                 360                 365

Leu Pro Thr Glu Thr Ile Asp Cys Leu Ala Lys Val Leu Thr Leu Asn
    370                 375                 380

Thr Glu Arg Glu Gly Ile Glu Asn Thr Leu Ala Phe Glu Leu Pro Glu
385                 390                 395                 400

Leu Ser Glu Ser Val Lys Leu Leu Val Leu Asp Arg Tyr Lys Glu Leu
                405                 410                 415

Ser Gln Ser Ile Ser Thr Gln Ser Trp His Arg Phe Ser Leu Lys Thr
            420                 425                 430

Leu His Leu Leu Ile Pro Glu Leu Met Asn Ala Thr Ser Glu Gln Asn
        435                 440                 445

Thr Leu Leu Glu Gln Phe Gln Leu Lys Ser Asp Val Arg Lys Arg Tyr
    450                 455                 460

Ser Glu Tyr Lys Lys Leu Pro Thr Lys Asp Val Leu Ala Glu Ile Tyr
465                 470                 475                 480

Asn Pro Thr Val Asn Lys Thr Val Ser Gln Ala Phe Lys Val Ile Asp
```

```
                485                 490                 495

Ala Leu Leu Val Lys Tyr Gly Lys Glu Gln Ile Arg Tyr Ile Thr Ile
            500                 505                 510

Glu Met Pro Arg Asp Asp Asn Glu Glu Asp Glu Lys Lys Arg Ile Lys
        515                 520                 525

Glu Leu His Ala Lys Asn Ser Gln Arg Lys Asn Asp Ser Gln Ser Tyr
    530                 535                 540

Phe Met Gln Lys Ser Gly Trp Ser Gln Glu Lys Phe Gln Thr Thr Ile
545                 550                 555                 560

Gln Lys Asn Arg Arg Phe Leu Ala Lys Leu Leu Tyr Tyr Tyr Glu Gln
                565                 570                 575

Asp Gly Ile Cys Ala Tyr Thr Gly Leu Pro Ile Ser Pro Glu Leu Leu
            580                 585                 590

Val Ser Asp Ser Thr Glu Ile Asp His Ile Ile Pro Ile Ser Ile Ser
        595                 600                 605

Leu Asp Asp Ser Ile Asn Asn Lys Val Leu Val Leu Ser Lys Ala Asn
    610                 615                 620

Gln Val Lys Gly Gln Gln Thr Pro Tyr Asp Ala Trp Met Asp Gly Ser
625                 630                 635                 640

Phe Lys Lys Ile Asn Gly Lys Phe Ser Asn Trp Asp Asp Tyr Gln Lys
                645                 650                 655

Trp Val Glu Ser Arg His Phe Ser His Lys Lys Glu Asn Asn Leu Leu
            660                 665                 670

Glu Thr Arg Asn Ile Phe Asp Ser Glu Gln Val Glu Lys Phe Leu Ala
        675                 680                 685
```

```
Arg Asn Leu Asn Asp Thr Arg Tyr Ala Ser Arg Leu Val Leu Asn Thr
    690                 695                 700

Leu Gln Ser Phe Phe Thr Asn Gln Glu Thr Lys Val Arg Val Val Asn
705                 710                 715                 720

Gly Ser Phe Thr His Thr Leu Arg Lys Lys Trp Gly Ala Asp Leu Asp
                725                 730                 735

Lys Thr Arg Glu Thr His His His His Ala Val Asp Ala Thr Leu Cys
            740                 745                 750

Ala Val Thr Ser Phe Val Lys Val Ser Arg Tyr His Tyr Ala Val Lys
        755                 760                 765

Glu Glu Thr Gly Glu Lys Val Met Arg Glu Ile Asp Phe Glu Thr Gly
    770                 775                 780

Glu Ile Val Asn Glu Met Ser Tyr Trp Glu Phe Lys Lys Ser Lys Lys
785                 790                 795                 800

Tyr Glu Arg Lys Thr Tyr Gln Val Lys Trp Pro Asn Phe Arg Glu Gln
                805                 810                 815

Leu Lys Pro Val Asn Leu His Pro Arg Ile Lys Phe Ser His Gln Val
            820                 825                 830

Asp Arg Lys Ala Asn Arg Lys Leu Ser Asp Ala Thr Ile Tyr Ser Val
        835                 840                 845

Arg Glu Lys Thr Glu Val Lys Thr Leu Lys Ser Gly Lys Gln Lys Ile
    850                 855                 860

Thr Thr Asp Glu Tyr Thr Ile Gly Lys Ile Lys Asp Ile Tyr Thr Leu
865                 870                 875                 880

Asp Gly Trp Glu Ala Phe Lys Lys Lys Gln Asp Lys Leu Leu Met Lys
```

```
               885                 890                 895

Asp Leu Asp Glu Lys Thr Tyr Glu Arg Leu Leu Ser Ile Ala Glu Thr
            900                 905                 910

Thr Pro Asp Phe Gln Glu Val Glu Glu Lys Asn Gly Lys Val Lys Arg
        915                 920                 925

Val Lys Arg Ser Pro Phe Ala Val Tyr Cys Glu Glu Asn Asp Ile Pro
    930                 935                 940

Ala Ile Gln Lys Tyr Ala Lys Lys Asn Asn Gly Pro Leu Ile Arg Ser
945                 950                 955                 960

Leu Lys Tyr Tyr Asp Gly Lys Leu Asn Lys His Ile Asn Ile Thr Lys
               965                 970                 975

Asp Ser Gln Gly Arg Pro Val Glu Lys Thr Lys Asn Gly Arg Lys Val
            980                 985                 990

Thr Leu Gln Ser Leu Lys Pro Tyr  Arg Tyr Asp Ile Tyr  Gln Asp Leu
        995                 1000                1005

Glu Thr  Lys Ala Tyr Tyr Thr  Val Gln Leu Tyr Tyr  Ser Asp Leu
    1010                1015                1020

Arg Phe  Val Glu Gly Lys Tyr  Gly Ile Thr Glu Lys  Glu Tyr Met
    1025                1030                1035

Lys Lys  Val Ala Glu Gln Thr  Lys Gly Gln Val Val  Arg Phe Cys
    1040                1045                1050

Phe Ser  Leu Gln Lys Asn Asp  Gly Leu Glu Ile Glu  Trp Lys Asp
    1055                1060                1065

Ser Gln  Arg Tyr Asp Val Arg  Phe Tyr Asn Phe Gln  Ser Ala Asn
    1070                1075                1080
```

```
Ser Ile  Asn Phe Lys Gly Leu  Glu Gln Glu Met Met  Pro Ala Glu
    1085                1090                1095


Asn Gln  Phe Lys Gln Lys Pro  Tyr Asn Asn Gly Ala  Ile Asn Leu
    1100                1105                1110


Asn Ile  Ala Lys Tyr Gly Lys  Glu Gly Lys Lys Leu  Arg Lys Phe
    1115                1120                1125


Asn Thr  Asp Ile Leu Gly Lys  Lys His Tyr Leu Phe  Tyr Glu Lys
    1130                1135                1140


Glu Pro  Lys Asn Ile Ile Lys
    1145                1150
```

<210> 184
<211> 1150
<212> PRT
<213> Enterococcus faecalis

<400> 184

```
Met Tyr Ser Ile Gly Leu Asp Leu Gly Val Ser Ser Val Gly Trp Ser
1               5                   10                  15


Val Ile Asp Glu Arg Thr Gly Asn Val Ile Asp Leu Gly Val Arg Leu
            20                  25                  30


Phe Ser Ala Lys Asn Ser Glu Lys Asn Leu Glu Arg Arg Thr Asn Arg
        35                  40                  45


Gly Gly Arg Arg Leu Ile Arg Arg Lys Thr Asn Arg Leu Lys Asp Ala
    50                  55                  60


Lys Lys Ile Leu Ala Ala Val Gly Phe Tyr Glu Asp Lys Ser Leu Lys
65                  70                  75                  80


Asn Ser Cys Pro Tyr Gln Leu Arg Val Lys Gly Leu Thr Glu Pro Leu
                85                  90                  95
```

```
Ser Lys Gly Glu Ile Tyr Lys Val Thr Leu His Ile Leu Lys Lys Arg
            100                 105                 110

Gly Ile Ser Tyr Leu Asp Glu Asp Asp Thr Glu Ala Ala Lys Glu Ser
        115                 120                 125

Gln Asp Tyr Lys Glu Gln Val Arg Glu Asn Ala Gln Leu Leu Thr Lys
    130                 135                 140

Tyr Thr Pro Gly Gln Ile Gln Leu Gln Arg Leu Lys Glu Asn Asn Arg
145                 150                 155                 160

Val Lys Thr Gly Ile Asn Ala Gln Gly Asn Tyr Gln Leu Asn Val Phe
                165                 170                 175

Lys Val Ser Ala Tyr Ala Asn Glu Leu Ala Thr Ile Leu Lys Thr Gln
            180                 185                 190

Gln Ala Phe Tyr Pro Asn Glu Leu Thr Asp Asp Trp Ile Ala Leu Phe
        195                 200                 205

Val Gln Pro Gly Ile Ala Glu Glu Ala Gly Leu Ile Tyr Arg Lys Arg
    210                 215                 220

Pro Tyr Tyr His Gly Pro Gly Asn Glu Ala Asn Asn Ser Pro Tyr Gly
225                 230                 235                 240

Arg Trp Ser Asp Phe Lys Lys Thr Gly Gln Pro Ala Thr Asn Ile Phe
                245                 250                 255

Asp Lys Leu Ile Gly Lys Asp Phe Gln Gly Glu Leu Arg Ala Ser Gly
            260                 265                 270

Leu Ser Leu Ser Ala Gln Gln Tyr Asn Leu Leu Asn Asp Leu Thr Asn
        275                 280                 285
```

```
Leu Lys Ile Asp Gly Glu Ile Pro Leu Ser Pro Glu Gln Lys Glu Tyr
    290                 295                 300

Ile Leu Ala Glu Leu Met Thr Lys Glu Phe Thr Arg Phe Gly Ile Asn
305                 310                 315                 320

Asp Val Ala Lys Leu Leu Gly Val Lys Lys Glu Arg Leu Ser Gly Trp
                325                 330                 335

Arg Leu Asp Lys Lys Gly Lys Pro Glu Ile His Thr Leu Lys Gly Tyr
            340                 345                 350

Arg Asn Trp Arg Lys Ile Phe Ala Glu Ser Gly Ile Asp Leu Ala Thr
        355                 360                 365

Leu Pro Thr Glu Thr Ile Asp Cys Leu Ala Lys Val Leu Thr Leu Asn
    370                 375                 380

Thr Glu Arg Glu Gly Ile Glu Asn Thr Leu Ala Phe Glu Leu Pro Glu
385                 390                 395                 400

Leu Ala Glu Ser Val Lys Leu Leu Val Leu Asp Arg Tyr Lys Glu Leu
                405                 410                 415

Ser Gln Ser Val Ser Thr Gln Ala Trp His Arg Phe Ser Leu Lys Thr
            420                 425                 430

Leu His Leu Leu Ile Pro Glu Leu Met Asn Ala Thr Ser Glu Gln Asn
        435                 440                 445

Thr Leu Leu Glu Gln Phe Gln Leu Lys Ser Asp Val Arg Lys Arg Tyr
    450                 455                 460

Ser Glu Tyr Lys Lys Leu Pro Thr Lys Asp Val Leu Thr Glu Ile Tyr
465                 470                 475                 480

Asn Pro Thr Val Asn Lys Thr Val Ser Gln Ala Phe Lys Val Ile Asp
                485                 490                 495
```

```
Ala Leu Leu Val Lys Tyr Gly Lys Glu Gln Ile Arg Tyr Ile Thr Ile
            500                 505                 510

Glu Met Pro Arg Asp Asp Asn Glu Glu Asp Glu Lys Lys Arg Ile Lys
        515                 520                 525

Glu Leu His Ala Lys Asn Ser Gln Arg Lys Asn Asp Ser Gln Ser Tyr
    530                 535                 540

Phe Met Gln Lys Ser Gly Trp Ser Gln Glu Lys Phe Gln Thr Thr Ile
545                 550                 555                 560

Gln Lys Asn Arg Arg Phe Leu Ala Lys Leu Leu Tyr Tyr Tyr Glu Gln
                565                 570                 575

Asp Gly Ile Cys Ala Tyr Thr Gly Leu Ser Ile Ser Pro Glu Leu Leu
            580                 585                 590

Val Ser Asp Ser Thr Glu Ile Asp His Ile Ile Pro Ile Ser Ile Ser
        595                 600                 605

Leu Asp Asp Ser Ile Asn Asn Lys Val Leu Val Leu Ser Lys Ala Asn
    610                 615                 620

Gln Val Lys Gly Gln Gln Thr Pro Tyr Asp Ala Trp Met Asp Gly Ser
625                 630                 635                 640

Phe Lys Lys Ile Asn Gly Lys Phe Ser Asn Trp Asp Asp Tyr Gln Lys
                645                 650                 655

Trp Val Glu Ser Arg His Phe Ser His Lys Lys Glu Asn Asn Leu Leu
            660                 665                 670

Glu Thr Arg Asn Ile Phe Asp Ser Glu Gln Val Glu Lys Phe Leu Ala
        675                 680                 685
```

```
Arg Asn Leu Asn Asp Thr Arg Tyr Ala Ser Arg Leu Val Leu Asn Thr
    690                 695                 700

Leu Gln Ser Phe Phe Ala Asn Gln Glu Thr Lys Val Arg Val Val Asn
705                 710                 715                 720

Gly Ser Phe Thr His Thr Leu Arg Lys Lys Trp Gly Ala Asp Leu Asp
                725                 730                 735

Lys Thr Arg Glu Thr His His His His Ala Val Asp Ala Thr Leu Cys
            740                 745                 750

Ala Val Thr Pro Phe Val Lys Val Ser Arg Tyr His Tyr Ala Val Lys
        755                 760                 765

Glu Glu Thr Gly Glu Lys Val Met Arg Glu Ile Asp Phe Glu Thr Gly
    770                 775                 780

Glu Ile Val Asp Glu Met Ser Tyr Arg Glu Phe Lys Lys Ser Lys Lys
785                 790                 795                 800

Tyr Glu Arg Lys Thr Tyr Gln Val Lys Trp Pro Asn Phe Arg Glu Gln
                805                 810                 815

Leu Lys Pro Val Asn Leu His Pro Arg Ile Lys Phe Ser His Gln Val
            820                 825                 830

Asp Arg Lys Ala Asn Arg Lys Leu Ser Asp Ala Thr Ile Tyr Ser Val
        835                 840                 845

Arg Glu Lys Thr Glu Val Lys Thr Leu Lys Ser Gly Lys Gln Lys Ile
    850                 855                 860

Thr Thr Asp Glu Tyr Thr Ile Gly Lys Ile Lys Asp Ile Tyr Thr Val
865                 870                 875                 880

Asp Gly Trp Glu Ala Phe Lys Lys Lys Gln Asp Lys Leu Leu Met Lys
                885                 890                 895
```

```
Asp Leu Asp Glu Lys Thr Tyr Glu Arg Leu Leu Ser Ile Ala Glu Thr
            900                 905                 910

Thr Pro Asp Phe Gln Glu Val Glu Glu Lys Asn Gly Lys Val Lys Arg
        915                 920                 925

Val Lys Arg Ser Pro Phe Ala Val Tyr Cys Glu Glu Asn Asp Ile Pro
    930                 935                 940

Ala Ile Arg Lys Tyr Ala Lys Asn Asn Asn Gly Pro Leu Ile Arg Ser
945                 950                 955                 960

Leu Lys Tyr Tyr Asp Gly Lys Leu Asn Lys His Ile Asn Ile Thr Lys
                965                 970                 975

Asp Ser Gln Gly Arg Pro Val Glu Lys Thr Lys Asn Gly Arg Lys Val
            980                 985                 990

Thr Leu Gln Ser Leu Lys Pro Tyr  Arg Tyr Asp Ile Tyr  Gln Asp Leu
        995                 1000                1005

Glu Thr  Lys Ala Tyr Tyr Thr  Val Gln Leu Tyr Tyr  Ser Asp Leu
    1010                1015                1020

Arg Phe  Val Glu Gly Lys Tyr  Gly Ile Thr Glu Lys  Glu Tyr Met
    1025                1030                1035

Lys Lys  Val Ala Glu Gln Thr  Lys Gly Gln Val Val  Arg Phe Cys
    1040                1045                1050

Phe Ser  Leu Gln Lys Asn Asp  Gly Leu Glu Ile Glu  Trp Lys Asp
    1055                1060                1065

Ser Gln  Cys Tyr Asp Val Arg  Phe Tyr Asn Phe Gln  Ser Ala Asn
    1070                1075                1080
```

Ser Ile Asn Phe Lys Gly Leu Glu Gln Glu Met Met Pro Ala Glu
    1085   1090   1095

Asn Gln Phe Lys Gln Lys Pro Tyr Asn Asn Gly Ala Ile Asn Leu
    1100   1105   1110

Asn Ile Ala Lys Tyr Gly Lys Glu Gly Lys Lys Leu Arg Lys Phe
    1115   1120   1125

Asn Thr Asp Ile Leu Gly Lys Lys His Tyr Leu Tyr Tyr Glu Lys
    1130   1135   1140

Glu Pro Lys Asn Ile Ile Lys
    1145   1150

<210> 185
<211> 1345
<212> PRT
<213> Streptococcus anginosus

<400> 185

Met Asp Gln Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20   25   30

Lys Val Leu Gly Asn Thr Asp Lys Gln Ser Ile Lys Lys Asn Leu Leu
        35   40   45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50   55   60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Leu Arg
65   70   75   80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Asn Lys Val Asp Glu Asn
                85   90   95

```
Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Asp Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Ile Ala Ala Glu Val Lys Tyr
        115                 120                 125

His Asp Asp Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140

Ile Ser Gln Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Gln Leu Lys Ala
                165                 170                 175

Glu Asn Thr Asn Val Gln Ala Leu Phe Lys Asp Phe Val Glu Val Tyr
            180                 185                 190

Asp Lys Thr Val Glu Glu Ser His Leu Ser Glu Met Thr Val Asp Ala
        195                 200                 205

Leu Ser Ile Leu Thr Glu Lys Val Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala His Tyr Pro Ala Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Gln Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Gly Leu Leu Gly Glu Ile Gly Asp Glu Tyr Ala Asp
        275                 280                 285

Leu Phe Ala Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
```

```
    290                 295                 300

Ile Leu Thr Val Asp Asp Asn Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Val Lys Arg Tyr Glu Glu His Gln Lys Asp Leu Lys Lys Leu Lys
                325                 330                 335

Asp Phe Ile Lys Val Asn Ala Pro Asp Gln Tyr Asn Ala Ile Phe Lys
            340                 345                 350

Asp Lys Asn Lys Lys Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val Lys
        355                 360                 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Gly Ile Leu Leu Gln Ile Asn
    370                 375                 380

Gly Ser Gly Asp Phe Leu Asp Lys Ile Asp Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Glu Glu His Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Gly Ser Arg Phe Ala Trp
    450                 455                 460

Ala Glu Tyr Lys Ala Asp Glu Lys Ile Thr Pro Trp Asn Phe Asp Asp
465                 470                 475                 480

Ile Leu Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met Thr
                485                 490                 495
```

```
Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Thr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Asn Glu Gln Gly Glu Ala Lys Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Leu Asn Tyr Leu Asn Lys Glu Phe Glu Glu Phe Arg Ile
                565                 570                 575

Val Asn Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ser Ser
            580                 585                 590

Leu Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Ser Phe Leu
        595                 600                 605

Asp Asp Lys Ala Asn Glu Lys Thr Ile Glu Asp Ile Ile Gln Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Gln Arg Leu Gln Lys Tyr
625                 630                 635                 640

Ser Asp Ile Phe Thr Lys Ala Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile Arg
            660                 665                 670

Asn Lys Glu Asn Lys Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Tyr Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
```

```
    690                 695                 700

Phe Lys Glu Glu Ile Ala Arg Ala Gln Ile Ile Gly Asp Val Asp Asp
705                 710                 715                 720

Ile Ala Asn Val Val His Asp Leu Pro Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val Lys Val Met
            740                 745                 750

Gly His Asn Pro Ala Asn Ile Ile Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Met Thr Asp Lys Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Leu Leu
    770                 775                 780

Gln Asp Ser Leu Lys Asn Leu Asp Asn Pro Val Asn Ile Lys Asn Val
785                 790                 795                 800

Glu Asn Gln Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Ile Gln
                805                 810                 815

Asn Gly Lys Asp Met Tyr Thr Gly Glu Thr Leu Asp Ile Asn Asn Leu
            820                 825                 830

Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp
        835                 840                 845

Asn Ser Leu Asp Asn Arg Val Leu Thr Arg Ser Asp Lys Asn Arg Gly
    850                 855                 860

Lys Ser Asp Asp Val Pro Ser Ile Glu Val Val His Glu Met Lys Ser
865                 870                 875                 880

Phe Trp Ser Lys Leu Leu Ser Val Lys Leu Ile Thr Gln Arg Lys Phe
                885                 890                 895
```

```
Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Glu Asp Lys
            900                 905                 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925

His Val Ala Gln Ile Leu Asp Glu Arg Phe Asn Thr Glu Phe Asp Gly
    930                 935                 940

Asn Lys Arg Arg Ile Arg Asn Val Lys Ile Ile Thr Leu Lys Ser Asn
945                 950                 955                 960

Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu
                965                 970                 975

Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val
            980                 985                 990

Gly Asn Ala Leu Leu Leu Lys Tyr  Pro Gln Leu Glu Pro  Glu Phe Val
        995                 1000                1005

Tyr Gly  Glu Tyr Pro Lys Tyr  Asn Ser Tyr Arg Ser  Arg Lys Ser
    1010                1015                1020

Ala Thr  Glu Lys Phe Leu Phe  Tyr Ser Asn Ile Leu  Arg Phe Phe
    1025                1030                1035

Lys Lys  Glu Asp Ile Gln Thr  Asn Glu Asp Gly Glu  Ile Ala Trp
    1040                1045                1050

Asn Lys  Glu Lys His Ile Lys  Ile Leu Arg Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Thr Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Glu Ser  Asp Lys Leu
```

```
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Asn  Ser Tyr Trp Asn Pro  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Val  Val Ala Tyr Ser Ile  Leu Val Phe
    1115                1120                1125

Ala Asp  Val Glu Lys Gly Lys  Ser Lys Lys Leu Arg  Lys Val Gln
    1130                1135                1140

Asp Met  Val Gly Ile Thr Ile  Met Glu Lys Lys Arg  Phe Glu Lys
    1145                1150                1155

His Pro  Val Asp Phe Leu Glu  Gln Arg Gly Tyr Arg  Asn Val Arg
    1160                1165                1170

Leu Glu  Lys Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu
    1175                1180                1185

Glu Asn  Lys Arg Arg Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Leu Val Ile  Pro Gln Arg Phe Thr  Thr Leu Leu
    1205                1210                1215

Tyr His  Ser Tyr Gln Ile Glu  Lys Asn Tyr Glu Pro  Glu His Arg
    1220                1225                1230

Glu Tyr  Val Glu Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Glu
    1235                1240                1245

Tyr Ile  Ser Val Phe Ser Arg  Lys Tyr Val Leu Ala  Asp Asn Asn
    1250                1255                1260

Leu Thr  Lys Ile Glu Met Leu  Phe Ser Lys Asn Lys  Asp Ala Glu
    1265                1270                1275
```

```
Val Ser  Ser Leu Ala Lys Ser  Phe Ile Ser Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Phe  Gly Ala Pro Ala Ala  Phe Asn Phe Phe Gly  Glu Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Val Thr Glu Cys Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Glu Asp
    1340                1345
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Leu Ile Asp Lys Asn Gly Thr Pro Gln His Ile Thr Met Ile Asp Lys
1               5                   10                  15


Met Arg Gly Lys Cys Thr Tyr Phe Pro Glu Glu Val Arg Ile Ala Lys
            20                  25                  30


Met Ser Tyr Thr Ala Glu Leu Phe Gly Leu Leu Asn Asp Phe Asn Asn
        35                  40                  45


Ile Tyr Phe Ala Asp Pro Glu Thr Gly Glu Lys Ile Gly Phe Thr Glu
    50                  55                  60
```

```
Ala Asp Lys Lys Tyr Phe Ile Asp Thr Phe Ile His Asp Gln Lys Gly
65                  70                  75                  80

Val Lys Asn Ile Thr Leu Lys Gln Ile Met Lys His Lys Asn Ile Ile
                85                  90                  95

Asn Glu Thr Asp Ile Phe Gly Tyr Arg Ile Asn Thr Lys Asn Gly Thr
            100                 105                 110

Pro Ile Phe Thr Glu Phe Lys Gly Leu Lys Ala Leu Lys Lys Ala Leu
        115                 120                 125

Lys Glu Val Asp Leu Pro Asp Glu Phe Tyr Gln Asn Thr Glu Met Met
    130                 135                 140

Asp Glu Ile Ala Asn Ile Leu Ser Ser Glu Lys Ser Phe Thr Arg Arg
145                 150                 155                 160

Glu Glu Gln Leu Lys Glu Leu Phe Leu Ala Ala Phe Asn Asp Glu Leu
                165                 170                 175

Glu Glu Ala Val Lys Glu Leu Ile Asn Asp Ile Thr Phe Lys Glu Phe
            180                 185                 190

His Ser Leu Ser Lys Lys Ala Ile Met Val Ile Leu Pro Glu Leu Trp
        195                 200                 205

Ser Thr Asn Gln Asn Gln Met Gln Leu Phe Val Gln His Lys Met Asp
    210                 215                 220

Lys Ser Arg Leu Glu Asn Leu Gln Asn Gly Thr Lys Ile Gln Phe Asp
225                 230                 235                 240

Asp Glu Ala Ile Leu Ser Thr Ile Ala Lys Arg Ala His Arg Glu Thr
                245                 250                 255

Ile Lys Ile Val Asp Ala Val Arg Ala Lys Tyr Gly Glu Leu Asp Tyr
            260                 265                 270
```

```
Val Ile Val Glu Met Ala Arg Glu Lys Asn Ser Asp Glu Gln Lys Lys
        275                 280                 285

Val Tyr Asn Arg Ala Gln Lys Lys Gln Gly Asp Phe Glu Lys Glu Met
    290                 295                 300

Cys Lys Leu Leu Gly Val Ser Glu Leu Lys Glu Leu Arg Leu Asn Gly
305                 310                 315                 320

Lys Gln His Leu Ala Leu Lys Phe Trp Lys Glu Gln Asp Gly Lys Cys
                325                 330                 335

Ile Tyr Ser Gly Lys Pro Ile Ala Leu Ser Asp Ile Val Asn Asn Phe
            340                 345                 350

Asn Gly Leu Leu Glu Ile Asp His Ile Ile Pro Ile Ser Ile Ser Tyr
        355                 360                 365

Asp Asp Ser Gln Gln Asn Lys Val Leu Cys Leu Arg Ser Glu Asn Gln
    370                 375                 380

Arg Lys Gly Gln Leu Ser Pro Tyr Gln Tyr Leu Ile Arg Gly Met Gly
385                 390                 395                 400

Glu Arg Ser Phe Asp Ala Phe Lys Ala Glu Val Leu Ser Arg His Phe
                405                 410                 415

Gly Lys Lys Lys Gln Asn Tyr Leu Leu Glu Met Glu Asp Ile Ala Asn
            420                 425                 430

Asn Asp Glu Leu Arg Lys His Phe Ile Asn Arg Asn Leu Val Asp Thr
        435                 440                 445

Arg Tyr Ala Met Arg Thr Phe Ser Asn Thr Leu Lys Thr Phe Tyr Thr
    450                 455                 460
```

```
Val Asn Gly Ile Pro Thr Lys Val Met Pro Val Asn Gly Ala Met Thr
465                 470                 475                 480

Ser Ala Leu Arg Lys Arg Ala Lys Leu Asn Lys Asp Arg Asp Ala Gly
                485                 490                 495

His Ala His His Ala Ile Asp Ala Leu Ile Val Ala Ala Ile Gly Arg
            500                 505                 510

Leu Pro Leu Ile Lys Gln Leu Ala Glu Leu Arg Val Asn Glu Glu Gly
        515                 520                 525

Glu Phe Ala Asp Lys Ile Thr Asp Lys Gly Leu Asp Asp Lys Thr Ala
    530                 535                 540

Phe Asp Asp Lys Thr Leu Lys Phe Leu Arg Asn Leu Leu Asn Tyr Glu
545                 550                 555                 560

Ser Lys Val Lys Tyr Ser His Lys Val Asp Arg Lys Pro Asn Arg Ser
                565                 570                 575

Leu Ser Lys Gln Thr Leu Tyr Ser Thr Arg Glu Lys Asp Gly Glu Lys
            580                 585                 590

Tyr Ile Ile Gly Lys Val Lys Asn Ile Tyr Thr Leu Asp Lys Ala Gly
        595                 600                 605

Tyr Ala Ala Leu Lys Lys Arg Ile Asp Lys Asn Pro Glu Asp Phe Leu
    610                 615                 620

Met Ala Gln His Asn Pro Lys Thr Trp Glu Glu Ile Ile Lys Ile Met
625                 630                 635                 640

Glu Val Tyr Ser Lys Ala Asp Asn Pro Phe Lys Glu Phe Tyr Asp Glu
                645                 650                 655

His Gly Phe Ile Met Lys Asp Gly Lys Val Pro Val Lys Ser Leu Arg
            660                 665                 670
```

```
Tyr His Asp Lys Lys Leu Gly Ile His Val Pro Leu Thr His Lys Tyr
        675                 680                 685

Glu Asn Thr Arg His Asp Val Val Leu Leu Lys Arg Asn Ser Leu Arg
    690                 695                 700

Val Asp Ile Tyr Met Asn Lys Glu Gly Val Tyr Lys Tyr Gln Gly Val
705                 710                 715                 720

Pro Tyr Asn Trp Phe Asn Gln Lys Gly Asp Lys Tyr Ile Leu Asp Met
                725                 730                 735

Glu Lys Tyr His Asn Glu Ile Asp Gly Thr Arg Ala Ser Phe Lys Asn
            740                 745                 750

Ile Asp Asn Thr Phe Glu Phe Gln Phe Ser Leu Tyr Lys Asn Asp Val
        755                 760                 765

Phe Ser Tyr Met Lys Lys Asp Lys Glu Gly Glu Xaa Val Ser Tyr Thr
    770                 775                 780

Lys Leu Phe Arg Ser Asp Ser Ser Pro Arg Glu Asn Arg Leu Glu Val
785                 790                 795                 800

Glu Asn Ile Asp Met Arg Thr Ser Ser Gln Gln Met Pro Thr Ile Asn
                805                 810                 815

Pro Leu Lys Asn Leu Ile Lys Tyr Asn Thr Asp Ile Leu Gly Asn Thr
            820                 825                 830

Tyr Pro Ile Gln Lys Glu Lys Phe Val Thr Val Phe Thr Leu His Ser
        835                 840                 845

Lys
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Met Lys Thr Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
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Ala Lys Val Ser Val Asp Asp Tyr Gly Asn Tyr Leu His Asp Ile Lys
20 25 30

Leu Gly Ser Arg Ile Ile Pro Met Ser Gln Asp Val Leu Gly Asn Phe
35 40 45

Asp Ser Gly Val Thr Val Ser Gln Thr Ala Gln Arg Thr Glu Phe Arg
50 55 60

Ser Lys Arg Arg Leu Val Gln Arg Asn Leu Gln Arg Arg Glu Arg Leu
65 70 75 80

His Arg Val Leu His Val Leu Asp Phe Leu Pro Ala His Tyr Asp Ala
85 90 95

Ala Ile Gly Trp Asp Arg Thr Glu Ala Val Thr Tyr Gly Lys Phe Leu
100 105 110

Asn His Ala Glu Pro Lys Leu Ala Trp Glu Glu Leu Gly Asn Gly Lys
115 120 125

Arg Arg Phe Leu Phe Met Asp Ser Phe His Glu Met Val Ala Asp Phe
130 135 140

Ala Arg Cys Gln Pro Ala Leu Val Ala Asp Gly Lys Lys Ile Pro Leu
145 150 155 160

Asp Trp Thr Ile Tyr Tyr Leu Arg Lys Lys Ala Leu Thr Gln Ala Ile
165 170 175

```
Thr Lys Glu Glu Leu Ala Trp Ile Leu Leu Asn Phe Asn Gln Lys Arg
            180                 185                 190

Gly Tyr Tyr Gln Leu Arg Gly Glu Glu Glu Glu Glu Asn Pro Thr Lys
        195                 200                 205

Gln Glu Glu Tyr Tyr Glu Leu Lys Val Val Ser Val Glu Ala Thr Asp
    210                 215                 220

Ser Arg Lys Gly Asn Asp Thr Trp Tyr Asn Val His Leu Glu Asn Gly
225                 230                 235                 240

Trp Ile Tyr Arg Arg Ser Ser Lys Ile Ser Leu Asp Asp Trp Val Gly
                245                 250                 255

Lys Val Lys Gln Phe Ile Val Thr Thr Glu Tyr Glu Lys Asp Gly Ala
            260                 265                 270

Thr Leu Lys Thr Asp Lys Glu Gly Tyr Val Lys Arg Ser Phe Arg Ala
        275                 280                 285

Pro Asn Glu Asn Asp Trp Gly Leu Arg Lys Lys Arg Thr Glu Thr Leu
    290                 295                 300

Leu Glu Met Ser Gly Lys Thr Val Gly Ala Phe Ile Tyr Asp His Leu
305                 310                 315                 320

Leu Gln Glu Pro Ala Asp Lys Ile Arg Gly Asn Phe Ile Arg Thr Ile
                325                 330                 335

Glu Arg His Tyr Tyr Lys Ala Glu Leu Glu Ala Ile Leu Ala Glu Gln
            340                 345                 350

Cys Lys Tyr His Ile Glu Leu Arg Asp Lys Glu Met Leu Glu Ala Cys
        355                 360                 365

Ala Arg Glu Leu Tyr Leu Asn Asn Leu Pro His Gln Arg Ser Leu Met
```

```
    370                 375                 380

Lys Lys Asp Met Thr Tyr Leu Leu Leu Tyr Asp Leu Ile Phe Tyr Gln
385                 390                 395                 400

Arg Pro Leu Lys Ser Lys Lys Ala Leu Ile Ala Asn Cys Pro Tyr Glu
                405                 410                 415

Tyr Tyr Glu Tyr Val Asp Lys Glu Thr Gly Glu Ile Lys Arg Gln Asn
            420                 425                 430

Ile Lys Cys Ile Ala Lys Ser Asn Pro Tyr Phe Gln Glu Phe Arg Leu
        435                 440                 445

Trp Gln Phe Val Leu Asn Leu Arg Leu Phe Asp Arg Val Glu Asp Lys
    450                 455                 460

Glu Val Thr Ala Asn Tyr Leu Pro Thr Ala Asp Asp His Ala Arg Leu
465                 470                 475                 480

Phe Thr Tyr Leu Asn Asp Arg Lys Glu Ile Asn Gln Glu Thr Leu Leu
                485                 490                 495

Lys Asp Tyr Phe Lys Leu Lys Lys Val Lys Ile Gly Asn Glu Lys Glu
            500                 505                 510

Tyr Pro Ile Arg Trp Asn Tyr Ile Glu Asp Lys Glu Lys Lys Tyr Pro
        515                 520                 525

Cys Asn Glu Thr Arg Tyr Glu Leu Leu Met Ala Leu Asp Arg Ala Gly
    530                 535                 540

Ile Glu His Lys Trp Leu Asp Asp Asn Asn Leu Glu Tyr Arg Leu Trp
545                 550                 555                 560

His Leu Leu Tyr Ser Val Glu Val Lys Ser Glu Ser Glu Thr Ala Leu
                565                 570                 575
```

```
Arg Lys Leu Lys Asn Asp Asp Ala Phe Val Asn Ser Phe Leu Lys Val
            580                 585                 590

Lys Pro Phe Lys Lys Glu Tyr Gly Ala Tyr Ser Glu Lys Ala Ile Lys
        595                 600                 605

Arg Leu Leu Ala Val Met Arg Lys Gly Phe Leu Trp Asn Glu Gln Asp
    610                 615                 620

Ile Cys Asp Glu Thr Arg Lys Arg Ile Glu Ile Ile Ile Lys Gly Asp
625                 630                 635                 640

Val Asp Glu Lys Val Lys Glu Arg Met Gly His Ala Ala Tyr Ser Phe
                645                 650                 655

Asp Arg Val Ser Asp Phe Gln Gly Leu Pro Glu Trp Leu Ala Cys Tyr
            660                 665                 670

Val Val Tyr Gly Arg His Ser Glu Ala Met Asp Ile Gln His Trp Asp
        675                 680                 685

Ser Pro Glu Arg Leu Met Ala Tyr Ile Asn Asn Phe Lys Gln Tyr Ser
    690                 695                 700

Leu Arg Asn Pro Ile Val Glu Gln Cys Ile Leu Glu Thr Leu Arg Thr
705                 710                 715                 720

Val His Asp Ile Trp Lys Glu Thr Gly Gln Ile Asp Glu Ile His Val
                725                 730                 735

Glu Leu Gly Arg Glu Met Lys Ser Thr Ser Glu Glu Arg Ala Arg Arg
            740                 745                 750

Thr Gln Asn Val Leu Arg Asn Glu Asn Thr Asn Leu Arg Ile Lys Ser
        755                 760                 765

Leu Leu Ile Glu Leu Lys Asn Asp Thr Asp Ile Cys Asn Val His Pro
```

```
    770                 775                 780

Tyr Ser Pro Met Gln Gln Glu Ile Leu Arg Ile Tyr Glu Glu Gly Ala
785                 790                 795                 800

Leu Gln Glu Leu Asn Arg Glu Asp Glu Asp Phe Glu Glu Ile Ser Lys
                805                 810                 815

Ile Ser Gln Met Ser Gln Pro Ser Gly Lys Glu Leu Asn Arg Tyr Lys
            820                 825                 830

Leu Trp Leu Glu Gln Lys Tyr Arg Ser Pro Tyr Thr Gly Lys Ala Ile
        835                 840                 845

Ser Leu Ala Lys Leu Phe Thr Pro Ala Tyr Gln Ile Glu His Val Ile
    850                 855                 860

Pro Gln Ser Arg Tyr Phe Asp Asp Ser Phe Thr Asn Lys Val Ile Cys
865                 870                 875                 880

Glu Ala Glu Val Asn Thr Leu Lys Ser Asn Leu Leu Gly Tyr Glu Phe
                885                 890                 895

Ile Lys Lys His Gly Gly Glu Ile Ile His Cys Thr Thr Leu Gly Asp
            900                 905                 910

Val Arg Ile Phe Ser Glu Ser Glu Tyr Lys Ala Phe Val Met Asp His
        915                 920                 925

Tyr Ala Asn Asn Lys Ser Lys Lys Asp Lys Leu Leu Met Glu Asp Ile
    930                 935                 940

Pro Gln Glu Phe Leu Ser Arg Gln Met Asn Asp Ser Arg Tyr Ile Ser
945                 950                 955                 960

Lys Val Val Lys Thr Leu Leu Ser Asn Ile Val Arg Met Ala Asp Glu
                965                 970                 975
```

```
Ser Glu Ala Thr Ser Lys Ser Val Ile Val Cys Thr Gly Gly Val Thr
            980                 985                 990


Asp Arg Leu Lys Lys Asp Trp Gly  Leu Asn Asp Val Trp  Asn Ser Ile
        995                 1000                1005


Val Tyr  Ser Arg Phe Glu Arg  Leu Asn Arg Leu Thr  Gly Thr Glu
    1010                1015                1020


Ala Phe  Gly His Trp Glu Asn  Lys Asp Gly Lys Arg  Val Phe Gln
    1025                1030                1035


Thr Ser  Met Pro Leu Glu Leu  Gln Arg Gly Phe Arg  Lys Lys Arg
    1040                1045                1050


Ile Asp  His Arg His His Ala  Met Asp Ala Leu Val  Ile Ala Cys
    1055                1060                1065


Ala Ser  Arg Asn Ile Val Asn  Tyr Leu Asn Asn Glu  Ser Ala Asn
    1070                1075                1080


Asn Pro  Lys Lys Arg Glu Asp  Leu Arg Arg Gln Leu  Cys Asp Lys
    1085                1090                1095


Asn Arg  Val Ile Arg Lys Pro  Trp Glu Thr Phe Thr  Gln Asp Ala
    1100                1105                1110


Tyr Asn  Ala Leu Glu Asn Val  Val Val Ser Phe Lys  Asn Tyr Val
    1115                1120                1125


Arg Val  Ile Asn Lys Ala Thr  Asn Arg Tyr Glu His  Tyr Asp Glu
    1130                1135                1140


Asn Gly  Lys Lys Arg Phe Val  Gln Gln Lys Gly Ser  Glu Leu Trp
    1145                1150                1155


Ala Ile  Arg Lys Pro Met His  Lys Glu Thr Tyr Tyr  Gly His Val
```

```
    1160                1165                1170

Asn Leu  Arg Arg Lys Glu Leu  Val Thr Leu Gln Lys  Ala Leu Asp
    1175                1180                1185

Asp Ile  Pro Ser Ile Cys Asp  Lys Lys Leu Arg Asp  Tyr Ile Ser
    1190                1195                1200

Ala Leu  Val Glu Lys His Phe  Asn Lys Arg Gln Leu  Leu Ala His
    1205                1210                1215

Phe Lys  Ser Thr Asp Tyr Tyr  Trp Gln Lys Gln Tyr  Val Asn Lys
    1220                1225                1230

Val Tyr  Val Trp Thr Phe Ser  Asp Asp Ile Lys Pro  Leu Val Ala
    1235                1240                1245

Thr Arg  Lys Leu Leu Asp Thr  Ser Phe Asp Ala Lys  Arg Ile Gly
    1250                1255                1260

Thr Ile  Thr Asp Thr Gly Ile  Gln Lys Ile Leu Arg  Asn Tyr Leu
    1265                1270                1275

Glu Ala  Lys Gly Gly Asn Ala  Thr Leu Ala Phe Thr  Pro Glu Gly
    1280                1285                1290

Ile Ala  Glu Met Asn Gln Asn  Ile Ser Lys Tyr Asn  Asp Gly Lys
    1295                1300                1305

Pro His  Gln Pro Ile Leu Lys  Val Arg Ile Thr Glu  Pro Met Gly
    1310                1315                1320

Ala Lys  Tyr Arg Val Gly Gln  Thr Gly Asn Lys Met  Ala Lys Tyr
    1325                1330                1335

Val Glu  Ala Gln Ser Gly Thr  Asn Leu Tyr Phe Ala  Ile Tyr Glu
    1340                1345                1350
```

```
Asp Ser  Glu Gly Lys Arg Ser  Tyr Thr Thr Val Pro  Leu Asp Glu
    1355                1360                1365


Val Ala  Glu Arg Leu Lys Gln  Arg Leu Ser Pro Val  Pro Glu Lys
    1370                1375                1380


Asp Glu  Asn Asp Val Pro Leu  Lys Phe Tyr Leu Ser  Pro Asn Asp
    1385                1390                1395


Leu Val  Tyr Val Pro Thr Glu  Glu Glu Leu Gln Leu  Arg Glu Cys
    1400                1405                1410


Lys Leu  Asn Lys Asp Arg Ile  Tyr Lys Met Val Ser  Ser Thr Gly
    1415                1420                1425


Asn Glu  Cys His Phe Ile Pro  Tyr Tyr Val Ala Asn  Val Ile Tyr
    1430                1435                1440


Asn Lys  Gly Gly Phe Asn Met  Gln Met His Arg Pro  Gln Ser
    1445                1450                1455


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Met Lys Asn Asp Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
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Gly Tyr Ser Val Val Thr Asp Asp Tyr Lys Val Ile Ser Lys Lys Met
            20                  25                  30


Asn Val Phe Gly Asn Thr Glu Lys Lys Ser Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Glu Ser Gly Gln Thr Ala Gln Glu Ala Arg Met
    50                  55                  60
```

```
Lys Arg Thr Ser Arg Arg Arg Ile Ala Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Gln Pro Glu Met Asn His Leu Asp Asn Asn
                85                  90                  95

Phe Phe Tyr Arg Leu Asn Glu Ser Phe Leu Val Ala Asp Asp Ala Lys
            100                 105                 110

Tyr Asp Lys His Pro Ile Phe Gly Thr Leu Asp Glu Glu Ile His Phe
        115                 120                 125

His Glu Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Tyr Leu Ala Asp
    130                 135                 140

Gly Asp Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Ile Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly Asn Phe Leu Ile Glu Gly Glu Leu Asn Thr
                165                 170                 175

Glu Asn Asn Ser Val Ile Glu Leu Ser Lys Val Phe Val Gln Leu Tyr
            180                 185                 190

Asn Gln Thr Leu Ser Glu Leu Glu Gly Phe Gln Phe Ile Asp Glu Ser
        195                 200                 205

Ile Asp Phe Ser Glu Val Leu Thr Gln Gln Leu Ser Lys Ser Glu Arg
    210                 215                 220

Ala Asp Asn Val Leu Lys Leu Phe Pro Asp Glu Lys Gly Thr Gly Ile
225                 230                 235                 240

Phe Ala Gln Phe Ile Lys Leu Ile Val Gly Asn Gln Gly Asn Phe Lys
                245                 250                 255
```

```
Lys Val Phe Gln Leu Glu Glu Asp Gln Lys Leu Gln Leu Ser Thr Asp
            260                 265                 270

Asp Tyr Glu Glu Asn Ile Glu Asn Leu Leu Ala Ile Ile Gly Asp Glu
        275                 280                 285

Tyr Gly Asp Ile Phe Val Ala Ala Gln Asn Leu Tyr Gln Ala Ile Leu
    290                 295                 300

Leu Ala Gly Ile Leu Thr Ser Thr Glu Lys Thr Arg Ala Lys Leu Ser
305                 310                 315                 320

Ala Ser Met Ile Gln Arg Tyr Glu Glu His Ala Lys Asp Leu Lys Leu
                325                 330                 335

Leu Lys Arg Phe Val Lys Glu His Ile Pro Asp Lys Tyr Ala Glu Ile
            340                 345                 350

Phe Asn Asp Ala Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Lys
        355                 360                 365

Thr Lys Glu Glu Glu Phe Tyr Lys Tyr Leu Lys Thr Thr Leu Val Gln
    370                 375                 380

Lys Ser Gly Tyr Gln Tyr Phe Ile Glu Lys Ile Glu Gln Glu Asn Phe
385                 390                 395                 400

Leu Arg Lys Gln Arg Ile Tyr Asp Asn Gly Val Ile Pro His Gln Val
                405                 410                 415

His Ala Glu Glu Leu Arg Ala Ile Leu Arg Lys Gln Glu Lys Tyr Tyr
            420                 425                 430

Ser Phe Leu Lys Glu Asn His Glu Lys Ile Glu Gln Ile Phe Lys Val
        435                 440                 445

Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Lys His Asn Glu Gln Ser
    450                 455                 460
```

```
Arg Phe Ala Trp Asn Ile Arg Lys Ser Asp Glu Pro Ile Arg Pro Trp
465                 470                 475                 480

Asn Met Asn Asp Val Val Asp Glu Asn Ala Ser Ala Val Ala Phe Ile
                485                 490                 495

Glu Arg Met Thr Ile Lys Asp Ile Tyr Leu Asn Glu Asn Val Leu Pro
            500                 505                 510

Arg His Ser Leu Ile Tyr Glu Lys Phe Thr Val Phe Asn Glu Leu Thr
        515                 520                 525

Lys Val Leu Tyr Ala Asp Asp Arg Gly Val Phe Gln Arg Phe Ser Ala
    530                 535                 540

Glu Glu Lys Glu Asp Ile Phe Glu Lys Leu Phe Lys Ser Glu Arg Lys
545                 550                 555                 560

Val Thr Lys Lys Lys Leu Glu Asn Tyr Leu Arg Ile Glu Leu Ser Ile
                565                 570                 575

Ser Ser Pro Ser Val Lys Gly Ile Glu Glu Gln Phe Asn Ala Asn Phe
            580                 585                 590

Gly Thr Tyr Leu Asp Leu Lys Lys Phe Asp Glu Leu His Pro Tyr Leu
        595                 600                 605

Asp Asp Glu Lys Tyr Gln Asp Thr Leu Glu Glu Val Ile Lys Val Leu
    610                 615                 620

Thr Val Phe Glu Asp Arg Ser Met Ile Gln Asn Gln Leu Glu Gln Leu
625                 630                 635                 640

Pro Leu Asn Leu Ser Thr Lys Thr Ile Lys Ala Leu Ser Arg Arg Lys
                645                 650                 655
```

```
Tyr Thr Gly Trp Gly Arg Leu Ser Ala Arg Leu Ile Asp Gly Ile His
            660                 665                 670

Asp Lys Asn Ser Gly Lys Thr Ile Leu Asp Tyr Leu Ile Glu Asp Glu
        675                 680                 685

Ser Asp Ser Tyr Ile Val Asn Arg Asn Phe Met Gln Leu Ile Asn Asp
    690                 695                 700

Asp His Leu Ser Phe Lys Lys Ile Ile Glu Asp Ser Gln Pro Tyr Lys
705                 710                 715                 720

Glu Gln Gln Ser Ala Glu Glu Ile Val Ser Glu Leu Ser Gly Ser Pro
                725                 730                 735

Ala Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu
            740                 745                 750

Val Ala Ile Met Gly Tyr Lys Pro Lys Asn Ile Val Val Glu Met Ala
        755                 760                 765

Arg Glu Asn Gln Thr Thr Gly Arg Gly Lys Gln Asn Ser Lys Pro Arg
    770                 775                 780

Leu Lys Gly Ile Glu Asn Gly Leu Lys Glu Phe Ser Asp Ser Val Leu
785                 790                 795                 800

Lys Gly Ser Ser Ile Asp Asn Lys Gln Leu Gln Asn Asp Arg Leu Tyr
                805                 810                 815

Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly His Glu Leu
            820                 825                 830

Asp Ile Asp His Leu Ser Thr Tyr Asp Ile Asp His Ile Ile Pro Gln
        835                 840                 845

Ser Phe Leu Thr Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Thr Ser
    850                 855                 860
```

```
Lys Ser Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val
865                 870                 875                 880


Arg Lys Met Asp Arg Phe Trp Arg Lys Leu Leu Asn Ala Lys Leu Ile
                885                 890                 895


Ser Glu Arg Lys Tyr Thr Asn Leu Thr Lys Lys Glu Leu Thr Glu Ser
            900                 905                 910


Asp Lys Ala Gly Phe Leu Lys Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925


Thr Lys His Val Ala Thr Ile Leu Asp Ser Lys Phe Asn Glu Asp Ser
    930                 935                 940


Asn Asn Arg Asp Val Gln Ile Ile Thr Leu Lys Ser Ala Leu Val Ser
945                 950                 955                 960


Glu Phe Arg Lys Thr Phe Asn Leu Tyr Lys Val Arg Glu Ile Asn Asp
                965                 970                 975


Leu His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Ala Leu Ser
            980                 985                 990


Leu Leu Arg Val Tyr Pro Gln Leu  Lys Pro Glu Phe Val  Tyr Gly Glu
        995                 1000                1005


Tyr Gly  Lys Asn Ser Ile His  Asp Gln Asn Lys Ala  Thr Ile Lys
    1010                1015                1020


Lys Gln  Phe Tyr Ser Asn Ile  Thr Arg Tyr Phe Ala  Ser Lys Asp
    1025                1030                1035


Tyr Ile  Ile Asn Asp Asp Gly  Glu Ile Leu Trp Asn  Lys Gln Glu
    1040                1045                1050
```

```
Thr Ile  Ala Gln Val Ile Lys  Thr Leu Gly Met His  Gln Val Asn
    1055                1060                1065

Val Val  Lys Lys Val Glu Ile  Gln Lys Gly Gly Phe  Ser Lys Glu
    1070                1075                1080

Ser Ile  Gln Pro Lys Gly Glu  Ser Gln Lys Leu Ile  Arg Arg Lys
    1085                1090                1095

Gln Gln  Trp Asn Thr Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Val
    1100                1105                1110

Val Ala  Tyr Ala Ile Leu Leu  Ser Phe Asp Lys Gly  Lys Arg Lys
    1115                1120                1125

Ala Arg  Ser Phe Lys Ile Val  Gly Ile Thr Ile Gln  Asp Arg Glu
    1130                1135                1140

Ser Phe  Glu Gly Asn Pro Ile  Leu Tyr Leu Ser Lys  Lys Asp Tyr
    1145                1150                1155

His Asn  Pro Lys Val Glu Ala  Ile Leu Pro Lys Tyr  Ser Leu Phe
    1160                1165                1170

Glu Phe  Glu Asn Gly Arg Arg  Arg Met Val Ala Ser  Ala Ser Glu
    1175                1180                1185

Thr Gln  Lys Gly Asn Gln Leu  Ile Ile Pro Gly His  Leu Met Glu
    1190                1195                1200

Leu Leu  Tyr His Ser Lys Lys  Ile Ile Asn Gly Lys  Asn Ser Asp
    1205                1210                1215

Ser Val  Ser Tyr Ile Gln Asn  Asn Lys Glu Lys Phe  Arg Glu Ile
    1220                1225                1230

Phe Glu  Tyr Ile Val Asp Phe  Ser Ser Lys Tyr Ile  Ser Ala Asp
    1235                1240                1245
```

```
Ala Asn  Leu Asn Lys Ile Glu  Lys Ile Phe Glu Asn  Asn Phe His
    1250                1255                1260


Lys Ala  Ser Glu Gln Glu Ile  Ala Lys Ser Phe Ile  Asn Leu Leu
    1265                1270                1275


Thr Phe  Thr Ala Met Gly Ala  Pro Ala Asp Phe Glu  Phe Phe Gly
    1280                1285                1290


Glu Lys  Ile Pro Arg Lys Arg  Tyr Val Ser Ile Ser  Glu Ile Ile
    1295                1300                1305


Asp Ala  Val Phe Ile His Gln  Ser Ile Thr Gly Leu  Tyr Glu Thr
    1310                1315                1320


Arg Val  Arg Leu Thr Glu Val
    1325                1330
```

<210> 189
<211> 1123
<212> PRT
<213> Mobiluncus curtisii

<400> 189

```
Met Phe Val Tyr Leu Asn Ser Pro Arg Gly Phe Gly Pro Ala Thr Phe
1               5                   10                  15


Leu Thr Asp Leu Pro His Phe Cys Ile Ile Phe Gly Asn Asn Asp Phe
            20                  25                  30


Met Asp Asn Arg Lys Tyr His Val Gly Ile Asp Val Gly Thr Asn Ser
        35                  40                  45


Val Gly Phe Ala Ala Val Glu Val Gly Asp Ser Gly Ser Pro Ile Arg
    50                  55                  60


Phe Leu Asn Thr Met Val Val Ile His Asp Ser Gly Val Asp Pro Glu
```

```
65                  70                  75                  80

Gln Lys Lys Tyr Ala Ile Thr Arg Leu Ala Ser Ala Gly Thr Ala Arg
                85                  90                  95

Arg Thr Arg Arg Leu Tyr Arg Thr Arg Arg Gln Arg Leu Arg Glu Leu
            100                 105                 110

Asp Asp Phe Ile Ser Asn Glu Leu Gly Tyr Pro Leu Val Asn Leu Glu
        115                 120                 125

Asn Phe Ala Asp Pro Tyr Glu Pro Trp Lys Val Arg Ala Asp Leu Ala
    130                 135                 140

Thr Ile Lys Leu Pro Ala Asp Glu Leu Pro Glu Ala Met Ser Ile Ala
145                 150                 155                 160

Leu Arg His Met Ala Arg His Arg Gly Trp Arg Ser Pro Tyr Gln Arg
                165                 170                 175

Val Glu Ala Leu His Leu His Ala Glu Ile Ser Glu Glu Phe Ser Ala
            180                 185                 190

Leu Lys Lys Arg Val Met Glu Lys Thr Gly Asp Val Phe Ser Asp Asp
        195                 200                 205

Ala Thr Pro Ala Glu Val Leu Val Asp Leu Met Gly Arg Gln Lys Ile
    210                 215                 220

Arg Gly Ala Asp Gly Met Leu Ser Gly Lys Leu Arg Gln Ser Asp Asn
225                 230                 235                 240

Ala Asn Glu Leu Arg Lys Ile Ala Ser Val Gln Gly Ile Asp Asp Glu
                245                 250                 255

Thr Leu Asn Arg Ile Ile Asp Arg Val Phe Phe Ser Arg Ser Pro Lys
            260                 265                 270
```

```
Gly Lys Ala Ser Glu Arg Val Gly Met Asp Ala Leu Pro Gly Gln Gly
        275                 280                 285

Ser Lys Pro Arg Ala Leu Lys Ala Met Pro Ser Phe Gln Lys Phe Arg
    290                 295                 300

Ile Val Ser Val Ile Cys Asn Leu Arg Ile Lys Asp Ser Gly Asp Asp
305                 310                 315                 320

Asn Arg Pro Leu Ser Met Glu Glu Lys Glu Gln Leu Ile Gly Tyr Leu
                325                 330                 335

Met Ser Ser Thr Thr Asp Asp His Val Thr Trp Thr Asp Val Ala Glu
            340                 345                 350

Leu Leu His Val Lys Arg Ser Asn Leu Gln Gly Thr Ala Lys Glu Gly
        355                 360                 365

Pro Asp Gly Glu Arg Pro Tyr Thr Arg Pro Pro Val Asn Ser Ala Trp
    370                 375                 380

Ser Lys Ile Lys Asp Ser Lys Ile Lys Ser Leu Val Ala Leu Trp Lys
385                 390                 395                 400

Thr Gly Asp Val Asp Val Gln Ser Ala Ile Val Glu Ala Leu Ser Asn
                405                 410                 415

Ala Ser Val Leu Glu Asp Ala Arg Pro Gly Ala Asp Ile Val Val Ala
            420                 425                 430

Tyr Leu Glu Ser Leu Asp Asp Lys Glu Leu Glu Ser Leu Asp Lys Val
        435                 440                 445

Gly Leu Pro Ala Gly Arg Ala Ser Tyr Ser Glu Asp Ser Leu Glu Arg
    450                 455                 460

Leu Thr Glu Arg Met Leu Gln Asp Asp Cys Asp Leu Phe Glu Ala Arg
```

```
465                 470                 475                 480

Lys Arg Glu Phe Gly Val Ser Asp Asp Trp Lys Pro Pro Ala Asp Pro
                485                 490                 495

Ile Tyr Ala Pro Val Gly Asn Pro Gly Val Asp Arg Val Leu Lys Ile
            500                 505                 510

Val Asn Arg Leu Leu Met Ala Ala Glu Arg Glu Trp Gly Ala Pro Thr
        515                 520                 525

Gln Ile Asn Ile Glu His Val Arg Ser Gly Phe Ser Ser Glu Leu Met
    530                 535                 540

Gln Arg Glu Phe Glu Arg Glu Asn Glu Arg Arg Arg Ala Gln Asn Glu
545                 550                 555                 560

Glu Ala Val Lys Ala Ile Leu Thr Glu Lys Gly Gly Asn Ser His Val
                565                 570                 575

Ser Lys Tyr Asp Ile Ile Arg Tyr Tyr Ala Val Lys Arg Gln Asn Cys
            580                 585                 590

Gln Cys Leu Tyr Cys Gly Thr Pro Ile Thr Phe Ser Asp Cys Glu Leu
        595                 600                 605

Asp His Ile Val Pro Arg Lys Gly Val Gly Ser Thr Asn Ser Arg Val
    610                 615                 620

Asn Leu Ala Ala Ala Cys Arg Ser Cys Asn Arg Asp Lys Ser Asn Leu
625                 630                 635                 640

Pro Phe Ala Val Trp Ala Gly Lys Thr Ser Asn Phe Asp Val Ser Ile
                645                 650                 655

Asp Gly Ala Val Ser Arg Val Lys Gln Trp Gln Arg Ser Gln Asn Glu
            660                 665                 670
```

```
Gly Ala Arg Glu Phe Arg Ala Phe Gln Asn Glu Val Ile Ser Arg Leu
        675                 680                 685

Leu Lys Thr Thr Glu Asp Pro Glu Ile Asp Ser Arg Ser Leu Glu Ser
    690                 695                 700

Val Ala Trp Met Ala Arg Glu Leu His His Arg Val Glu Tyr Tyr Phe
705                 710                 715                 720

Gln Ser Lys Gly Ala Gln Thr Gln Val Ser Val Tyr Arg Gly Ala Val
                725                 730                 735

Thr Ala Gln Ala Arg Lys Ser Ser Gly Leu Glu Asp Lys Val Lys Met
            740                 745                 750

Ile Gly Gly Gly Gly Lys Thr Arg Leu Asp Arg Arg His His Ala Met
        755                 760                 765

Asp Ala Ala Thr Ile Ala Leu Met Thr Pro Gly Ile Ser Thr Thr Leu
    770                 775                 780

Ser Glu Lys Asn Asn Leu Arg Asp Ala Gln Lys Phe Thr Gly Gln Ser
785                 790                 795                 800

Glu Thr Trp Lys Asp Tyr Cys Gly Arg Thr Glu Thr Ala Arg Glu His
                805                 810                 815

Phe Ala Val Trp Lys Ser Asn Met Glu Arg Leu Thr Asp Leu Phe Asn
            820                 825                 830

Asp Lys Leu Glu Asn Asp Ala Ile Pro Val Val Gln Pro Leu Arg Leu
        835                 840                 845

Arg Leu Ser Asp Ser Lys Ala His Asp Asp Gly Ile Gly Lys Leu Asp
    850                 855                 860

Ser Lys Lys Leu Gly Ser Val Trp Ser Leu Ala Asp Ile Asp Arg Ala
```

```
865                 870                 875                 880

Ala Thr Pro Gln Ile Trp Thr Ala Leu Thr Arg Cys Asp Asp Phe Asp
                885                 890                 895

Pro Thr Lys Gly Leu Pro Glu Asn Ala Asn Arg Val Ile Arg Ala Gln
            900                 905                 910

Gly Val Lys Tyr Glu Ser Glu Asp Asn Ile Pro Val Phe Pro Ser Asn
        915                 920                 925

Val Ala Ala Ile Ala Val Arg Asp Gly Tyr Ala Glu Ile Gly Ser Thr
    930                 935                 940

Ile His His Ala Arg Ile Tyr Arg Ile Asp Asp Gly Lys Lys Ile Phe
945                 950                 955                 960

Tyr Ser Met Ile Arg Val Phe Ala Val Asp Leu Leu Lys His Gln Ala
                965                 970                 975

Glu Asp Leu Phe Thr Val Lys Leu Pro Pro Ser Ala Ile Ser Ile Arg
            980                 985                 990

Thr Cys Glu Asp Ser Leu Arg Arg  Ala Leu Ser Asn Gly  Thr Ala Glu
        995                 1000                1005

Tyr Leu  Gly Trp Leu Val Pro  Gly Asp Glu Ile Ile  Val Asp Thr
    1010                1015                1020

Ser Asp  Lys Ala Phe His Thr  Gly Gln Ile Gly Asp  Leu Leu Arg
    1025                1030                1035

Asn Phe  Pro Val Asn Ser Phe  Arg Leu Thr Gly Phe  Pro Ser Asn
    1040                1045                1050

Ser Arg  Leu Arg Leu Lys Pro  Val Leu Leu Ala Gly  Glu Gly Leu
    1055                1060                1065
```

```
Arg Asp  Asp Ala Glu Asp Ser  Ile Lys Lys Ile Leu  Ser Gly Gln
    1070                1075                1080


Gly Trp  Arg Pro Ala Ile Asn  Val Leu Phe Ser Lys  Gly Lys Pro
    1085                1090                1095


Arg Ile  Val Arg Arg Asn Ser  Leu Gly Ile Glu Arg  Pro Ser Ser
    1100                1105                1110


Asn Asn  Gly Leu Pro Phe Ser  Trp Glu Ala
    1115                1120
```

<210> 190
<211> 1054
<212> PRT
<213> Staphylococcus lugdunensis

<400> 190

```
Met Asn Gln Lys Phe Ile Leu Gly Leu Asp Ile Gly Ile Thr Ser Val
1               5                   10                  15


Gly Tyr Gly Leu Ile Asp Tyr Glu Thr Lys Asn Ile Ile Asp Ala Gly
            20                  25                  30


Val Arg Leu Phe Pro Glu Ala Asn Val Glu Asn Asn Glu Gly Arg Arg
        35                  40                  45


Ser Lys Arg Gly Ser Arg Arg Leu Lys Arg Arg Arg Ile His Arg Leu
    50                  55                  60


Glu Arg Val Lys Lys Leu Leu Glu Asp Tyr Asn Leu Leu Asp Gln Ser
65                  70                  75                  80


Gln Ile Pro Gln Ser Thr Asn Pro Tyr Ala Ile Arg Val Lys Gly Leu
                85                  90                  95


Ser Glu Ala Leu Ser Lys Asp Glu Leu Val Ile Ala Leu Leu His Ile
            100                 105                 110
```

```
Ala Lys Arg Arg Gly Ile His Lys Ile Asp Val Ile Asp Ser Asn Asp
        115                 120                 125

Asp Val Gly Asn Glu Leu Ser Thr Lys Glu Gln Leu Asn Lys Asn Ser
    130                 135                 140

Lys Leu Leu Lys Asp Lys Phe Val Cys Gln Ile Gln Leu Glu Arg Met
145                 150                 155                 160

Asn Glu Gly Gln Val Arg Gly Glu Lys Asn Arg Phe Lys Thr Ala Asp
                165                 170                 175

Ile Ile Lys Glu Ile Ile Gln Leu Leu Asn Val Gln Lys Asn Phe His
            180                 185                 190

Gln Leu Asp Glu Asn Phe Ile Asn Lys Tyr Ile Glu Leu Val Glu Met
        195                 200                 205

Arg Arg Glu Tyr Phe Glu Gly Pro Gly Lys Gly Ser Pro Tyr Gly Trp
    210                 215                 220

Glu Gly Asp Pro Lys Ala Trp Tyr Glu Thr Leu Met Gly His Cys Thr
225                 230                 235                 240

Tyr Phe Pro Asp Glu Leu Arg Ser Val Lys Tyr Ala Tyr Ser Ala Asp
                245                 250                 255

Leu Phe Asn Ala Leu Asn Asp Leu Asn Asn Leu Val Ile Gln Arg Asp
            260                 265                 270

Gly Leu Ser Lys Leu Glu Tyr His Glu Lys Tyr His Ile Ile Glu Asn
        275                 280                 285

Val Phe Lys Gln Lys Lys Lys Pro Thr Leu Lys Gln Ile Ala Asn Glu
    290                 295                 300
```

```
Ile Asn Val Asn Pro Glu Asp Ile Lys Gly Tyr Arg Ile Thr Lys Ser
305                 310                 315                 320

Gly Lys Pro Gln Phe Thr Glu Phe Lys Leu Tyr His Asp Leu Lys Ser
                325                 330                 335

Val Leu Phe Asp Gln Ser Ile Leu Glu Asn Glu Asp Val Leu Asp Gln
            340                 345                 350

Ile Ala Glu Ile Leu Thr Ile Tyr Gln Asp Lys Asp Ser Ile Lys Ser
        355                 360                 365

Lys Leu Thr Glu Leu Asp Ile Leu Leu Asn Glu Glu Asp Lys Glu Asn
    370                 375                 380

Ile Ala Gln Leu Thr Gly Tyr Thr Gly Thr His Arg Leu Ser Leu Lys
385                 390                 395                 400

Cys Ile Arg Leu Val Leu Glu Glu Gln Trp Tyr Ser Ser Arg Asn Gln
                405                 410                 415

Met Glu Ile Phe Thr His Leu Asn Ile Lys Pro Lys Lys Ile Asn Leu
            420                 425                 430

Thr Ala Ala Asn Lys Ile Pro Lys Ala Met Ile Asp Glu Phe Ile Leu
        435                 440                 445

Ser Pro Val Val Lys Arg Thr Phe Gly Gln Ala Ile Asn Leu Ile Asn
    450                 455                 460

Lys Ile Ile Glu Lys Tyr Gly Val Pro Glu Asp Ile Ile Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Asn Asn Ser Lys Asp Lys Gln Lys Phe Ile Asn Glu Met
                485                 490                 495

Gln Lys Lys Asn Glu Asn Thr Arg Lys Arg Ile Asn Glu Ile Ile Gly
            500                 505                 510
```

```
Lys Tyr Gly Asn Gln Asn Ala Lys Arg Leu Val Glu Lys Ile Arg Leu
        515                 520                 525

His Asp Glu Gln Glu Gly Lys Cys Leu Tyr Ser Leu Glu Ser Ile Pro
    530                 535                 540

Leu Glu Asp Leu Leu Asn Asn Pro Asn His Tyr Glu Val Asp His Ile
545                 550                 555                 560

Ile Pro Arg Ser Val Ser Phe Asp Asn Ser Tyr His Asn Lys Val Leu
                565                 570                 575

Val Lys Gln Ser Glu Asn Ser Lys Lys Ser Asn Leu Thr Pro Tyr Gln
            580                 585                 590

Tyr Phe Asn Ser Gly Lys Ser Lys Leu Ser Tyr Asn Gln Phe Lys Gln
        595                 600                 605

His Ile Leu Asn Leu Ser Lys Ser Gln Asp Arg Ile Ser Lys Lys Lys
    610                 615                 620

Lys Glu Tyr Leu Leu Glu Glu Arg Asp Ile Asn Lys Phe Glu Val Gln
625                 630                 635                 640

Lys Glu Phe Ile Asn Arg Asn Leu Val Asp Thr Arg Tyr Ala Thr Arg
                645                 650                 655

Glu Leu Thr Asn Tyr Leu Lys Ala Tyr Phe Ser Ala Asn Asn Met Asn
            660                 665                 670

Val Lys Val Lys Thr Ile Asn Gly Ser Phe Thr Asp Tyr Leu Arg Lys
        675                 680                 685

Val Trp Lys Phe Lys Lys Glu Arg Asn His Gly Tyr Lys His His Ala
    690                 695                 700
```

```
Glu Asp Ala Leu Ile Ile Ala Asn Ala Asp Phe Leu Phe Lys Glu Asn
705                 710                 715                 720

Lys Lys Leu Lys Ala Val Asn Ser Val Leu Glu Lys Pro Glu Ile Glu
                725                 730                 735

Ser Lys Gln Leu Asp Ile Gln Val Asp Ser Glu Asp Asn Tyr Ser Glu
            740                 745                 750

Met Phe Ile Ile Pro Lys Gln Val Gln Asp Ile Lys Asp Phe Arg Asn
        755                 760                 765

Phe Lys Tyr Ser His Arg Val Asp Lys Lys Pro Asn Arg Gln Leu Ile
    770                 775                 780

Asn Asp Thr Leu Tyr Ser Thr Arg Lys Lys Asp Asn Ser Thr Tyr Ile
785                 790                 795                 800

Val Gln Thr Ile Lys Asp Ile Tyr Ala Lys Asp Asn Thr Thr Leu Lys
                805                 810                 815

Lys Gln Phe Asp Lys Ser Pro Glu Lys Phe Leu Met Tyr Gln His Asp
            820                 825                 830

Pro Arg Thr Phe Glu Lys Leu Glu Val Ile Met Lys Gln Tyr Ala Asn
        835                 840                 845

Glu Lys Asn Pro Leu Ala Lys Tyr His Glu Glu Thr Gly Glu Tyr Leu
    850                 855                 860

Thr Lys Tyr Ser Lys Lys Asn Asn Gly Pro Ile Val Lys Ser Leu Lys
865                 870                 875                 880

Tyr Ile Gly Asn Lys Leu Gly Ser His Leu Asp Val Thr His Gln Phe
                885                 890                 895

Lys Ser Ser Thr Lys Lys Leu Val Lys Leu Ser Ile Lys Pro Tyr Arg
            900                 905                 910
```

```
Phe Asp Val Tyr Leu Thr Asp Lys Gly Tyr Lys Phe Ile Thr Ile Ser
        915                 920                 925

Tyr Leu Asp Val Leu Lys Lys Asp Asn Tyr Tyr Tyr Ile Pro Glu Gln
    930                 935                 940

Lys Tyr Asp Lys Leu Lys Leu Gly Lys Ala Ile Asp Lys Asn Ala Lys
945                 950                 955                 960

Phe Ile Ala Ser Phe Tyr Lys Asn Asp Leu Ile Lys Leu Asp Gly Glu
                965                 970                 975

Ile Tyr Lys Ile Ile Gly Val Asn Ser Asp Thr Arg Asn Met Ile Glu
            980                 985                 990

Leu Asp Leu Pro Asp Ile Arg Tyr  Lys Glu Tyr Cys Glu  Leu Asn Asn
        995                 1000                1005

Ile Lys  Gly Glu Pro Arg Ile  Lys Lys Thr Ile Gly  Lys Lys Val
    1010                1015                1020

Asn Ser  Ile Glu Lys Leu Thr  Thr Asp Val Leu Gly  Asn Val Phe
    1025                1030                1035

Thr Asn  Thr Gln Tyr Thr Lys  Pro Gln Leu Leu Phe  Lys Arg Gly
    1040                1045                1050

Asn
```

<210> 191
<211> 586
<212> PRT
<213> Pseudoramibacter alactolyticus

<400> 191

```
Met Thr Tyr Tyr Leu Gly Leu Asp Met Gly Thr Gly Ser Val Gly Trp
```

```
1               5                   10                  15

Ala Ala Thr Asp Lys Asn Tyr Lys Leu Ile Arg Ala Lys Gly Lys Asp
            20                  25                  30

Leu Trp Gly Val Arg Leu Phe Gln Thr Ala Lys Thr Ala Ala Glu Arg
        35                  40                  45

Arg Ser His Arg Val Ala Arg Leu Arg Arg Gln Arg Glu Lys Val Arg
    50                  55                  60

Ile Gly Tyr Leu Lys Thr Ile Phe Ser Asp Ala Ile Asn Lys Val Asp
65                  70                  75                  80

Pro Gly Phe Phe Gln Arg Leu Asp Asp Ser Phe Phe Tyr Ala Glu Asp
                85                  90                  95

Lys Asn Ile Asn Gln Pro Tyr Ala Leu Phe Ala Asp Thr Gly Tyr Thr
            100                 105                 110

Asp Val Asp Tyr Tyr Arg Asp Tyr Pro Thr Ile Phe His Leu Arg Ser
        115                 120                 125

Thr Leu Ile His Asp Thr Ser Pro Lys Asp Val Arg Leu Val Tyr Leu
    130                 135                 140

Ala Val Leu Asn Met Phe Lys His Arg Gly His Phe Leu Ala Ser Asn
145                 150                 155                 160

Leu Ser Glu Asn Gly Val Asp Asp Phe Gly Asp Ile Tyr Gln Gln Trp
                165                 170                 175

Cys Lys Ser Val Pro Lys Pro Val Gln Ile Ser Asp Pro Glu Ala Lys
            180                 185                 190

Thr Glu Lys Ile Glu Asn Ile Leu Ser Lys Ala Gly Ile Ser Asn Thr
        195                 200                 205
```

```
Arg Arg Leu Glu Ala Leu Leu Glu Val Phe Gly Ile Lys Arg Arg Asp
    210                 215                 220

Ala Phe Ala Glu Val Leu Lys Leu Trp Cys Gly Leu Lys Gly Asn Leu
225                 230                 235                 240

Ser Lys Ile Trp Ser Glu Thr Asp Phe Ser Asp Leu Asp Asn Thr Lys
                245                 250                 255

Pro Ala Leu Ser Phe Lys Asp Ser Asn Leu Asp Met Val Leu Ser Gln
            260                 265                 270

Leu Glu Glu Ile Leu Pro Asp Glu Asp Tyr Ser Trp Leu Met Leu Thr
        275                 280                 285

Lys Gln Ile Tyr Asp Trp Ser Leu Leu Ser Gly Met Met Lys Asp Ala
    290                 295                 300

Ser Gly Lys Ser Tyr Asp Tyr Leu Ser Asp Ala Arg Val Ala Ser Tyr
305                 310                 315                 320

Gln Lys His Ser Glu Asp Leu Lys Thr Leu Lys Arg Phe Tyr His Asp
                325                 330                 335

Asn His Leu Ser Ala Ala Tyr Asp Gln Met Phe Arg Val Met Gly Lys
            340                 345                 350

Asp Asn Tyr Ser Ala Tyr Ala Gly Ser Val Gln Ser Lys Lys Glu Val
        355                 360                 365

Val Arg Arg Gly Ala Ser Cys Gly Ile Glu Glu Leu Tyr Lys Arg Ile
    370                 375                 380

Lys Lys Asp Leu Lys Pro Val Pro Asp Cys Glu Thr Lys Gln Ile Ile
385                 390                 395                 400

Leu Glu Asn Ile Glu Arg Gly Thr Phe Leu Pro Lys Gln Leu Thr Arg
```

```
                405                 410                 415

Asp Asn Gly Val Ile Pro Asn Gln Ile His Val His Glu Leu Lys Ala
            420                 425                 430

Ile Leu Lys Asn Ala Glu Asn Tyr Leu Pro Phe Leu Lys Glu Gly Ser
        435                 440                 445

Glu Leu Thr Asn Ser Glu Lys Ile Leu Gln Leu Phe Gln Phe Gln Ile
    450                 455                 460

Pro Tyr Tyr Val Gly Pro Leu Tyr Ser Asp Glu Asn Asn Tyr Ala Trp
465                 470                 475                 480

Val Val Arg Lys Glu Gly Gly Arg Val Phe Pro Trp Asn Phe Ala Glu
                485                 490                 495

Lys Val Asp Glu Lys Ala Ser Ala Glu Gly Phe Ile Ser Glu Leu Val
            500                 505                 510

Ala Arg Cys Thr Tyr Leu Asp Asn Glu Lys Val Leu Pro Lys Ala Ser
        515                 520                 525

Leu Leu Tyr Glu Lys Phe Met Val Leu Asn Glu Leu Asn Asn Leu Arg
    530                 535                 540

Ile Asn Gly Glu Arg Ile Ser Val Asp Ile Lys Gln Glu Leu Tyr Gln
545                 550                 555                 560

Asn Leu Phe Thr Arg Gly Lys Lys Val Thr Leu Lys Lys Ser Glu Gly
                565                 570                 575

Leu Phe Gly Gly Gln Arg Ile Phe Cys Leu
            580                 585
```

<210> 192
<211> 1385
<212> PRT

<213> Gemella morbillorum

<400> 192

```
Met Lys Asn Lys Thr Trp Tyr Leu Gly Leu Gly Val Gly Pro Thr Ser
1               5                  10                  15


Ile Gly Trp Ala Ala Thr Asp Ser Asn Tyr Lys Leu Leu Arg Lys Asn
            20                  25                  30


Lys Lys Arg Leu Trp Gly Val Arg Leu Phe Glu Glu Ala Lys Thr Ala
        35                  40                  45


Val Asp Arg Arg Thr Phe Arg Ala Glu Arg Arg Arg Leu Ala Arg Arg
    50                  55                  60


Lys Trp Arg Ile Ser Leu Leu Glu Glu Leu Phe Ala Lys Glu Val Ser
65                  70                  75                  80


Lys Asn Asp Pro Asn Phe Phe Leu Arg Leu Lys Glu Ser Lys Tyr His
                85                  90                  95


Phe Glu Asp Lys Ser Leu Met Asn Glu Tyr Ile Leu Phe Asn Asp Lys
            100                 105                 110


Asp Tyr Thr Asp Lys Asp Tyr Tyr Lys Glu Tyr Pro Thr Ile Tyr His
        115                 120                 125


Leu Arg Leu Ser Leu Thr Thr Glu Glu Asn Pro Asp Ile Arg Lys Val
    130                 135                 140


Tyr Leu Ala Val His Ser Met Leu Lys Asn Arg Gly His Phe Leu Leu
145                 150                 155                 160


Gln Gly Gln Ser Phe Asn Asp Ser Asn Ile Asp Ser Val Ile Lys Glu
                165                 170                 175


Leu Leu Glu Leu Glu Thr Val Lys Ile Asn Phe Glu Val Thr Asp Glu
            180                 185                 190
```

```
Val Ile His Ser Leu Lys Lys Ile Ala Leu Glu Lys Lys Asn Leu Ser
        195                 200                 205

Asp Lys Asn Asn Asp Val Lys Lys Leu Tyr Pro Lys Glu Lys Gln Leu
    210                 215                 220

Gln Glu Ile Phe Lys Leu Val Phe Gly Gly Lys Thr Ser Leu Asp Lys
225                 230                 235                 240

Leu Tyr Asp Ile Glu Glu Tyr Lys Glu Leu Asp Asn Ser Val Lys Ser
                245                 250                 255

Ile Ser Phe Lys Glu Lys Val Tyr Glu Glu Val Arg Pro Asp Tyr Glu
            260                 265                 270

Gln Ile Leu Ser Asn Tyr Ile Glu Leu Leu Asp Leu Ala Lys Leu Val
        275                 280                 285

Tyr Asp Ser Ile Val Leu Ala Asp Ile Lys Lys Glu Gly Lys Thr Ile
    290                 295                 300

Ser Glu Ser Lys Val Glu Leu Tyr Asn Lys His Lys Asp Asp Leu Ala
305                 310                 315                 320

Asn Leu Lys Lys Leu Val Lys Ile Asp Ser Lys Leu Ser Glu Asp Lys
                325                 330                 335

Lys Lys Glu Val Tyr Phe Thr Ile Phe Lys Glu Asp Lys Glu Lys Gly
            340                 345                 350

Thr Asn Tyr Val Asn Tyr Thr His Arg Ser Gln Glu Gly Lys Ser Cys
        355                 360                 365

Ser Tyr Glu Asp Phe Lys Lys Phe Leu Lys Lys Glu Leu Glu Lys Leu
    370                 375                 380
```

```
Glu Asp Ser Pro Thr Lys Thr Thr Ile Leu Glu Glu Leu Asp Leu Glu
385                 390                 395                 400

Thr Phe Leu Pro Leu Gln Arg Thr Lys Asp Asn Ser Val Val Pro Tyr
                405                 410                 415

Gln Ile His Lys Glu Glu Leu Val Lys Ile Leu Asp Asn Ala Ala Lys
            420                 425                 430

Tyr His Ser Phe Leu Ala Glu Lys Asp Asp Ser Gly Tyr Ser Thr Arg
        435                 440                 445

Glu Lys Val Val Gln Leu Phe Glu Phe Arg Ile Pro Tyr Tyr Ile Gly
    450                 455                 460

Pro Leu Asn Ala His His Asn Thr Glu Asn Gly Gly Tyr Ser Trp Ala
465                 470                 475                 480

Ile Arg Lys Lys Gly Met Glu Ser Val Pro Val Thr Pro Trp Asn Phe
                485                 490                 495

Lys Asp Val Ile Asp Glu Ser Ala Ser Ala Glu Ala Phe Val Asn Asn
            500                 505                 510

Leu Lys Asn Lys Cys Ala Tyr Leu Ser Gly Glu Asp Val Leu Pro Lys
        515                 520                 525

Asn Ser Leu Leu Tyr Ser Glu Tyr Ala Leu Leu Asn Glu Leu Asn Ala
    530                 535                 540

Leu Arg Tyr Glu Gly Asn Arg Ile Ser Val Glu Ala Arg Asp Val Ile
545                 550                 555                 560

Val Thr Lys Leu Phe Lys Glu Gln Gly Lys Lys Val Thr Lys Lys Thr
                565                 570                 575

Ile Lys Glu Leu Leu Lys Thr Glu Gly Phe Ile Asp Gly Lys Gly Glu
            580                 585                 590
```

```
Ile Val Gly Ile Asp Asn Ile Val Lys Asn Asp Leu Lys Ser Tyr Arg
        595                 600                 605

Asp Phe Lys Lys Ile Leu Ala Asp Lys Phe Asp Lys Glu Arg Val Glu
    610                 615                 620

Asn Ile Ile Leu Trp Ile Thr Leu Tyr Gly Glu Ser Arg Lys Leu Ile
625                 630                 635                 640

Lys Glu Lys Ile Thr Lys Val Tyr Gly Asp Phe Tyr Thr Val Asp Glu
                645                 650                 655

Ile Glu Lys Met Ser Arg Leu Thr Tyr Lys Asp Trp Gly Ile Leu Ser
            660                 665                 670

Arg Lys Leu Leu Thr Glu Leu Val Ser Glu Lys Leu Tyr Asn Glu Glu
        675                 680                 685

Thr Gly Glu Cys Leu Asn Ile Ile Gly Ala Met Arg Gln Gly Thr Ile
    690                 695                 700

Leu Phe Met Glu Leu Leu Ala Asp Lys Phe Asp Tyr Met Ser Gln Ile
705                 710                 715                 720

Lys Asn His Asn Lys Glu Asn Lys Asp Asp Ile Thr Glu Ile Thr Pro
                725                 730                 735

Asp Ile Leu Glu Asn Leu His Ala Ser Pro Ala Val Lys Arg Ser Ile
            740                 745                 750

Trp Gln Thr Val Arg Ile Val Glu Glu Leu Lys Thr Ile Ile Gly Cys
        755                 760                 765

Val Pro Thr Lys Ile Phe Ile Glu Thr Thr Lys Arg Asn Asn Ala Pro
    770                 775                 780
```

```
Tyr Lys Val Pro Thr Leu Asn Arg Asn Asp Leu Val Thr Lys Tyr Lys
785                 790                 795                 800

Thr Ile Arg Glu His Glu Ile Phe Glu Leu Glu Lys Glu Leu Lys Asn
                805                 810                 815

Thr Leu Asp Phe Thr Leu Asn Lys Asn Arg Leu Ile Asn Glu Glu Pro
            820                 825                 830

Ser Lys Leu Lys Ala Thr Lys Leu Tyr Leu Tyr Tyr Thr Gln Leu Gly
        835                 840                 845

Arg Cys Met Tyr Thr Gly Lys Lys Ile Asp Leu Gly Glu Leu Phe Asp
    850                 855                 860

Asn Asn Asn Lys Tyr Asp Ile Asp His Ile Tyr Pro Gln Ser Lys Val
865                 870                 875                 880

Lys Asp Gly Ser Phe Asn Asn Ile Val Leu Val Thr Lys Ala Ser Asn
                885                 890                 895

Asp Met Lys Ala Asp Val Phe Pro Leu Lys Ser Lys Phe Gln Thr Lys
            900                 905                 910

Glu Asn Lys Ile Phe Trp Arg Phe Leu Lys Glu Lys Lys Leu Ile Thr
        915                 920                 925

Glu Glu Lys Tyr Asn Arg Leu Val Arg Thr Glu Glu Phe Ser Asn Gly
    930                 935                 940

Glu Leu Thr Gly Phe Ile Thr Arg Gln Leu Val Glu Thr Ser Gln Ala
945                 950                 955                 960

Ile Lys Val Ile Ser Asn Val Leu Arg Glu Leu Asn Pro Glu Thr Thr
                965                 970                 975

Ile Cys Tyr Ser Lys Ala Glu Asn Val Ser Ser Phe Arg Gln Ser Phe
            980                 985                 990
```

```
Gly Lys Ile Lys Glu Ala Asn Arg  Lys Ala Glu Asn Asn  Glu Lys Leu
        995                 1000                1005


Ile Arg  Val Gln Glu Ile Asn  Asp Tyr Tyr Asn Ala  Lys Asp Ala
    1010                1015                1020


Tyr Leu  Ser Ile Val Val Gly  Asn Val Tyr Asp Val  Lys Phe Thr
    1025                1030                1035


Arg Asn  Val His Asn Phe Ile  Lys Asn Asn Lys Asp  Ala Arg Arg
    1040                1045                1050


Tyr Ser  Leu Asn Gly Leu Phe  Tyr Thr Asp Val Lys  Asn Ala Asn
    1055                1060                1065


Thr Ile  Ala Trp Glu Met Asp  Lys Thr Val His Val  Val Glu Lys
    1070                1075                1080


Thr Met  Asn Asn Asn Asn Ile  Leu Ile Thr Arg Arg  Thr Ser Glu
    1085                1090                1095


Gln Lys  Gly Ala Leu Tyr Asp  Ala Thr Leu Tyr Lys  Ala Lys Val
    1100                1105                1110


Ala Glu  Lys Ala Lys Glu Gly  Thr Tyr Tyr Pro Leu  Lys Thr Thr
    1115                1120                1125


Asp Ser  Lys Ile Lys Asp Val  Gly Lys Tyr Gly Gly  Phe Thr Lys
    1130                1135                1140


Ile Lys  Ile Ala Tyr Tyr Ser  Ile Phe Glu Tyr Thr  Leu Asp Gly
    1145                1150                1155


Lys Lys  Gly Lys Gln Lys Ile  Thr Arg Ile Val Pro  Ile Pro Ile
    1160                1165                1170
```

```
Tyr Ile  Ser Gln Asn Ile Lys  Asp Asp Lys Ala Leu  Leu Glu Tyr
    1175                1180                1185

Ala Gln  Thr Arg Leu Pro Gly  Lys Asp Leu Lys Ile  Lys Tyr Arg
    1190                1195                1200

Lys Leu  Cys Ile Gly Ser Leu  Val Lys Ile Asn Asn  Phe Asn Tyr
    1205                1210                1215

Tyr Ile  Gly Gly Lys Thr Asn  Asn Asn Phe Thr Phe  Asp Ser Ala
    1220                1225                1230

Val Gln  Val Ile Leu Asp Lys  Asp Ser Glu Ser Tyr  Ile Lys Glu
    1235                1240                1245

Leu Ala  Lys Tyr Leu Asn Trp  Lys Lys Glu Asn Lys  Asp Gly Lys
    1250                1255                1260

Leu Trp  Glu Ser Ile Thr Glu  Asp Lys Asn Ile Gln  Leu Tyr Asp
    1265                1270                1275

Ser Leu  Val Lys Lys Met Asn  Thr Gly Ile Phe Ile  Arg Lys Thr
    1280                1285                1290

Pro Asn  Lys Tyr Thr Glu Leu  Leu Thr Leu Glu Val  Lys Asn Lys
    1295                1300                1305

Phe Ile  Asn Ile Asp Ile Asp  Glu Gln Val Lys Leu  Leu Leu Glu
    1310                1315                1320

Ile Leu  Asn Leu Leu Thr Asn  Lys Lys Phe Thr Ser  Lys Leu Asn
    1325                1330                1335

Glu Ile  Gly Ile Thr Ala Ser  Arg Gly Val Cys Ser  Phe Asn Leu
    1340                1345                1350

Ser Asn  Gln Ser Gln Phe Ser  Ile Ile Glu Gln Ser  Val Thr Gly
    1355                1360                1365
```

Val Tyr Glu Lys Glu Lys Leu Ile Ile Glu Lys Lys Lys Glu Gly
    1370   1375   1380

Ile Leu
    1385

<210> 193
<211> 1029
<212> PRT
<213> Alicycliphilus denitrificans

<400> 193

Met Arg Ser Leu Arg Tyr Arg Leu Ala Leu Asp Leu Gly Ser Thr Ser
1   5   10   15

Leu Gly Trp Ala Leu Phe Arg Leu Asp Ala Cys Asn Arg Pro Thr Ala
            20   25   30

Val Ile Lys Ala Gly Val Arg Ile Phe Ser Asp Gly Arg Asn Pro Lys
        35   40   45

Asp Gly Ser Ser Leu Ala Val Thr Arg Arg Ala Ala Arg Ala Met Arg
    50   55   60

Arg Arg Arg Asp Arg Leu Leu Lys Arg Lys Thr Arg Met Gln Ala Lys
65   70   75   80

Leu Val Glu His Gly Phe Phe Pro Ala Asp Ala Gly Lys Arg Lys Ala
                85   90   95

Leu Glu Gln Leu Asn Pro Tyr Ala Leu Arg Ala Lys Gly Leu Gln Glu
            100   105   110

Ala Leu Leu Pro Gly Glu Phe Ala Arg Ala Leu Phe His Ile Asn Gln
        115   120   125

Arg Arg Gly Phe Lys Ser Asn Arg Lys Thr Asp Lys Lys Asp Asn Asp

```
    130                 135                 140

Ser Gly Val Leu Lys Lys Ala Ile Gly Gln Leu Arg Gln Gln Met Ala
145                 150                 155                 160

Glu Gln Gly Ser Arg Thr Val Gly Glu Tyr Leu Trp Thr Arg Leu Gln
                165                 170                 175

Gln Gly Gln Gly Val Arg Ala Arg Tyr Arg Glu Lys Pro Tyr Thr Thr
            180                 185                 190

Glu Glu Gly Lys Lys Arg Ile Asp Lys Ser Tyr Asp Leu Tyr Ile Asp
        195                 200                 205

Arg Ala Met Ile Glu Gln Glu Phe Asp Ala Leu Trp Ala Ala Gln Ala
    210                 215                 220

Ala Phe Asn Pro Thr Leu Phe His Glu Ala Ala Arg Ala Asp Leu Lys
225                 230                 235                 240

Asp Thr Leu Leu His Gln Arg Pro Leu Arg Pro Val Lys Pro Gly Arg
                245                 250                 255

Cys Thr Leu Leu Pro Glu Glu Glu Arg Ala Pro Leu Ala Leu Pro Ser
            260                 265                 270

Thr Gln Arg Phe Arg Ile His Gln Glu Val Asn His Leu Arg Leu Leu
        275                 280                 285

Asp Glu Asn Leu Arg Glu Val Ala Leu Thr Leu Ala Gln Arg Asp Ala
    290                 295                 300

Val Val Thr Ala Leu Glu Thr Lys Ala Lys Leu Ser Phe Glu Gln Ile
305                 310                 315                 320

Arg Lys Leu Leu Lys Leu Ser Gly Ser Val Gln Phe Asn Leu Glu Asp
                325                 330                 335
```

```
Ala Lys Arg Thr Glu Leu Lys Gly Asn Ala Thr Ser Ala Ala Leu Ala
            340                 345                 350

Arg Lys Glu Leu Phe Gly Ala Ala Trp Ser Gly Phe Asp Glu Ala Leu
        355                 360                 365

Gln Asp Glu Ile Val Trp Gln Leu Val Thr Glu Glu Gly Glu Gly Ala
    370                 375                 380

Leu Ile Ala Trp Leu Gln Thr His Thr Gly Val Asp Glu Ala Arg Ala
385                 390                 395                 400

Gln Ala Ile Val Asp Val Ser Leu Pro Glu Gly Tyr Gly Asn Leu Ser
                405                 410                 415

Arg Lys Ala Leu Ala Arg Ile Val Pro Ala Leu Arg Ala Ala Val Ile
            420                 425                 430

Thr Tyr Asp Lys Ala Val Gln Ala Ala Gly Phe Asp His His Ser Gln
        435                 440                 445

Leu Gly Phe Glu Tyr Asp Ala Ser Glu Val Glu Asp Leu Val His Pro
    450                 455                 460

Glu Thr Gly Glu Ile Arg Ser Val Phe Lys Gln Leu Pro Tyr Tyr Gly
465                 470                 475                 480

Lys Ala Leu Gln Arg His Val Ala Phe Gly Ser Gly Lys Pro Glu Asp
                485                 490                 495

Pro Asp Glu Lys Arg Tyr Gly Lys Ile Ala Asn Pro Thr Val His Ile
            500                 505                 510

Gly Leu Asn Gln Val Arg Met Val Val Asn Ala Leu Ile Arg Arg Tyr
        515                 520                 525

Gly Arg Pro Thr Glu Val Val Ile Glu Leu Ala Arg Asp Leu Lys Gln
```

```
    530                 535                 540

Ser Arg Glu Gln Lys Val Glu Ala Gln Arg Arg Gln Ala Asp Asn Gln
545                 550                 555                 560

Arg Arg Asn Ala Arg Ile Arg Arg Ser Ile Ala Glu Val Leu Gly Ile
                565                 570                 575

Gly Glu Glu Arg Val Arg Gly Ser Asp Ile Gln Lys Trp Ile Cys Trp
            580                 585                 590

Glu Glu Leu Ser Phe Asp Ala Ala Asp Arg Arg Cys Pro Tyr Ser Gly
        595                 600                 605

Val Gln Ile Ser Ala Ala Met Leu Leu Ser Asp Glu Val Glu Val Glu
    610                 615                 620

His Ile Leu Pro Phe Ser Lys Thr Leu Asp Asp Ser Leu Asn Asn Arg
625                 630                 635                 640

Thr Val Ala Met Arg Gln Ala Asn Arg Ile Lys Arg Asn Arg Thr Pro
                645                 650                 655

Trp Asp Ala Arg Ala Glu Phe Glu Ala Gln Gly Trp Ser Tyr Glu Asp
            660                 665                 670

Ile Leu Gln Arg Ala Glu Arg Met Pro Leu Arg Lys Arg Tyr Arg Phe
        675                 680                 685

Ala Pro Asp Gly Tyr Glu Arg Trp Leu Gly Asp Asp Lys Asp Phe Leu
    690                 695                 700

Ala Arg Ala Leu Asn Asp Thr Arg Tyr Leu Ser Arg Val Ala Ala Glu
705                 710                 715                 720

Tyr Leu Arg Leu Val Cys Pro Gly Thr Arg Val Ile Pro Gly Gln Leu
                725                 730                 735
```

```
Thr Ala Leu Leu Arg Gly Lys Phe Gly Leu Asn Asp Val Leu Gly Leu
            740                 745                 750

Asp Gly Glu Lys Asn Arg Asn Asp His Arg His His Ala Val Asp Ala
        755                 760                 765

Cys Val Ile Gly Val Thr Asp Gln Gly Leu Met Gln Arg Phe Ala Thr
    770                 775                 780

Ala Ser Ala Gln Ala Arg Gly Asp Gly Leu Thr Arg Leu Val Asp Gly
785                 790                 795                 800

Met Pro Met Pro Trp Pro Thr Tyr Arg Asp His Val Glu Arg Ala Val
                805                 810                 815

Arg His Ile Trp Val Ser His Arg Pro Asp His Gly Phe Glu Gly Ala
            820                 825                 830

Met Met Glu Glu Thr Ser Tyr Gly Ile Arg Lys Asp Gly Ser Ile Lys
        835                 840                 845

Gln Arg Arg Lys Ala Asp Gly Ser Ala Gly Arg Glu Ile Ser Asn Leu
    850                 855                 860

Ile Arg Ile His Glu Ala Thr Gln Pro Leu Arg His Gly Val Ser Ala
865                 870                 875                 880

Asp Gly Gln Pro Leu Ala Tyr Lys Gly Tyr Val Gly Gly Ser Asn Tyr
                885                 890                 895

Cys Ile Glu Ile Thr Val Asn Asp Lys Gly Lys Trp Glu Gly Glu Val
            900                 905                 910

Ile Ser Thr Phe Arg Ala Tyr Gly Val Val Arg Ala Gly Gly Met Gly
        915                 920                 925

Arg Leu Arg Asn Pro His Glu Gly Gln Asn Gly Arg Lys Leu Ile Met
```

```
    930                 935                 940

Arg Leu Val Ile Gly Asp Ser Val Arg Leu Glu Val Asp Gly Ala Glu
945                 950                 955                 960

Arg Thr Met Arg Ile Val Lys Ile Ser Gly Ser Asn Gly Gln Ile Phe
                965                 970                 975

Met Ala Pro Ile His Glu Ala Asn Val Asp Ala Arg Asn Thr Asp Lys
            980                 985                 990

Gln Asp Ala Phe Thr Tyr Thr Ser  Lys Tyr Ala Gly Ser  Leu Gln Lys
        995                 1000                1005

Ala Lys  Thr Arg Arg Val Thr  Ile Ser Pro Ile Gly  Glu Val Arg
    1010                1015                1020

Asp Pro  Gly Phe Lys Gly
    1025


<210>  194
<211>  1422
<212>  PRT
<213>  Sutterella wadsworthensis

<400>  194

Met Thr Gln Ser Glu Arg Arg Phe Ser Cys Ser Ile Gly Ile Asp Met
1               5                   10                  15

Gly Ala Lys Tyr Thr Gly Val Phe Tyr Ala Leu Phe Asp Arg Glu Glu
            20                  25                  30

Leu Pro Thr Asn Leu Asn Ser Lys Ala Met Thr Leu Val Met Pro Glu
        35                  40                  45

Thr Gly Pro Arg Tyr Val Gln Ala Gln Arg Thr Ala Val Arg His Arg
    50                  55                  60
```

```
Leu Arg Gly Gln Lys Arg Tyr Thr Leu Ala Arg Lys Leu Ala Phe Leu
65                  70                  75                  80

Val Val Asp Asp Met Ile Lys Lys Gln Glu Lys Arg Leu Thr Asp Glu
                85                  90                  95

Glu Trp Lys Arg Gly Arg Glu Ala Leu Ser Gly Leu Leu Lys Arg Arg
            100                 105                 110

Gly Tyr Ser Arg Pro Asn Ala Asp Gly Glu Asp Leu Thr Pro Leu Glu
        115                 120                 125

Asn Val Arg Ala Asp Val Phe Ala Ala His Pro Ala Phe Ser Thr Tyr
    130                 135                 140

Phe Ser Glu Val Arg Ser Leu Ala Glu Gln Trp Glu Glu Phe Thr Ala
145                 150                 155                 160

Asn Ile Ser Asn Val Glu Lys Phe Leu Gly Asp Pro Asn Ile Pro Ala
                165                 170                 175

Asp Lys Glu Phe Ile Glu Phe Ala Val Ala Glu Gly Leu Ile Asp Lys
            180                 185                 190

Thr Glu Lys Lys Ala Tyr Gln Ser Ala Leu Ser Thr Leu Arg Ala Asn
        195                 200                 205

Ala Asn Val Leu Thr Gly Leu Arg Gln Met Gly His Lys Pro Arg Ser
    210                 215                 220

Glu Tyr Phe Lys Ala Ile Glu Ala Asp Leu Lys Lys Asp Ser Arg Leu
225                 230                 235                 240

Ala Lys Ile Asn Glu Ala Phe Gly Gly Ala Glu Arg Leu Ala Arg Leu
                245                 250                 255

Leu Gly Asn Leu Ser Asn Leu Gln Leu Arg Ala Glu Arg Trp Tyr Phe
            260                 265                 270
```

```
Asn Ala Pro Asp Ile Met Lys Asp Arg Gly Trp Glu Pro Asp Arg Phe
        275                 280                 285

Lys Lys Thr Leu Val Arg Ala Phe Lys Phe Phe His Pro Ala Lys Asp
    290                 295                 300

Gln Asn Lys Gln His Leu Glu Leu Ile Lys Gln Ile Glu Asn Ser Glu
305                 310                 315                 320

Asp Ile Ile Glu Thr Leu Cys Thr Leu Asp Pro Asn Arg Thr Ile Pro
                325                 330                 335

Pro Tyr Glu Asp Gln Asn Asn Arg Arg Pro Pro Leu Asp Gln Thr Leu
            340                 345                 350

Leu Leu Ser Pro Glu Lys Leu Thr Arg Gln Tyr Gly Glu Ile Trp Lys
        355                 360                 365

Thr Trp Ser Ala Arg Leu Thr Ser Ala Glu Pro Thr Leu Ala Pro Ala
    370                 375                 380

Ala Glu Ile Leu Glu Arg Ser Thr Asp Arg Lys Ser Arg Val Ala Val
385                 390                 395                 400

Asn Gly His Glu Pro Leu Pro Thr Leu Ala Tyr Gln Leu Ser Tyr Ala
                405                 410                 415

Leu Gln Arg Ala Phe Asp Arg Ser Lys Ala Leu Asp Pro Tyr Ala Leu
            420                 425                 430

Arg Ala Leu Ala Ala Gly Ser Lys Ser Asn Lys Leu Thr Ser Ala Arg
        435                 440                 445

Thr Ala Leu Glu Asn Cys Ile Gly Gly Gln Asn Val Lys Thr Phe Leu
    450                 455                 460
```

```
Asp Cys Ala Arg Arg Tyr Tyr Arg Glu Ala Asp Asp Ala Lys Val Gly
465                 470                 475                 480

Leu Trp Phe Asp Asn Ala Asp Gly Leu Leu Glu Arg Ser Asp Leu His
                485                 490                 495

Pro Pro Met Lys Lys Lys Ile Leu Pro Leu Leu Val Ala Asn Ile Leu
            500                 505                 510

Gln Thr Asp Glu Thr Thr Gly Gln Lys Phe Leu Asp Glu Ile Trp Arg
        515                 520                 525

Lys Gln Ile Lys Gly Arg Glu Thr Val Ala Ser Arg Cys Ala Arg Ile
    530                 535                 540

Glu Thr Val Arg Lys Ser Phe Gly Gly Gly Phe Asn Ile Ala Tyr Asn
545                 550                 555                 560

Thr Ala Gln Tyr Arg Glu Val Asn Lys Leu Pro Arg Asn Ala Gln Asp
                565                 570                 575

Lys Glu Leu Leu Thr Ile Arg Asp Arg Val Ala Glu Thr Ala Asp Phe
            580                 585                 590

Ile Ala Ala Asn Leu Gly Leu Ser Asp Glu Gln Lys Arg Lys Phe Ala
        595                 600                 605

Asn Pro Phe Ser Leu Ala Gln Phe Tyr Thr Leu Ile Glu Thr Glu Val
    610                 615                 620

Ser Gly Phe Ser Ala Thr Thr Leu Ala Val His Leu Glu Asn Ala Trp
625                 630                 635                 640

Arg Met Thr Ile Lys Asp Ala Val Ile Asn Gly Glu Thr Val Arg Ala
                645                 650                 655

Ala Gln Cys Ser Arg Leu Pro Ala Glu Thr Ala Arg Pro Phe Asp Gly
            660                 665                 670
```

```
Leu Val Arg Arg Leu Val Asp Arg Gln Ala Trp Glu Ile Ala Lys Arg
        675                 680                 685

Val Ser Thr Asp Ile Gln Ser Lys Val Asp Phe Ser Asn Gly Ile Val
    690                 695                 700

Asp Val Ser Ile Phe Val Glu Glu Asn Lys Phe Glu Phe Ser Ala Ser
705                 710                 715                 720

Val Ala Asp Leu Lys Lys Asn Lys Arg Val Lys Asp Lys Met Leu Ser
                725                 730                 735

Glu Ala Glu Lys Leu Glu Thr Arg Trp Leu Ile Lys Asn Glu Arg Ile
            740                 745                 750

Lys Lys Ala Ser Arg Gly Thr Cys Pro Tyr Thr Gly Asp Arg Leu Ala
        755                 760                 765

Glu Gly Gly Glu Ile Asp His Ile Leu Pro Arg Ser Leu Ile Lys Asp
    770                 775                 780

Ala Arg Gly Ile Val Phe Asn Ala Glu Pro Asn Leu Ile Tyr Ala Ser
785                 790                 795                 800

Ser Arg Gly Asn Gln Leu Lys Lys Asn Gln Arg Tyr Ser Leu Ser Asp
                805                 810                 815

Leu Lys Ala Asn Tyr Arg Asn Glu Ile Phe Lys Thr Ser Asn Ile Ala
            820                 825                 830

Ala Ile Thr Ala Glu Ile Glu Asp Val Val Thr Lys Leu Gln Gln Thr
        835                 840                 845

His Arg Leu Lys Phe Phe Asp Leu Leu Asn Glu His Glu Gln Asp Cys
    850                 855                 860
```

```
Val Arg His Ala Leu Phe Leu Asp Asp Gly Ser Glu Ala Arg Asp Ala
865                 870                 875                 880

Val Leu Glu Leu Leu Ala Thr Gln Arg Arg Thr Arg Val Asn Gly Thr
                885                 890                 895

Gln Ile Trp Met Ile Lys Asn Leu Ala Asn Lys Ile Arg Glu Glu Leu
            900                 905                 910

Gln Asn Trp Cys Lys Thr Thr Asn Asn Arg Leu His Phe Gln Ala Ala
        915                 920                 925

Ala Thr Asn Val Ser Asp Ala Lys Asn Leu Arg Leu Lys Leu Ala Gln
    930                 935                 940

Asn Gln Pro Asp Phe Glu Lys Pro Asp Ile Gln Pro Ile Ala Ser His
945                 950                 955                 960

Ser Ile Asp Ala Leu Cys Ser Phe Ala Val Gly Ser Ala Asp Ala Glu
                965                 970                 975

Arg Asp Gln Asn Gly Phe Asp Tyr Leu Asp Gly Lys Thr Val Leu Gly
            980                 985                 990

Leu Tyr Pro Gln Ser Cys Glu Val  Ile His Leu Gln Ala  Lys Pro Gln
        995                 1000                1005

Glu Glu  Lys Ser His Phe Asp  Ser Val Ala Ile Phe  Lys Glu Gly
    1010                1015                1020

Ile Tyr  Ala Glu Gln Phe Leu  Pro Ile Phe Thr Leu  Asn Glu Lys
    1025                1030                1035

Ile Trp  Ile Gly Tyr Glu Thr  Leu Asn Ala Lys Gly  Glu Arg Cys
    1040                1045                1050

Gly Ala  Ile Glu Val Ser Gly  Lys Gln Pro Lys Glu  Leu Leu Glu
    1055                1060                1065
```

```
Met Leu  Ala Pro Phe Phe Asn  Lys Pro Val Gly Asp  Leu Ser Ala
    1070                1075                1080

His Ala  Thr Tyr Arg Ile Leu  Lys Lys Pro Ala Tyr  Glu Phe Leu
    1085                1090                1095

Ala Lys  Ala Ala Leu Gln Pro  Leu Ser Ala Glu Glu  Lys Arg Leu
    1100                1105                1110

Ala Ala  Leu Leu Asp Ala Leu  Arg Tyr Cys Thr Ser  Arg Lys Ser
    1115                1120                1125

Leu Met  Ser Leu Phe Met Ala  Ala Asn Gly Lys Ser  Leu Lys Lys
    1130                1135                1140

Arg Glu  Asp Val Leu Lys Pro  Lys Leu Phe Gln Leu  Lys Val Glu
    1145                1150                1155

Leu Lys  Gly Glu Lys Ser Phe  Lys Leu Asn Gly Ser  Leu Thr Leu
    1160                1165                1170

Pro Val  Lys Gln Asp Trp Leu  Arg Ile Cys Asp Ser  Pro Glu Leu
    1175                1180                1185

Ala Asp  Ala Phe Gly Lys Pro  Cys Ser Ala Asp Glu  Leu Thr Ser
    1190                1195                1200

Lys Leu  Ala Arg Ile Trp Lys  Arg Pro Val Met Arg  Asp Leu Ala
    1205                1210                1215

His Ala  Pro Val Arg Arg Glu  Phe Ser Leu Pro Ala  Ile Asp Asn
    1220                1225                1230

Pro Ser  Gly Gly Phe Arg Ile  Arg Arg Thr Asn Leu  Phe Gly Asn
    1235                1240                1245
```

```
Glu Leu  Tyr Gln Val His Ala  Ile Asn Ala Lys Lys  Tyr Arg Gly
    1250                1255                1260

Phe Ala  Ser Ala Gly Ser Asn  Val Asp Trp Ser Lys  Gly Ile Leu
    1265                1270                1275

Phe Asn  Glu Leu Gln His Glu  Asn Leu Thr Glu Cys  Gly Gly Arg
    1280                1285                1290

Phe Ile  Thr Ser Ala Asp Val  Thr Pro Met Ser Glu  Trp Arg Lys
    1295                1300                1305

Val Val  Ala Glu Asp Asn Leu  Ser Ile Trp Ile Ala  Pro Gly Thr
    1310                1315                1320

Glu Gly  Arg Arg Tyr Val Arg  Val Glu Thr Thr Phe  Ile Gln Ala
    1325                1330                1335

Ser His  Trp Phe Glu Gln Ser  Val Glu Asn Trp Ala  Ile Thr Ser
    1340                1345                1350

Pro Leu  Ser Leu Pro Ala Ser  Phe Lys Val Asp Lys  Pro Ala Glu
    1355                1360                1365

Phe Gln  Lys Ala Val Gly Thr  Glu Leu Ser Glu Leu  Leu Gly Gln
    1370                1375                1380

Pro Arg  Ser Glu Ile Phe Ile  Glu Asn Val Gly Asn  Ala Lys His
    1385                1390                1395

Ile Arg  Phe Trp Tyr Ile Val  Val Ser Ser Asn Lys  Lys Met Asn
    1400                1405                1410

Glu Ser  Tyr Asn Asn Val Ser  Lys Ser
    1415                1420
```

<210> 195
<211> 1132

<212> PRT
<213> Nitratifractor salsuginis

<400> 195

Met Lys Lys Ile Leu Gly Val Asp Leu Gly Ile Thr Ser Phe Gly Tyr
1 5 10 15

Ala Ile Leu Gln Glu Thr Gly Lys Asp Leu Tyr Arg Cys Leu Asp Asn
20 25 30

Ser Val Val Met Arg Asn Asn Pro Tyr Asp Glu Lys Ser Gly Glu Ser
35 40 45

Ser Gln Ser Ile Arg Ser Thr Gln Lys Ser Met Arg Arg Leu Ile Glu
50 55 60

Lys Arg Lys Lys Arg Ile Arg Cys Val Ala Gln Thr Met Glu Arg Tyr
65 70 75 80

Gly Ile Leu Asp Tyr Ser Glu Thr Met Lys Ile Asn Asp Pro Lys Asn
85 90 95

Asn Pro Ile Lys Asn Arg Trp Gln Leu Arg Ala Val Asp Ala Trp Lys
100 105 110

Arg Pro Leu Ser Pro Gln Glu Leu Phe Ala Ile Phe Ala His Met Ala
115 120 125

Lys His Arg Gly Tyr Lys Ser Ile Ala Thr Glu Asp Leu Ile Tyr Glu
130 135 140

Leu Glu Leu Glu Leu Gly Leu Asn Asp Pro Glu Lys Glu Ser Glu Lys
145 150 155 160

Lys Ala Asp Glu Arg Arg Gln Val Tyr Asn Ala Leu Arg His Leu Glu
165 170 175

Glu Leu Arg Lys Lys Tyr Gly Gly Glu Thr Ile Ala Gln Thr Ile His

```
            180                 185                 190

Arg Ala Val Glu Ala Gly Asp Leu Arg Ser Tyr Arg Asn His Asp Asp
        195                 200                 205

Tyr Glu Lys Met Ile Arg Arg Glu Asp Ile Glu Glu Glu Ile Glu Lys
    210                 215                 220

Val Leu Leu Arg Gln Ala Glu Leu Gly Ala Leu Gly Leu Pro Glu Glu
225                 230                 235                 240

Gln Val Ser Glu Leu Ile Asp Glu Leu Lys Ala Cys Ile Thr Asp Gln
                245                 250                 255

Glu Met Pro Thr Ile Asp Glu Ser Leu Phe Gly Lys Cys Thr Phe Tyr
            260                 265                 270

Lys Asp Glu Leu Ala Ala Pro Ala Tyr Ser Tyr Leu Tyr Asp Leu Tyr
        275                 280                 285

Arg Leu Tyr Lys Lys Leu Ala Asp Leu Asn Ile Asp Gly Tyr Glu Val
    290                 295                 300

Thr Gln Glu Asp Arg Glu Lys Val Ile Glu Trp Val Glu Lys Lys Ile
305                 310                 315                 320

Ala Gln Gly Lys Asn Leu Lys Lys Ile Thr His Lys Asp Leu Arg Lys
                325                 330                 335

Ile Leu Gly Leu Ala Pro Glu Gln Lys Ile Phe Gly Val Glu Asp Glu
            340                 345                 350

Arg Ile Val Lys Gly Lys Lys Glu Pro Arg Thr Phe Val Pro Phe Phe
        355                 360                 365

Phe Leu Ala Asp Ile Ala Lys Phe Lys Glu Leu Phe Ala Ser Ile Gln
    370                 375                 380
```

```
Lys His Pro Asp Ala Leu Gln Ile Phe Arg Glu Leu Ala Glu Ile Leu
385                 390                 395                 400

Gln Arg Ser Lys Thr Pro Gln Glu Ala Leu Asp Arg Leu Arg Ala Leu
                405                 410                 415

Met Ala Gly Lys Gly Ile Asp Thr Asp Asp Arg Glu Leu Leu Glu Leu
            420                 425                 430

Phe Lys Asn Lys Arg Ser Gly Thr Arg Glu Leu Ser His Arg Tyr Ile
        435                 440                 445

Leu Glu Ala Leu Pro Leu Phe Leu Glu Gly Tyr Asp Glu Lys Glu Val
    450                 455                 460

Gln Arg Ile Leu Gly Phe Asp Asp Arg Glu Asp Tyr Ser Arg Tyr Pro
465                 470                 475                 480

Lys Ser Leu Arg His Leu His Leu Arg Glu Gly Asn Leu Phe Glu Lys
                485                 490                 495

Glu Glu Asn Pro Ile Asn Asn His Ala Val Lys Ser Leu Ala Ser Trp
            500                 505                 510

Ala Leu Gly Leu Ile Ala Asp Leu Ser Trp Arg Tyr Gly Pro Phe Asp
        515                 520                 525

Glu Ile Ile Leu Glu Thr Thr Arg Asp Ala Leu Pro Glu Lys Ile Arg
    530                 535                 540

Lys Glu Ile Asp Lys Ala Met Arg Glu Arg Glu Lys Ala Leu Asp Lys
545                 550                 555                 560

Ile Ile Gly Lys Tyr Lys Lys Glu Phe Pro Ser Ile Asp Lys Arg Leu
                565                 570                 575

Ala Arg Lys Ile Gln Leu Trp Glu Arg Gln Lys Gly Leu Asp Leu Tyr
```

```
            580                 585                 590

Ser Gly Lys Val Ile Asn Leu Ser Gln Leu Leu Asp Gly Ser Ala Asp
        595                 600                 605

Ile Glu His Ile Val Pro Gln Ser Leu Gly Gly Leu Ser Thr Asp Tyr
    610                 615                 620

Asn Thr Ile Val Thr Leu Lys Ser Val Asn Ala Ala Lys Gly Asn Arg
625                 630                 635                 640

Leu Pro Gly Asp Trp Leu Ala Gly Asn Pro Asp Tyr Arg Glu Arg Ile
                645                 650                 655

Gly Met Leu Ser Glu Lys Gly Leu Ile Asp Trp Lys Lys Arg Lys Asn
            660                 665                 670

Leu Leu Ala Gln Ser Leu Asp Glu Ile Tyr Thr Glu Asn Thr His Ser
        675                 680                 685

Lys Gly Ile Arg Ala Thr Ser Tyr Leu Glu Ala Leu Val Ala Gln Val
    690                 695                 700

Leu Lys Arg Tyr Tyr Pro Phe Pro Asp Pro Glu Leu Arg Lys Asn Gly
705                 710                 715                 720

Ile Gly Val Arg Met Ile Pro Gly Lys Val Thr Ser Lys Thr Arg Ser
                725                 730                 735

Leu Leu Gly Ile Lys Ser Lys Ser Arg Glu Thr Asn Phe His His Ala
            740                 745                 750

Glu Asp Ala Leu Ile Leu Ser Thr Leu Thr Arg Gly Trp Gln Asn Arg
        755                 760                 765

Leu His Arg Met Leu Arg Asp Asn Tyr Gly Lys Ser Glu Ala Glu Leu
    770                 775                 780
```

```
Lys Glu Leu Trp Lys Lys Tyr Met Pro His Ile Glu Gly Leu Thr Leu
785                 790                 795                 800

Ala Asp Tyr Ile Asp Glu Ala Phe Arg Arg Phe Met Ser Lys Gly Glu
                805                 810                 815

Glu Ser Leu Phe Tyr Arg Asp Met Phe Asp Thr Ile Arg Ser Ile Ser
            820                 825                 830

Tyr Trp Val Asp Lys Lys Pro Leu Ser Ala Ser Ser His Lys Glu Thr
        835                 840                 845

Val Tyr Ser Ser Arg His Glu Val Pro Thr Leu Arg Lys Asn Ile Leu
    850                 855                 860

Glu Ala Phe Asp Ser Leu Asn Val Ile Lys Asp Arg His Lys Leu Thr
865                 870                 875                 880

Thr Glu Glu Phe Met Lys Arg Tyr Asp Lys Glu Ile Arg Gln Lys Leu
                885                 890                 895

Trp Leu His Arg Ile Gly Asn Thr Asn Asp Glu Ser Tyr Arg Ala Val
            900                 905                 910

Glu Glu Arg Ala Thr Gln Ile Ala Gln Ile Leu Thr Arg Tyr Gln Leu
        915                 920                 925

Met Asp Ala Gln Asn Asp Lys Glu Ile Asp Glu Lys Phe Gln Gln Ala
    930                 935                 940

Leu Lys Glu Leu Ile Thr Ser Pro Ile Glu Val Thr Gly Lys Leu Leu
945                 950                 955                 960

Arg Lys Met Arg Phe Val Tyr Asp Lys Leu Asn Ala Met Gln Ile Asp
                965                 970                 975

Arg Gly Leu Val Glu Thr Asp Lys Asn Met Leu Gly Ile His Ile Ser
```

```
            980                 985                 990

Lys Gly Pro Asn Glu Lys Leu Ile  Phe Arg Arg Met Asp  Val Asn Asn
        995                 1000                1005

Ala His  Glu Leu Gln Lys Glu  Arg Ser Gly Ile Leu  Cys Tyr Leu
    1010                1015                1020

Asn Glu  Met Leu Phe Ile Phe  Asn Lys Lys Gly Leu  Ile His Tyr
    1025                1030                1035

Gly Cys  Leu Arg Ser Tyr Leu  Glu Lys Gly Gln Gly  Ser Lys Tyr
    1040                1045                1050

Ile Ala  Leu Phe Asn Pro Arg  Phe Pro Ala Asn Pro  Lys Ala Gln
    1055                1060                1065

Pro Ser  Lys Phe Thr Ser Asp  Ser Lys Ile Lys Gln  Val Gly Ile
    1070                1075                1080

Gly Ser  Ala Thr Gly Ile Ile  Lys Ala His Leu Asp  Leu Asp Gly
    1085                1090                1095

His Val  Arg Ser Tyr Glu Val  Phe Gly Thr Leu Pro  Glu Gly Ser
    1100                1105                1110

Ile Glu  Trp Phe Lys Glu Glu  Ser Gly Tyr Gly Arg  Val Glu Asp
    1115                1120                1125

Asp Pro  His His
    1130
```

<210> 196
<211> 1327
<212> PRT
<213> Solobacterium moorei

<400> 196

```
Met Glu Gly Gln Met Lys Asn Asn Gly Asn Asn Leu Gln Gln Gly Asn
1               5                  10                  15

Tyr Tyr Leu Gly Leu Asp Val Gly Thr Ser Ser Val Gly Trp Ala Val
            20                  25                  30

Thr Asp Thr Asp Tyr Asn Val Leu Lys Phe Arg Gly Lys Ser Met Trp
        35                  40                  45

Gly Ala Arg Leu Phe Asp Glu Ala Ser Thr Ala Glu Glu Arg Arg Thr
    50                  55                  60

His Arg Gly Asn Arg Arg Arg Leu Ala Arg Arg Lys Tyr Arg Leu Leu
65                  70                  75                  80

Leu Leu Glu Gln Leu Phe Glu Lys Glu Ile Arg Lys Ile Asp Asp Asn
                85                  90                  95

Phe Phe Val Arg Leu His Glu Ser Asn Leu Trp Ala Asp Asp Lys Ser
            100                 105                 110

Lys Pro Ser Lys Phe Leu Leu Phe Asn Asp Thr Asn Phe Thr Asp Lys
        115                 120                 125

Asp Tyr Leu Lys Lys Tyr Pro Thr Ile Tyr His Leu Arg Ser Asp Leu
    130                 135                 140

Ile His Asn Ser Thr Glu His Asp Ile Arg Leu Val Phe Leu Ala Leu
145                 150                 155                 160

His His Leu Ile Lys Tyr Arg Gly His Phe Ile Tyr Asp Asn Ser Ala
                165                 170                 175

Asn Gly Asp Val Lys Thr Leu Asp Glu Ala Val Ser Asp Phe Glu Glu
            180                 185                 190

Tyr Leu Asn Glu Asn Asp Ile Glu Phe Asn Ile Glu Asn Lys Lys Glu
        195                 200                 205
```

```
Phe Ile Asn Val Leu Ser Asp Lys His Leu Thr Lys Lys Glu Lys Lys
    210                 215                 220

Ile Ser Leu Lys Lys Leu Tyr Gly Asp Ile Thr Asp Ser Glu Asn Ile
225                 230                 235                 240

Asn Ile Ser Val Leu Ile Glu Met Leu Ser Gly Ser Ser Ile Ser Leu
                245                 250                 255

Ser Asn Leu Phe Lys Asp Ile Glu Phe Asp Gly Lys Gln Asn Leu Ser
            260                 265                 270

Leu Asp Ser Asp Ile Glu Glu Thr Leu Asn Asp Val Val Asp Ile Leu
        275                 280                 285

Gly Asp Asn Ile Asp Leu Leu Ile His Ala Lys Glu Val Tyr Asp Ile
    290                 295                 300

Ala Val Leu Thr Ser Ser Leu Gly Lys His Lys Tyr Leu Cys Asp Ala
305                 310                 315                 320

Lys Val Glu Leu Phe Glu Lys Asn Lys Lys Asp Leu Met Ile Leu Lys
                325                 330                 335

Lys Tyr Ile Lys Lys Asn His Pro Glu Asp Tyr Lys Lys Ile Phe Ser
            340                 345                 350

Ser Pro Thr Glu Lys Lys Asn Tyr Ala Ala Tyr Ser Gln Thr Asn Ser
        355                 360                 365

Lys Asn Val Cys Ser Gln Glu Glu Phe Cys Leu Phe Ile Lys Pro Tyr
    370                 375                 380

Ile Arg Asp Met Val Lys Ser Glu Asn Glu Asp Glu Val Arg Ile Ala
385                 390                 395                 400
```

```
Lys Glu Val Glu Asp Lys Ser Phe Leu Thr Lys Leu Lys Gly Thr Asn
                405                 410                 415

Asn Ser Val Val Pro Tyr Gln Ile His Glu Arg Glu Leu Asn Gln Ile
            420                 425                 430

Leu Lys Asn Ile Val Ala Tyr Leu Pro Phe Met Asn Asp Glu Gln Glu
        435                 440                 445

Asp Ile Ser Val Val Asp Lys Ile Lys Leu Ile Phe Lys Phe Lys Ile
    450                 455                 460

Pro Tyr Tyr Val Gly Pro Leu Asn Thr Lys Ser Thr Arg Ser Trp Val
465                 470                 475                 480

Tyr Arg Ser Asp Glu Lys Ile Tyr Pro Trp Asn Phe Ser Asn Val Ile
                485                 490                 495

Asp Leu Asp Lys Thr Ala His Glu Phe Met Asn Arg Leu Ile Gly Arg
            500                 505                 510

Cys Thr Tyr Thr Asn Asp Pro Val Leu Pro Met Asp Ser Leu Leu Tyr
        515                 520                 525

Ser Lys Tyr Asn Val Leu Asn Glu Ile Asn Pro Ile Lys Val Asn Gly
    530                 535                 540

Lys Ala Ile Pro Val Glu Val Lys Gln Ala Ile Tyr Thr Asp Leu Phe
545                 550                 555                 560

Glu Asn Ser Lys Lys Lys Val Thr Arg Lys Ser Ile Tyr Ile Tyr Leu
                565                 570                 575

Leu Lys Asn Gly Tyr Ile Glu Lys Glu Asp Ile Val Ser Gly Ile Asp
            580                 585                 590

Ile Glu Ile Lys Ser Lys Leu Lys Ser His His Asp Phe Thr Gln Ile
        595                 600                 605
```

```
Val Gln Glu Asn Lys Cys Thr Pro Glu Glu Ile Glu Arg Ile Ile Lys
    610                 615                 620

Gly Ile Leu Val Tyr Ser Asp Asp Lys Ser Met Leu Arg Arg Trp Leu
625                 630                 635                 640

Lys Asn Asn Ile Lys Gly Leu Ser Glu Asn Asp Val Lys Tyr Leu Ala
                645                 650                 655

Lys Leu Asn Tyr Lys Glu Trp Gly Arg Leu Ser Lys Thr Leu Leu Thr
            660                 665                 670

Asp Ile Tyr Thr Ile Asn Pro Glu Asp Gly Glu Ala Cys Ser Ile Leu
        675                 680                 685

Asp Ile Met Trp Asn Thr Asn Ala Thr Leu Met Glu Ile Leu Ser Asn
    690                 695                 700

Glu Lys Tyr Gln Phe Lys Gln Asn Ile Glu Asn Tyr Lys Ala Glu Asn
705                 710                 715                 720

Tyr Asp Glu Lys Gln Asn Leu His Glu Glu Leu Asp Asp Met Tyr Ile
                725                 730                 735

Ser Pro Ala Ala Arg Arg Ser Ile Trp Gln Ala Leu Arg Ile Val Asp
            740                 745                 750

Glu Ile Val Asp Ile Lys Lys Ser Ala Pro Lys Lys Ile Phe Ile Glu
        755                 760                 765

Met Ala Arg Glu Lys Lys Ser Ala Met Lys Lys Lys Arg Thr Glu Ser
    770                 775                 780

Arg Lys Asp Thr Leu Leu Glu Leu Tyr Lys Ser Cys Lys Ser Gln Ala
785                 790                 795                 800
```

```
Asp Gly Phe Tyr Asp Glu Glu Leu Phe Glu Lys Leu Ser Asn Glu Ser
                805                 810                 815

Asn Ser Arg Leu Arg Arg Asp Gln Leu Tyr Leu Tyr Tyr Thr Gln Met
            820                 825                 830

Gly Arg Ser Met Tyr Thr Gly Lys Arg Ile Asp Phe Asp Lys Leu Ile
        835                 840                 845

Asn Asp Lys Asn Thr Tyr Asp Ile Asp His Ile Tyr Pro Arg Ser Lys
    850                 855                 860

Ile Lys Asp Asp Ser Ile Thr Asn Arg Val Leu Val Glu Lys Asp Ile
865                 870                 875                 880

Asn Gly Glu Lys Thr Asp Ile Tyr Pro Ile Ser Glu Asp Ile Arg Gln
                885                 890                 895

Lys Met Gln Pro Phe Trp Lys Ile Leu Lys Glu Lys Gly Leu Ile Asn
            900                 905                 910

Glu Glu Lys Tyr Lys Arg Leu Thr Arg Asn Tyr Glu Leu Thr Asp Glu
        915                 920                 925

Glu Leu Ser Ser Phe Val Ala Arg Gln Leu Val Glu Thr Gln Gln Ser
    930                 935                 940

Thr Lys Ala Leu Ala Thr Leu Leu Lys Lys Glu Tyr Pro Ser Ala Lys
945                 950                 955                 960

Ile Val Tyr Ser Lys Ala Gly Asn Val Ser Glu Phe Arg Asn Arg Lys
                965                 970                 975

Asp Lys Glu Leu Pro Lys Phe Arg Glu Ile Asn Asp Leu His His Ala
            980                 985                 990

Lys Asp Ala Tyr Leu Asn Ile Val  Val Gly Asn Val Tyr  Asp Thr Lys
        995                 1000                1005
```

```
Phe Thr  Glu Lys Phe Phe Asn  Asn Ile Arg Asn Glu  Asn Tyr Ser
    1010                1015                1020

Leu Lys  Arg Val Phe Asp Phe  Ser Val Pro Gly Ala  Trp Asp Ala
    1025                1030                1035

Lys Gly  Ser Thr Phe Asn Thr  Ile Lys Lys Tyr Met  Ala Lys Asn
    1040                1045                1050

Asn Pro  Ile Ile Ala Phe Ala  Pro Tyr Glu Val Lys  Gly Glu Leu
    1055                1060                1065

Phe Asp  Gln Gln Ile Val Pro  Lys Gly Lys Gly Gln  Phe Pro Ile
    1070                1075                1080

Lys Gln  Gly Lys Asp Ile Glu  Lys Tyr Gly Gly Tyr  Asn Lys Leu
    1085                1090                1095

Ser Ser  Ala Phe Leu Phe Ala  Val Glu Tyr Lys Gly  Lys Lys Ala
    1100                1105                1110

Arg Glu  Arg Ser Leu Glu Thr  Val Tyr Ile Lys Asp  Val Glu Leu
    1115                1120                1125

Tyr Leu  Gln Asp Pro Ile Lys  Tyr Cys Glu Ser Val  Leu Gly Leu
    1130                1135                1140

Lys Glu  Pro Gln Ile Ile Lys  Pro Lys Ile Leu Met  Gly Ser Leu
    1145                1150                1155

Phe Ser  Ile Asn Asn Lys Lys  Leu Val Val Thr Gly  Arg Ser Gly
    1160                1165                1170

Lys Gln  Tyr Val Cys His His  Ile Tyr Gln Leu Ser  Ile Asn Asp
    1175                1180                1185
```

```
Glu Asp  Ser Gln Tyr Leu Lys  Asn Ile Ala Lys Tyr  Leu Gln Glu
    1190                 1195                 1200


Glu Pro  Asp Gly Asn Ile Glu  Arg Gln Asn Ile Leu  Asn Ile Thr
    1205                 1210                 1215


Ser Val  Asn Asn Ile Lys Leu  Phe Asp Val Leu Cys  Thr Lys Phe
    1220                 1225                 1230


Asn Ser  Asn Thr Tyr Glu Ile  Ile Leu Asn Ser Leu  Lys Asn Asp
    1235                 1240                 1245


Val Asn  Glu Gly Arg Glu Lys  Phe Ser Glu Leu Asp  Ile Leu Glu
    1250                 1255                 1260


Gln Cys  Asn Ile Leu Leu Gln  Leu Leu Lys Ala Phe  Lys Cys Asn
    1265                 1270                 1275


Arg Glu  Ser Ser Asn Leu Glu  Lys Leu Asn Asn Lys  Lys Gln Ala
    1280                 1285                 1290


Gly Val  Ile Val Ile Pro His  Leu Phe Thr Lys Cys  Ser Val Phe
    1295                 1300                 1305


Lys Val  Ile His Gln Ser Ile  Thr Gly Leu Phe Glu  Lys Glu Met
    1310                 1315                 1320


Asp Leu  Leu Lys
    1325


<210>  197
<211>  738
<212>  PRT
<213>  Treponema phagedenis

<400>  197

Met Leu Gln Glu Leu Phe Ala Lys Glu Ile Ala Lys Ile Asp Glu Gly
1               5                  10                  15
```

```
Phe Phe Arg Arg Leu Asp Glu Ser Ala Phe Tyr Leu Glu Asp Lys Ser
            20                  25                  30

Leu Lys Gln Lys Tyr Ser Leu Phe Asn Asp Asp Asn Phe Thr Asp Lys
        35                  40                  45

Asp Tyr Tyr Lys Lys Phe Pro Thr Ile His His Leu Ile Lys Ala Leu
    50                  55                  60

Ile Asn Asp Glu Thr His Val Asp Ile Arg Leu Leu Tyr Leu Ala Cys
65                  70                  75                  80

His Thr Ile Ile Lys Asn Arg Gly His Phe Leu Phe Glu Gly Lys Glu
                85                  90                  95

Phe Asn Thr Glu Ser Arg Phe Asp Asp Ala Ile Asn Glu Leu Phe Ser
            100                 105                 110

Tyr Leu Arg Gln Asp Met Glu Ile Asp Phe Ala Phe Glu Asp Lys Ile
        115                 120                 125

Ala Asp Ile Lys Glu Ile Leu Glu Asn Lys Lys Ile Gly Met Arg Asp
    130                 135                 140

Lys Gln Asn Ala Leu Asn Lys Lys Leu Ser Ile Ala Pro Lys Asp Lys
145                 150                 155                 160

Gln Lys Lys Glu Ile Ile Lys Leu Ile Val Gly Ala Ser Phe Asn Leu
                165                 170                 175

Lys Thr Leu Phe Asn Asp Glu Lys Tyr Ser Ser Glu Lys Glu Ser Tyr
            180                 185                 190

Ser Phe Ala Lys Ser Asn Tyr Glu Glu Lys Glu Ala Val Leu Glu Ser
        195                 200                 205

Leu Leu Gly Asp Gly Phe Gly Leu Ile Leu Arg Ala Lys Ala Val Tyr
```

```
    210                 215                 220

Asp Ser Ser Val Leu Ser Glu Ile Leu Gly Asn Glu Thr Tyr Leu Ser
225                 230                 235                 240

Phe Ala Lys Val Lys Ile Tyr Asp Lys His Lys Glu Asp Leu Ala Lys
                245                 250                 255

Leu Lys Lys Val Ile Lys Thr Tyr His Ala Asp Glu Phe Lys Lys Val
            260                 265                 270

Phe Ala Glu Ala Asn Ile Gln Gly Asn Tyr Cys Ser Tyr Val Gly Ser
        275                 280                 285

Cys Lys Lys Asn Gly Lys Lys Val Pro Ile Glu Lys Arg Ala Asp Lys
    290                 295                 300

Asp Ala Phe Tyr Asp Phe Leu Lys Lys Ile Leu Lys Asp Glu Lys Ala
305                 310                 315                 320

Lys Asn Ser Asp Ala Asp Tyr Ala Phe Ile Leu Asn Glu Ile Glu Leu
                325                 330                 335

Lys Thr Phe Leu Pro Lys Gln Val Ser Lys Lys Asn Ala Asn Ile Pro
            340                 345                 350

Tyr Gln Leu Arg Arg Met Glu Leu Glu Lys Ile Val Asn Asn Ala Glu
        355                 360                 365

Lys Tyr Phe Ser Phe Leu Ser Glu Lys Asp Glu Tyr Gly Thr Val Lys
    370                 375                 380

Glu Lys Ile Ile Gln Leu Leu Thr Phe Lys Arg Pro Tyr Tyr Ile Gly
385                 390                 395                 400

Ile Ile Gln Asp Thr His Lys Glu Lys Phe Pro Asp Arg Cys Trp Val
                405                 410                 415
```

```
Val Lys Lys Glu Asn Ala Lys Asn Glu Lys Ile Thr Pro Trp Asn Phe
            420                 425                 430

Tyr Asp His Ile Asp Glu Asp Lys Thr Ala Glu Ala Phe Ile Thr Ser
        435                 440                 445

Arg Thr Asn Lys Cys Thr Tyr Leu Ile Gly Glu Asp Val Leu Pro Arg
    450                 455                 460

Asn Ser Leu Leu Tyr Met Glu Tyr Thr Val Leu Asn Glu Leu Asn Asn
465                 470                 475                 480

Leu Lys Val Ser Val Asp Gly Val Asn Ile Phe Asp Val Lys Leu Lys
                485                 490                 495

Lys Lys Ile Tyr Glu Gln Val Phe Lys Gln Arg Lys Glu Val Ser Lys
            500                 505                 510

Lys Thr Ile Ala Asp Phe Leu Lys Lys Glu Gly Ile Cys Lys Lys Glu
        515                 520                 525

Asn Asp Val Val Ile Thr Gly Ile Asp Glu Lys Cys Thr Thr Ser Leu
    530                 535                 540

Lys Leu Tyr Ile Asp Ile Lys Lys Ile Ile Gly Lys Arg Ile Glu Glu
545                 550                 555                 560

Glu Pro Thr Lys Asn Ala Leu Glu Asp Ile Ile Leu Trp Ala Ser Ile
                565                 570                 575

Tyr Asp Glu Gly Glu Gly Arg Lys Ile Leu Glu Ala Lys Ile Gln Ser
            580                 585                 590

Val Tyr Pro Asp Val Phe Thr Gln Asp Glu Leu Asn Lys Ile Leu Lys
        595                 600                 605

Leu Lys Ile Ser Gly Trp Gly Arg Phe Ser Arg Lys Phe Leu Glu Ser
```

```
    610                 615                 620

Ile Val Ala Ser Phe Pro Gly Phe Thr Asp Thr Ile Asn Ile Ile Thr
625                 630                 635                 640

Ala Met Arg Glu Thr Asn Phe Asn Leu Met Glu Leu Leu Gly Asp Ala
                645                 650                 655

Tyr Gly Phe Ser Lys Gly Ile Glu Lys Phe Asn Ser Lys Phe Asn Asp
            660                 665                 670

Asp Lys Lys Val Phe Ser Tyr Asp Lys Leu Val Lys Asp Leu Tyr Leu
        675                 680                 685

Ser Pro Ser Val Lys Arg Met Leu Trp Arg Ala Leu Val Ile Val Lys
    690                 695                 700

Glu Val Lys Ser Ile Met Gly Lys Asp Pro Lys Lys Tyr Leu Leu Lys
705                 710                 715                 720

Trp Gln Glu Glu Lys Lys Leu Lys Arg Glu Gly Leu Pro Pro Ala Met
                725                 730                 735

Gln Val
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<210> 198
<211> 1377
<212> PRT
<213> Streptococcus equinus

<400> 198

```
Met Glu Lys Thr Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30
```

```
Lys Val Leu Gly Asn Thr Asp Lys Lys Tyr Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Ala Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Lys Glu Met Ala Lys Val Asp Glu Ser
                85                  90                  95

Phe Phe Gln Arg Leu Glu Glu Ser Phe Leu Thr Asp Asp Asp Lys Thr
            100                 105                 110

Phe Asp Ser His Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Thr Tyr
        115                 120                 125

His Gln Glu Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140

Ser Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Gln Leu Asn Ala
                165                 170                 175

Glu Asn Thr Asp Val Gln Lys Ile Phe Ala Asp Phe Val Gly Val Tyr
            180                 185                 190

Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205

Ala Ser Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Lys Gln Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240
```

```
Leu Val Ala Leu Ala Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285

Leu Phe Thr Ala Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Asp Asp Asn Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Glu Glu His His Glu Asp Leu Glu Lys Leu Lys
                325                 330                 335

Thr Phe Ile Lys Val Asn Asn Phe Asp Lys Tyr His Glu Ile Phe Lys
            340                 345                 350

Asp Lys Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val Lys
        355                 360                 365

Gln Asp Ile Phe Tyr Lys His Leu Lys Ser Ile Ile Ser Glu Lys Asn
    370                 375                 380

Gly Gly Gln Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Thr Ile Leu Arg Arg Gln Gly Glu Tyr Tyr Pro Phe
            420                 425                 430
```

```
Leu Lys Glu Asn Gln Ala Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Asn Ser Arg Phe Ala Trp
    450                 455                 460

Ala Lys Tyr His Ser Asp Glu Pro Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Val Val Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met Thr
                485                 490                 495

Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Tyr Val Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Ile Lys
        515                 520                 525

Tyr Val Asn Glu Gln Gly Lys Ser Phe Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys Val Thr Lys
545                 550                 555                 560

Ala Lys Leu Leu Ser Tyr Leu Asn Asn Glu Phe Glu Glu Phe Arg Ile
                565                 570                 575

Asn Asp Leu Ile Gly Leu Asp Lys Asp Ser Lys Ser Phe Asn Ala Ser
            580                 585                 590

Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Ser Phe Leu
        595                 600                 605

Asp Asp Lys Thr Asn Glu Gln Ile Ile Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Asp Met Ile His Glu Arg Leu Gln Lys Tyr
625                 630                 635                 640
```

```
Ser Asp Ile Phe Thr Ser Gln Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile Arg
            660                 665                 670

Asn Lys Glu Asn Asn Lys Thr Ile Leu Asp Phe Leu Ile Asp Asp Gly
        675                 680                 685

Asp Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu Ser
    690                 695                 700

Phe Lys Thr Thr Ile Gln Glu Ala Gln Val Val Gly Asp Val Asp Asp
705                 710                 715                 720

Ile Glu Ala Val Val His Asp Leu Pro Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val Lys Val Met
            740                 745                 750

Gly His Asn Pro Gln Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Ile Thr Gly Tyr Gly Arg Asn Arg Ser Asn Gln Arg Leu Lys Arg Leu
    770                 775                 780

Gln Asp Ser Leu Lys Glu Phe Gly Ser Asp Ile Leu Ser Lys Lys Lys
785                 790                 795                 800

Pro Ser Tyr Val Asp Ser Lys Val Glu Asn Ser His Leu Gln Asn Asp
                805                 810                 815

Arg Leu Phe Leu Tyr Tyr Ile Gln Asn Gly Lys Asp Met Tyr Thr Gly
            820                 825                 830
```

```
Glu Glu Leu Asp Ile Asp His Leu Ser Asp Tyr Asp Ile Asp His Ile
        835                 840                 845

Ile Pro Gln Ala Phe Ile Lys Asp Asn Ser Ile Asp Asn Arg Val Leu
    850                 855                 860

Thr Ser Ser Ala Lys Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Ile
865                 870                 875                 880

Glu Ile Val Arg Asn Arg Lys Ser Tyr Trp Tyr Lys Leu Tyr Lys Ser
                885                 890                 895

Gly Leu Ile Ser Lys Arg Lys Phe Asp Asn Leu Thr Lys Ala Glu Arg
            900                 905                 910

Gly Gly Leu Thr Glu Thr Asp Lys Ala Gly Phe Ile Lys Arg Gln Leu
        915                 920                 925

Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln Ile Leu Asp Ala
    930                 935                 940

Arg Phe Asn Thr Lys Cys Asp Glu Asn Asp Lys Val Ile Arg Asp Val
945                 950                 955                 960

Lys Val Ile Thr Leu Lys Ser Ser Leu Val Ser Gln Phe Arg Lys Glu
                965                 970                 975

Phe Lys Phe Tyr Lys Val Arg Glu Ile Asn Asp Tyr His His Ala His
            980                 985                 990

Asp Ala Tyr Leu Asn Ala Val Val  Gly Thr Ala Leu Leu  Lys Lys Tyr
        995                 1000                1005

Pro Lys  Leu Ala Pro Glu Phe  Val Tyr Gly Glu Tyr  Lys Lys Tyr
    1010                1015                1020

Asp Val  Arg Lys Leu Val Ala  Lys Ser Ser Asp Asn  His Ser Glu
    1025                1030                1035
```

```
Leu Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe Tyr Ser  Asn Leu Met
    1040                1045                1050

Asn Phe  Phe Lys Thr Glu Val  Lys Tyr Ala Asp Gly  Arg Val Phe
    1055                1060                1065

Glu Arg  Pro Asp Ile Glu Thr  Asn Ala Asp Gly Glu  Val Val Trp
    1070                1075                1080

Asn Lys  Gln Arg Asp Phe Asn  Ile Val Arg Lys Val  Leu Ser Tyr
    1085                1090                1095

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Val Gln  Thr Gly Gly
    1100                1105                1110

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asp Ser  Asp Lys Leu
    1115                1120                1125

Ile Pro  Arg Lys Thr Lys Lys  Leu Gln Trp Glu Thr  Gln Lys Tyr
    1130                1135                1140

Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr Ser Val  Leu Val Val
    1145                1150                1155

Ala Asp  Val Glu Lys Gly Lys  Thr Arg Lys Leu Lys  Thr Val Lys
    1160                1165                1170

Glu Leu  Val Gly Ile Ser Ile  Met Glu Arg Ser Ser  Phe Glu Glu
    1175                1180                1185

Asn Pro  Val Ser Phe Leu Glu  Lys Lys Gly Tyr His  Asn Val Gln
    1190                1195                1200

Glu Asp  Lys Leu Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Phe
    1205                1210                1215
```

```
Glu Gly  Gly Arg Arg Arg Leu  Leu Ala Ser Ala Thr  Glu Leu Gln
    1220                1225                1230

Lys Gly  Asn Glu Val Val Leu  Pro Gln Tyr Met Val  Asn Leu Leu
    1235                1240                1245

Tyr His  Ser Gln His Val Asn  Asn Ser His Lys Pro  Glu His Leu
    1250                1255                1260

Asn Tyr  Val Lys Gln His Lys  Asp Glu Phe Lys Asp  Ile Phe Asn
    1265                1270                1275

Leu Ile  Ile Ser Ile Ala Arg  Ile Asn Ile Leu Lys  Pro Lys Val
    1280                1285                1290

Val Asp  Asn Leu Ile Asn Glu  Phe Thr Glu Tyr Gly  Gln Glu Asp
    1295                1300                1305

Ile Ser  Ser Leu Ser Glu Ser  Phe Ile Asn Leu Leu  Lys Phe Ile
    1310                1315                1320

Ser Phe  Gly Ala Pro Gly Ala  Phe Lys Phe Leu Lys  Leu Asp Val
    1325                1330                1335

Lys Gln  Ser Asn Leu Arg Tyr  Lys Ser Thr Thr Glu  Ala Leu Ser
    1340                1345                1350

Ala Thr  Leu Ile His Gln Ser  Val Thr Gly Leu Tyr  Glu Thr Arg
    1355                1360                1365

Ile Asp  Leu Ser Lys Leu Gly  Glu Glu
    1370                1375
```

<210> 199
<211> 1128
<212> PRT
<213> Streptococcus vestibularis

<400> 199

```
Met Ser Asp Leu Val Leu Gly Leu Asp Ile Gly Ile Gly Ser Val Gly
1               5                  10                  15

Val Gly Ile Leu Asn Lys Val Thr Gly Glu Ile Ile His Lys Asn Ser
            20                  25                  30

Arg Ile Phe Pro Ala Ala Gln Ala Glu Asn Asn Val Glu Arg Arg Thr
        35                  40                  45

Asn Arg Gln Gly Arg Arg Leu Thr Arg Arg Lys Lys His Arg Arg Val
    50                  55                  60

Arg Leu Asn His Leu Phe Glu Glu Ser Gly Leu Ile Thr Asp Phe Thr
65                  70                  75                  80

Lys Val Ser Ile Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly Leu
                85                  90                  95

Ile Asp Glu Leu Ser Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Met
            100                 105                 110

Val Lys His Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Asp Asp Gly
        115                 120                 125

Asn Ser Ser Val Gly Asp Tyr Ala Gln Ile Val Lys Glu Asn Ser Lys
    130                 135                 140

Gln Leu Glu Thr Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Tyr Gln
145                 150                 155                 160

Lys Tyr Gly Gln Leu Arg Gly Asp Phe Thr Val Glu Glu Asp Gly Lys
                165                 170                 175

Lys His Arg Leu Ile Asn Val Phe Pro Thr Ser Ala Tyr Arg Ser Glu
            180                 185                 190

Ala Leu Arg Ile Leu Gln Thr Gln Lys Glu Phe Asn Pro Gln Ile Thr
```

```
        195                 200                 205

Asp Glu Phe Ile Asn Arg Tyr Leu Glu Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240

Tyr Thr Thr Lys Lys Asp Ser Glu Asn Glu Tyr Ile Thr Leu Asp Asn
                245                 250                 255

Ile Phe Gly Ile Leu Ile Gly Lys Cys Thr Phe Tyr Pro Glu Glu Tyr
            260                 265                 270

Arg Ala Ala Lys Ala Ser Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn
        275                 280                 285

Asp Leu Asn Asn Leu Thr Val Pro Thr Glu Thr Lys Lys Leu Ser Glu
    290                 295                 300

Glu Gln Lys Asn Gln Ile Ile Asn Tyr Val Lys Asn Glu Lys Ala Met
305                 310                 315                 320

Gly Pro Ala Lys Leu Phe Lys Tyr Ile Ala Lys Leu Leu Ser Cys Asp
                325                 330                 335

Val Ala Asp Ile Lys Gly Tyr Arg Ile Asp Lys Ser Asp Lys Ala Glu
            340                 345                 350

Ile His Thr Phe Glu Ala Tyr Arg Lys Met Lys Thr Leu Glu Thr Ile
        355                 360                 365

Asp Phe Glu Lys Met Ser Arg Asp Gln Leu Asp Lys Leu Ala Tyr Val
    370                 375                 380

Leu Thr Leu Asn Thr Glu Arg Glu Gly Ile Gln Glu Ala Leu Asp His
385                 390                 395                 400
```

```
Glu Phe Ala Asp Gly Asn Phe Ser Gln Glu Gln Ile Asp Glu Leu Val
                405                 410                 415

Gln Phe Arg Lys Ala Asn Ser Ser Ile Phe Gly Lys Gly Trp His Asn
            420                 425                 430

Phe Ser Val Lys Leu Met Met Glu Leu Ile Pro Glu Leu Tyr Ala Thr
        435                 440                 445

Ser Glu Glu Gln Met Thr Ile Leu Thr Arg Leu Gly Lys Gln Lys Thr
    450                 455                 460

Thr Ser Ser Ser Asn Lys Thr Lys Tyr Ile Asp Glu Lys Leu Leu Thr
465                 470                 475                 480

Glu Glu Ile Tyr Asn Pro Val Val Ala Lys Ser Val Arg Gln Ala Ile
                485                 490                 495

Lys Ile Val Asn Ala Ala Ile Lys Glu Tyr Gly Asp Phe Asp Asn Ile
            500                 505                 510

Val Ile Glu Met Ala Arg Glu Thr Asn Glu Asp Asp Glu Lys Lys Ala
        515                 520                 525

Ile Gln Lys Ile Gln Lys Ala Asn Lys Asp Glu Lys Asp Ala Ala Met
    530                 535                 540

Leu Lys Ala Ala Asn Gln Tyr Asn Gly Arg Ala Glu Leu Pro His Ser
545                 550                 555                 560

Val Phe His Gly His Lys Gln Leu Ala Thr Lys Ile Arg Leu Trp His
                565                 570                 575

Gln Gln Gly Glu Arg Cys Leu Tyr Thr Gly Lys Thr Ile Ser Ile His
            580                 585                 590

Asp Leu Ile Asn Asn Pro Asn Gln Phe Glu Ile Asp His Ile Leu Pro
```

```
        595                 600                 605

Leu Ser Ile Thr Phe Asp Asp Ser Leu Ala Asn Lys Val Leu Val Tyr
    610                 615                 620

Ala Thr Ala Asn Gln Glu Lys Gly Gln Arg Thr Pro Tyr Gln Ala Leu
625                 630                 635                 640

Asp Ser Met Asp Asp Ala Trp Ser Phe Arg Glu Leu Lys Ala Phe Val
                645                 650                 655

Arg Glu Ser Lys Ser Leu Ser Asn Lys Lys Lys Glu Tyr Leu Leu Thr
            660                 665                 670

Glu Glu Asp Ile Ser Arg Phe Asp Val Arg Lys Lys Phe Ile Glu Arg
        675                 680                 685

Asn Leu Val Asp Thr Arg Tyr Ala Ser Arg Val Val Leu Asn Ala Leu
    690                 695                 700

Gln Glu His Phe Arg Ala His Lys Thr Asp Thr Lys Val Ser Val Val
705                 710                 715                 720

Arg Gly Gln Phe Thr Ser Gln Leu Arg Arg His Trp Gly Ile Glu Lys
                725                 730                 735

Thr Arg Asp Thr Tyr His His His Ala Val Asp Ala Leu Ile Ile Ala
            740                 745                 750

Ala Ser Ser Gln Leu Asn Leu Trp Lys Lys Gln Lys Asn Thr Leu Val
        755                 760                 765

Asn Tyr Ser Glu Asn Gln Leu Leu Asp Ile Glu Thr Gly Glu Leu Ile
    770                 775                 780

Ser Asp Asp Glu Tyr Lys Glu Ser Val Phe Lys Ala Pro Tyr Gln His
785                 790                 795                 800
```

```
Phe Val Asp Thr Leu Lys Ser Lys Glu Phe Glu Asp Ser Ile Leu Phe
                805                 810                 815

Ser Tyr Gln Val Asp Ser Lys Phe Asn Arg Lys Ile Ser Asp Ala Thr
            820                 825                 830

Ile Tyr Ala Thr Arg Gln Ala Lys Val Gly Lys Asp Lys Lys Asp Glu
        835                 840                 845

Thr Tyr Val Leu Gly Lys Ile Lys Asp Ile Tyr Ser Gln Thr Gly Tyr
    850                 855                 860

Asp Ala Phe Ile Lys Ile Tyr Gln Lys Asp Lys Ser Lys Phe Leu Met
865                 870                 875                 880

Tyr Arg His Asp Pro Gln Thr Phe Glu Lys Val Ile Glu Pro Ile Leu
                885                 890                 895

Glu Asn Tyr Pro Asn Lys Glu Met Asn Glu Lys Gly Lys Glu Val Pro
            900                 905                 910

Cys Asn Pro Phe Leu Lys Tyr Lys Glu Glu His Gly Asp Tyr Ile Arg
        915                 920                 925

Lys Tyr Ser Lys Lys Gly Asn Gly Pro Glu Ile Lys Ser Leu Lys Tyr
    930                 935                 940

Tyr Asp Ser Lys Leu Gly Asn His Ile Asp Ile Thr Pro Lys Asp Ser
945                 950                 955                 960

Asn Asn Lys Val Val Leu Gln Ser Val Ser Pro Trp Arg Ala Asp Val
                965                 970                 975

Tyr Phe Asn Lys Thr Thr Gly Lys Tyr Glu Ile Leu Gly Leu Lys Tyr
            980                 985                 990

Ala Asp Leu Gln Phe Glu Lys Gly  Thr Gly Thr Tyr Lys  Ile Ser Gln
```

995 1000 1005

Glu Lys Tyr Asn Val Ile Lys Lys Lys Glu Gly Val Asp Ser Asp
1010 1015 1020

Ser Glu Phe Lys Phe Thr Leu Tyr Lys Asn Asp Leu Leu Leu Ile
1025 1030 1035

Lys Asp Thr Glu Thr Lys Glu Gln Gln Leu Phe Arg Phe Leu Ser
1040 1045 1050

Arg Thr Lys Pro Asn Val Lys His Tyr Val Glu Leu Lys Pro Tyr
1055 1060 1065

Asp Lys Gln Lys Phe Glu Gly Asn Glu Ser Leu Ile Asn Val Leu
1070 1075 1080

Gly Ala Val Ala Lys Gly Gly Gln Cys Gln Lys Gly Ile Asn Lys
1085 1090 1095

Pro Asn Ile Ser Ile Tyr Lys Val Arg Thr Asp Val Leu Gly Asn
1100 1105 1110

Gln His Ile Ile Lys Asn Glu Gly Asp Lys Pro Lys Leu Asp Phe
1115 1120 1125

<210> 200
<211> 1080
<212> PRT
<213> Methylocystis sp.

<400> 200

Met Arg Val Leu Gly Leu Asp Gly Gly Ile Ala Ser Ile Gly Trp Ala
1 5 10 15

Leu Ile Glu Ile Phe Glu Asp His Glu Pro Ser Asp Gly Arg Ile Ile
20 25 30

```
Asp Thr Gly Ala Trp Met Phe Asp Ala Pro Glu Glu Lys Ser Gln Thr
        35                  40                  45

Gly Thr Lys Leu Lys Ser Glu Leu Arg Arg Ile Phe Arg Gly Gln Arg
    50                  55                  60

Arg Val Ile Arg Arg Arg Arg Gln Arg Met Asn Glu Val Arg Arg Ile
65                  70                  75                  80

Leu His Arg His Gly Leu Leu Ser Ser Asp Asn Arg Asp Ala Leu Lys
                85                  90                  95

Gln Pro Gly Leu Asp Pro Trp Lys Ile Arg Ala Glu Gly Ile Asp Arg
            100                 105                 110

Leu Leu Ser Pro Ile Glu Phe Ala Val Ala Leu Gly His Ile Ala Arg
        115                 120                 125

His Arg Gly Phe Lys Ser Asn Ser Lys Gly Ala Lys Thr Ser Asp Leu
    130                 135                 140

Asp Ala Glu Ser Ser Arg Met Lys Lys Ala Val Gly Glu Thr Arg Glu
145                 150                 155                 160

Lys Leu Ala Arg Phe Gly Ser Pro Ala Lys Leu Leu Val Glu Asp Glu
                165                 170                 175

Gly Phe Val Leu Arg Gln Thr Lys Leu Lys Ser Gly Ala Leu Glu Thr
            180                 185                 190

Val Arg Arg Phe Arg Asn Arg Asp Gly Asp Tyr Ser Arg Ser Leu Leu
        195                 200                 205

Arg Asp Asp Leu Ala Ala Glu Val Arg Ala Leu Phe Arg Ala Gln Ala
    210                 215                 220

Arg Leu Gln Ser Thr Phe Ala Lys Val Glu Leu Glu Ala Glu Phe Thr
225                 230                 235                 240
```

```
Gln Ala Ala Phe Phe Gln Arg Pro Leu Gln Asp Ser Glu Arg Leu Val
                245                 250                 255

Gly Pro Cys Pro Phe Glu Pro Ala Glu Lys Arg Ser Pro Lys Arg Gly
            260                 265                 270

Tyr Ser Phe Glu Leu Phe Arg Phe Leu Ser Arg Leu Asn His Leu Thr
        275                 280                 285

Leu Arg Glu Gly Ser Glu Glu Arg Thr Leu Thr Val Glu Glu Leu Arg
    290                 295                 300

Thr Ala Ala Ala Asp Phe Gly Gly Val Ala Lys Phe Thr Phe Ser Thr
305                 310                 315                 320

Leu Arg Lys Arg Leu Ala Leu Pro Asp Ile Ala Ile Phe Val Gly Ile
                325                 330                 335

Lys Ala Asp Asp Glu Lys Lys Leu Asp Val Val Ala Arg Ser Gly Glu
            340                 345                 350

Ala Ala Thr Gly Thr Ala Arg Leu Arg Arg Val Val Ile Asp Ala Leu
        355                 360                 365

Gly Glu Leu Ala Trp Gly Ala Leu Ile Ser Ala Pro Glu Arg Leu Asp
    370                 375                 380

Lys Ile Thr Glu Ile Ile Thr Phe Arg Ser Asp Leu Asp Arg Ile Arg
385                 390                 395                 400

Ala Gly Leu Ile Glu Ala Gly Phe Asp Thr Pro Leu Ile Glu Ala Ile
                405                 410                 415

Val Arg Ala Ala Ala Asp Gly Lys Leu Asp Ala Phe Thr Gly Val Gly
            420                 425                 430
```

```
His Ile Ser Ala Lys Ala Ala Arg Asn Ile Ile Pro Gly Leu Met Arg
        435                 440                 445

Gly Met Thr Tyr Asp Lys Ala Cys Ala Ala Ala Gly Tyr Asp His Thr
    450                 455                 460

Ala Ser Arg Glu Arg Asp Ala Phe Asp Val Gly Met His Gly Lys Glu
465                 470                 475                 480

Ala Leu Lys Lys Ile Leu Gln Glu Glu Arg Ile Ser Arg Glu Leu Val
                485                 490                 495

Gly Ser Pro Ser Ala Arg Lys Ala Leu Ile Glu Ala Val Lys Gln Val
            500                 505                 510

Lys Ala Ile Ile Glu Lys Tyr Gly Val Pro Asp Arg Ile His Val Glu
        515                 520                 525

Leu Ala Arg Asp Val Gly Lys Ser Ile Glu Glu Arg Arg Asp Ile His
    530                 535                 540

Phe Gly Ile Glu Lys Arg Ser Arg Gln Lys Asp Lys Leu Arg Glu Leu
545                 550                 555                 560

Phe Gly Lys Glu Val Gly His Leu Pro Gln Asp Gly Glu Arg Gly Lys
                565                 570                 575

Glu Glu Leu Leu Arg Phe Glu Leu Trp Asn Glu Gln Met Gly Arg Cys
            580                 585                 590

Leu Tyr Thr Asp Glu Tyr Ile Asn Pro Lys Gln Leu Val Ala Ser Asp
        595                 600                 605

Asn Ser Val Gln Val Asp His Ile Leu Pro Trp Ser Arg Phe Gly Asp
    610                 615                 620

Asp Ser Tyr Leu Asn Lys Thr Leu Cys Thr Ala Lys Ala Asn Gln Asp
625                 630                 635                 640
```

```
Lys Lys Gly Arg Thr Pro Tyr Glu Trp Phe Arg Ala Asp Lys Pro Glu
               645                 650                 655

Ala Glu Trp Asp Ala Phe Val Ala Arg Val Glu Ser Ile Gln Phe Met
            660                 665                 670

Lys Gly Leu Lys Lys Arg Asn Tyr Lys Leu Lys Asn Ala Glu Glu Ala
        675                 680                 685

Ala Glu Lys Phe Arg Ser Arg Asn Leu Asn Asp Thr Arg Trp Thr Cys
    690                 695                 700

Arg Leu Leu Ala Glu Ala Leu Lys Gln Leu Tyr Pro Lys Gly Glu Lys
705                 710                 715                 720

Asp Lys Asp Gly Lys Glu Arg Arg Arg Val Phe Thr Arg Pro Gly Ala
               725                 730                 735

Leu Thr Asn Arg Leu Arg Arg Ala Trp Ser Leu Gln Arg Arg Lys Lys
            740                 745                 750

Ser Glu Lys Gly Glu Arg Ile Ala Asp Asp Arg His His Ala Leu Asp
        755                 760                 765

Ala Ile Ile Val Ala Ala Thr Thr Glu Ser Leu Leu Ile Arg Ala Thr
    770                 775                 780

Arg Glu Val Gln Asp Ile Glu Arg Lys Gly Leu His Tyr Asp Leu Thr
785                 790                 795                 800

Lys Asn Ile Thr Gln Pro Trp Pro Gly Phe Ala Asp Glu Ala Leu Asp
               805                 810                 815

Ala Val Glu Lys Val Phe Val Ala Arg Ala Glu Arg Arg Arg Ala Arg
            820                 825                 830
```

```
Gly Lys Ala His Asp Ala Thr Ile Arg His Ile Ala Val Arg Asp Asp
        835                 840                 845

Glu Ala Lys Val Tyr Glu Arg Lys Lys Val Gly Asp Ile Lys Leu Gly
    850                 855                 860

Asp Leu Ile Arg Val Lys Asp Ala Glu Arg Asn Ala Pro Leu Ile Glu
865                 870                 875                 880

Asn Leu Arg Lys Trp Ile Glu Ala Gly Ser Pro Arg Asp Asn Pro Pro
                885                 890                 895

Leu Ser Pro Lys Gly Asp Pro Val Ser Lys Val Arg Leu Val Thr Lys
            900                 905                 910

Asn Lys Val Asn Ile Thr Leu Asp Thr Gly Asn Pro Glu Arg Leu Ala
        915                 920                 925

Thr Val Asp Arg Gly Glu Met Ala Arg Val Asp Val Phe Arg Lys Ala
    930                 935                 940

Asn Arg Lys Gly Lys Tyr Glu Tyr Tyr Leu Val Pro Ile Tyr Pro His
945                 950                 955                 960

Glu Ile Ala Thr Met Glu Thr Pro Pro Met Arg Ala Val Gln Gly Gly
                965                 970                 975

Gly Asp Asp Asp Lys Trp Pro Glu Ile Asp Ser Thr Phe Glu Phe Leu
            980                 985                 990

Trp Ser Ile Asn Gln Leu Ser Leu  Leu Glu Leu Thr Lys  Pro Asp Gly
        995                 1000                1005

Glu Val  Ile Arg Ser Tyr Phe  Arg Ser Leu Asp Arg  Asn Thr Gly
    1010                1015                1020

Ala Leu  Thr Val Ser Gly Ile  Ala Asn Ser Thr Ala  Thr Arg Lys
    1025                1030                1035
```

Gly Ile Gly Thr Arg Thr Leu Ile Asp Phe Lys Lys Leu His Val
    1040   1045   1050

Asp Arg Leu Gly Gln Ile Phe Glu Val Glu Arg Glu Leu Arg Thr
    1055   1060   1065

Trp Arg Gly Glu Thr Trp Arg Gly Lys Asp Cys Ile
    1070   1075   1080

<210> 201
<211> 1087
<212> PRT
<213> Phascolarctobacterium succinatutens

<400> 201

Met Leu Arg Met Lys Tyr Ala Ile Gly Leu Asp Ile Gly Ile Ala Ser
1   5   10   15

Val Gly Tyr Ala Val Leu Ala Leu Asp His Glu Glu Asn Pro Trp Gly
            20   25   30

Ile Ile Arg Leu Gly Ser Arg Ile Phe Asp Val Ala Glu Asn Pro Lys
        35   40   45

Asp Gly Ala Ser Leu Ala Leu Pro Arg Arg Glu Ala Arg Ser Val Arg
    50   55   60

Arg Arg Leu Arg Arg His His His Arg Leu Glu Arg Ile Lys Asn Leu
65   70   75   80

Leu Ile Asn Thr Glu Phe Ile Thr Lys Asp Glu Leu Leu His Leu Tyr
                85   90   95

Asp Gly Asn Leu Ser Asp Val Tyr Glu Leu Arg Val Lys Ala Leu Asp
            100   105   110

Tyr Ser Val Thr Asn Ala Glu Leu Thr Arg Ile Leu Leu His Leu Ala

```
        115                 120                 125

Gln Arg Arg Gly Phe Lys Ser Asn Arg Lys Ser Asp Ala Asn Asp Lys
    130                 135                 140

Glu Ala Gly Gln Leu Leu Glu Ala Val Ser Ala Asn Ala Lys Arg Met
145                 150                 155                 160

Gln Glu Asn His Tyr Arg Thr Val Gly Glu Met Phe Tyr Lys Asp Asp
                165                 170                 175

Leu Phe Ser Lys Tyr Lys Arg Asn Lys Gly Gly Thr Tyr Leu Thr Thr
            180                 185                 190

Val His Arg Asp Met Ile Ala Ala Glu Ala Arg Thr Ile Leu Glu Lys
        195                 200                 205

Gln Phe Ala Leu Gly Asn Asn Ile Cys Thr Gln Asp Phe Ile Asp Lys
    210                 215                 220

Tyr Leu Ser Ile Leu Leu Ser Gln Arg Gln Phe Asp Glu Gly Pro Gly
225                 230                 235                 240

Glu Pro Ser Pro Tyr Ala Gly Asn Gln Ile Ala Asn Met Ile Gly Lys
                245                 250                 255

Cys Thr Phe Glu Pro Asn Glu Tyr Arg Ala Ala Lys Ala Ser Tyr Ser
            260                 265                 270

Phe Glu Arg Phe Asn Leu Leu Gln Lys Val Asn His Leu Arg Leu Leu
        275                 280                 285

Leu Glu Gly Lys Ser Ile Ala Leu Asp Asn Glu Gln Arg Lys Lys Ile
    290                 295                 300

Ile Ala Leu Ala His Asp Lys Ala Asp Leu Arg Tyr Ser His Ile Arg
305                 310                 315                 320
```

```
Lys Ala Leu Gly Leu Asp Glu Lys Val Leu Phe Asn Thr Ile Thr Tyr
                325                 330                 335

Asn Asp Asp Val Ser Val Ile Glu Lys Lys Thr Lys Phe Asn Phe Leu
            340                 345                 350

Gln Ala Tyr His Gln Ile Lys Lys Val Leu Ala Glu Asp Met Gln Lys
        355                 360                 365

Leu Thr Thr Glu Gln Leu Asp Asn Ile Gly Gln Ile Leu Ser Thr Tyr
    370                 375                 380

Lys Ser Asp Asn Lys Arg Thr Glu Glu Leu Ser Ala Leu Gly Leu Glu
385                 390                 395                 400

Lys Lys Ile Ile Asp Ala Leu Leu Gly Ile Asn Gly Leu Ser Lys Phe
                405                 410                 415

Ala His Leu Ser Leu Lys Ala Leu Arg Lys Ile Asn Pro Tyr Leu Glu
            420                 425                 430

Glu Gly Lys Ile Tyr Asn Glu Ala Cys Thr Ala Ala Gly Tyr Asp Phe
        435                 440                 445

Lys Ala His Ala Asn Thr Gln Lys Thr Glu Leu Leu Pro Ala Tyr Lys
    450                 455                 460

Glu Glu Met Asp Asp Ile Thr Ser Pro Val Ala Arg Arg Ala Ile Ala
465                 470                 475                 480

Gln Ser Ile Lys Val Ile Asn Ala Ile Ile Arg Glu Gln Lys Gly Ser
                485                 490                 495

Pro Leu Tyr Ile Asn Ile Glu Leu Ala Arg Glu Met Ala Lys Gly Phe
            500                 505                 510

Asp Glu Arg Thr Gln Ile Asp Lys Ala Asn Lys Glu Asn Gln Ala Lys
```

```
        515                 520                 525

Asn Glu Arg Ile Met Glu Arg Ile Arg Thr Glu Phe His Lys Ala Asn
    530                 535                 540

Pro Thr Gly Met Asp Leu Ile Lys Leu Lys Leu Trp Glu Glu Gln Asp
545                 550                 555                 560

Gly Arg Ser Pro Tyr Ser Gln Lys Ala Ile Ser Ile Asn Arg Leu Phe
                565                 570                 575

Glu Pro Gly Tyr Val Asp Ile Asp His Ile Val Pro Tyr Ser Ile Ser
            580                 585                 590

Phe Asp Asp Ser Phe Lys Asn Lys Val Leu Val Phe Ser Asp Glu Asn
        595                 600                 605

Arg Asp Lys Gly Asn Arg Leu Pro Ile Ala Tyr Leu Gln Ser Lys Phe
    610                 615                 620

Gly Ala Lys Ala Ala Glu Asn Phe Met Ile Trp Val Gln Ser Asn Ile
625                 630                 635                 640

Lys Asp Tyr Lys Lys Arg Gln Lys Leu Leu Lys Arg Glu Ile Thr Glu
                645                 650                 655

Glu Asp Ile Asn Lys Phe Lys Glu Arg Asn Leu Gln Asp Thr Lys Thr
            660                 665                 670

Ile Ser Arg Phe Leu Tyr Asn Tyr Ile Asn Asp Tyr Leu Leu Phe Ala
        675                 680                 685

Pro Ser Asp Thr Gly Lys Lys Lys Arg Val Thr Ala Val Asn Gly Thr
    690                 695                 700

Ile Thr Ala Tyr Leu Arg Lys Arg Trp Gly Ile Asn Lys Ile Arg Ala
705                 710                 715                 720
```

```
Asn Gly Asp Lys His His Ala Val Asp Ala Val Val Ile Ala Cys Thr
               725                 730                 735

Thr Asp Lys Met Ile Lys Asp Leu Ser Ser Phe Ser Arg Tyr His Glu
            740                 745                 750

Leu Glu Tyr Thr His Thr Asp Thr Glu Ser Phe Leu Val Asn Ser Leu
        755                 760                 765

Thr Gly Glu Ile Leu Lys Arg Phe Pro Tyr Pro Trp Glu Asp Phe Arg
    770                 775                 780

Pro Glu Leu Met Ala Arg Leu Ser Asp Asn Pro Ala Asp Ala Leu Arg
785                 790                 795                 800

Lys Leu Asn Leu Ile Phe Tyr His Gly Ile Asp Leu Ser Thr Ile Lys
               805                 810                 815

Pro Ile Phe Val Ser Arg Met Pro Arg His Lys Val Thr Gly Ala Ala
            820                 825                 830

His Lys Ala Thr Ile Lys Ser Ala Arg Cys Leu Asp Asn Gly Ile Val
        835                 840                 845

Ile Cys Lys Thr Ser Leu Gln Asn Leu Lys Leu Asp Lys Glu Gly Glu
    850                 855                 860

Ile Ala Asn Tyr Tyr Ala Pro Glu Ser Asp Thr Ile Leu Tyr Asn Ala
865                 870                 875                 880

Leu Lys Glu Arg Leu Arg Ser Tyr Asp Asn Lys Pro Ala Lys Ala Phe
               885                 890                 895

Ala Glu Pro Phe Tyr Lys Pro Lys Ala Asp Gly Thr Pro Gly Pro Leu
            900                 905                 910

Val Lys Lys Val Lys Val Tyr Glu Lys Ser Thr Leu Asn Val Ala Val
```

```
        915                 920                 925

Gln Gln Asn Thr Ala Val Ala Asp Asn Asp Ser Met Val Arg Val Asp
    930                 935                 940

Val Phe His Val Lys Gly Asn Gly Tyr Tyr Leu Val Pro Ile Tyr Ile
945                 950                 955                 960

Ala Asp Thr Leu Lys Lys Glu Leu Pro Asn Lys Ala Ile Val Ala Tyr
                965                 970                 975

Lys Pro Tyr Ala Asp Trp Pro Val Met Asp Asp Ser Asn Phe Ile Phe
            980                 985                 990

Ser Leu Tyr Pro Asn Asp Leu Ile  Lys Phe Glu His Lys  Asn Ser Val
        995                 1000                1005

Lys Phe  Ala Lys Val Asn Lys  Glu Ser Thr Leu Asn  Asp Phe Tyr
    1010                1015                1020

Ser Thr  Lys Ser Glu Ile Val  Tyr Phe Lys Gly Cys  Asn Ile Asn
    1025                1030                1035

Thr Gly  Ala Ile Thr Ile Ile  Asn His Glu Asn Thr  Tyr Val Val
    1040                1045                1050

Ser Ser  Leu Gly Val Lys Thr  Leu Pro Ser Leu Glu  Lys Tyr Gln
    1055                1060                1065

Ala Asp  Val Leu Gly Asn Tyr  Thr Lys Val Lys Lys  Glu Val Arg
    1070                1075                1080

Lys Pro  Phe Arg
    1085
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<210> 202
<211> 1375
<212> PRT

<213> Lactobacillus ruminis

<400> 202

```
Met Arg Lys Asn Gln Glu Pro Tyr Asn Ile Gly Leu Asp Ile Gly Thr
1               5                   10                  15


Ser Ser Ile Gly Trp Ser Ile Met Asn Asp Asn Phe Asp Leu Met Arg
            20                  25                  30


Val Lys Gly Lys Lys Gly Ile Gly Val Arg Leu Tyr Asn Glu Gly Gln
        35                  40                  45


Ser Ala Ala Glu Arg Arg Met His Arg Thr Ala Arg Arg Arg Tyr Gly
    50                  55                  60


Arg Arg Lys Trp Arg Leu Arg Leu Leu Glu Asp Phe Phe Asp Glu His
65                  70                  75                  80


Met Ala Glu Val Asp Asp Thr Phe Phe Ala Arg Leu Lys Asp Ser Asn
                85                  90                  95


Ile Ser Pro Lys Asp Asp Lys Lys Tyr Arg Lys Ser Leu Leu Phe Pro
            100                 105                 110


Lys Ser Lys Gly Val Thr Tyr Gln Asp Asp Gly Glu Phe Tyr Lys Lys
        115                 120                 125


Tyr Pro Thr Met Tyr His Leu Arg Tyr Ala Leu Met Thr Glu His Arg
    130                 135                 140


Lys Phe Asp Leu Arg Glu Ile Tyr Leu Ala Phe His His Met Val Lys
145                 150                 155                 160


Tyr Arg Gly Asn Phe Leu Tyr Asp Thr Ser Val Asp Ser Phe Glu Ala
                165                 170                 175


Lys Asn Leu Asp Ile Lys Gly Lys Phe Asp Glu Ile Asn Asp Leu Leu
            180                 185                 190
```

```
Ser Ser Tyr Thr Asp Phe Tyr Val Asp Asn Ser Asn Ala Ala Leu Val
        195                 200                 205

Glu Ser Ile Leu Leu Glu Lys Asn Thr Thr Arg Lys Asp Lys Ser Lys
    210                 215                 220

Lys Ile Ala Lys Leu Leu His Val Glu Asp Lys Glu Lys Gly Lys Asn
225                 230                 235                 240

Lys Lys Ala Lys Asp Leu Ala Thr Gln Ile Ser Asn Ala Val Leu Gly
                245                 250                 255

Leu Lys Cys Asn Phe His Leu Ile Phe Glu Leu Gln Gln Lys Tyr Ser
            260                 265                 270

Phe Asp Leu Cys Ser Glu Lys Thr Glu Glu Asn Ile Ala Lys Leu Ser
        275                 280                 285

Glu Val Leu Asp Glu Asn Gln Lys Met Leu Leu Met Ile Leu Lys Glu
    290                 295                 300

Val Gln Asp Gln Val Met Leu Asn Ala Phe Val Pro Ser Gly Met Ser
305                 310                 315                 320

Leu Ser Glu Ala Met Met Gln Lys Tyr Asp Asp Tyr Gly Glu Gln Leu
                325                 330                 335

Lys Ile Tyr His Glu Leu Glu His Ser Val Ser Asp Asp Ser Ala Ala
            340                 345                 350

Lys Leu Arg Gly Ala Tyr Arg Asp Tyr Asn Asp Asn Ile Ile Lys Arg
        355                 360                 365

Ile Asp Gly Asp Asn Lys Lys Asp Thr Phe Tyr Lys Arg Val Lys Asn
    370                 375                 380
```

```
Ile Leu Thr Lys Ile Ser Lys Glu Tyr Val Asp Gln Asp Val Leu Glu
385                 390                 395                 400

Ser Cys Gly Lys Leu Lys Lys Leu Ile Asp Glu Asn Lys Leu Phe Ile
                405                 410                 415

Arg Gln Arg Thr Ala Ala Asn Gly Val Leu Pro His Gln Leu His Gln
            420                 425                 430

Ile Glu Met Arg Lys Ile Ile Asp Asn Gln Lys Glu Tyr Tyr Pro Trp
        435                 440                 445

Leu Ala Glu Pro Asn Pro Asn Glu Lys Arg Arg Val Tyr Ser Lys Tyr
    450                 455                 460

Lys Val Glu Glu Leu Ile Ala Phe Arg Ile Pro Tyr Tyr Val Gly Pro
465                 470                 475                 480

Leu Val Asp Pro Asn Asn Ala Asp Lys Asn Lys Glu Ala Arg Phe Ser
                485                 490                 495

Trp Met Val Arg Lys Lys Asp Gly Glu Ile Thr Pro Trp Asn Phe Tyr
            500                 505                 510

Asp Lys Val Asp Trp Ala Glu Ser Ala Asn Asn Phe Ile Glu Arg Met
        515                 520                 525

Lys Ser Lys Asp Thr Tyr Leu Leu Gly Glu Asp Val Val Pro Lys Glu
    530                 535                 540

Ser Met Leu Tyr Gln Lys Tyr Glu Val Leu Asn Glu Leu Asn Asn Leu
545                 550                 555                 560

Arg Ile Asn Asp Ser Gly Leu Ser Asp Ser Phe Glu Asp Val Lys Leu
                565                 570                 575

Lys Gln Ala Ile Tyr Asn Asp Leu Phe Lys Lys Gln Lys Ile Val Lys
            580                 585                 590
```

```
Ile Thr Asp Leu Gln Asn Tyr Leu Val Gln Asn His Lys Tyr Leu Val
        595                 600                 605

Lys Pro Lys Ile Ser Gly Leu Ala Asp Glu Asn Arg Phe Leu Ser Ser
    610                 615                 620

Leu Ser Thr Tyr Ser Asp Leu Lys Thr Ile Phe Gly Asp Lys Val Asp
625                 630                 635                 640

Asp Arg Thr Tyr Phe Asn Asp Phe Glu Lys Met Val Glu Tyr Ser Thr
                645                 650                 655

Val Phe Glu Asp Gly His Asp Tyr Asn Gln Lys Leu Asp Glu Tyr Thr
            660                 665                 670

Trp Leu Thr Lys Glu Glu Lys Tyr Lys Ile Gly Lys Lys Arg Tyr Arg
        675                 680                 685

Gly Trp Gly Lys Leu Ser Lys Lys Leu Leu Thr Gly Leu Arg Asp Lys
    690                 695                 700

Asn Asn His Thr Ile Met Asp Asn Leu Trp Glu Thr Asn Arg Asn Phe
705                 710                 715                 720

Met Gln Ile Gln Thr Ala Asp Glu Phe Ser Lys Gln Ile Ala Glu Glu
                725                 730                 735

Asn Glu Arg His Leu Lys Gly Ser Val Ser Asp Ala Ile Asn Asp Met
            740                 745                 750

Tyr Thr Ser Pro Ala Asn Lys Lys Ala Ile Arg Gln Val Leu Arg Val
        755                 760                 765

Val Asp Asp Ile Gln Lys Ala Met Gly Tyr Ala Pro Ser Ser Ile Ser
    770                 775                 780
```

```
Leu Glu Phe Ala Arg Glu Asp Gly Pro Ser Val Arg Thr Val Ser Arg
785                 790                 795                 800

Ala Asn Arg Met Lys Ser Ile Tyr Glu Lys Tyr Ala Ser Glu Val Ser
                805                 810                 815

Glu Glu Val Met Lys Asp Leu Asp Gly Val Ile Lys Asp Lys Lys Gly
            820                 825                 830

Leu Asn Asp Arg Leu Tyr Leu Tyr Phe Glu Gln Gln Gly Lys Asp Met
        835                 840                 845

Tyr Ser Gly His Pro Leu Asp Phe Asp Lys Val Ile Ser Gly Gln Glu
    850                 855                 860

Tyr Asp Ile Asp His Ile Leu Pro Gln Ala Val Ile Lys Asp Asp Ser
865                 870                 875                 880

Leu Asp Asn Arg Val Leu Thr Thr Lys Ala Leu Asn Asn Asp Val Lys
                885                 890                 895

Ser Lys Gly Val Pro Cys Arg Met Phe Asn Gly Met His Ser Phe Trp
            900                 905                 910

Lys Asn Leu Tyr Asp Lys Gly Phe Ile Ser Arg Arg Lys Phe Asn Asn
        915                 920                 925

Leu Thr Thr Asn Pro Glu Asn Ile Asp Lys Tyr Lys Met Lys Gly Phe
    930                 935                 940

Val Asn Arg Gln Leu Val Glu Thr Arg Gln Ile Ile Lys Leu Val Ala
945                 950                 955                 960

Asn Val Leu Asn Asp Lys Tyr Gln Asn Asp Asp Val Asp Ile Ile Glu
                965                 970                 975

Val Arg Ala Glu Leu Thr His Asp Val Arg Lys His Phe Lys Phe Tyr
            980                 985                 990
```

```
Lys Asn Arg Asn Val Asn Asp Tyr  His His Ala Phe Asp  Ala Tyr Leu
        995                 1000                1005


Thr Ser  Phe Ile Gly His Tyr  Leu Phe Lys Lys Tyr  Pro Asn Leu
    1010                1015                1020


Arg Pro  Leu Phe Asp Tyr Asn  Asp Phe Met Lys Val  Ser Asp Asn
    1025                1030                1035


Val Phe  Lys Gln Leu Arg Gly  Asn Asn Phe Leu Gly  Glu Phe Leu
    1040                1045                1050


Asn Lys  Thr Gly Asp Ile Ile  Ser Thr Asp Gly Asn  Phe Val Leu
    1055                1060                1065


Asn Lys  Glu Glu Met Ile Asn  Lys Leu Asn Lys Ala  Tyr Ala Phe
    1070                1075                1080


Lys Lys  Ile Leu Val Thr Lys  Glu Val Gly Gln Arg  Thr Gly Ala
    1085                1090                1095


Met Phe  Asn Glu Thr Arg Tyr  Pro Ala Pro Asn Ser  Arg Lys Ala
    1100                1105                1110


Ala Leu  Lys Tyr Arg Arg Met  Pro Lys Pro Asp Ser  Leu Ile Ser
    1115                1120                1125


Val Lys  Asp Tyr Lys Asn Thr  Asp Ile Tyr Gly Gly  Tyr Ser Gly
    1130                1135                1140


Lys Asn  Asp Ala Tyr Met Val  Ile Val Asp Met Gly  Lys Gln Tyr
    1145                1150                1155


Met Val  Val Gly Val Pro Val  Arg Tyr Thr Glu Lys  Leu Asp Lys
    1160                1165                1170
```

```
Leu Arg  Ile Lys His Ser Glu  Leu Tyr Arg Asp Glu  Leu Arg Lys
    1175                1180                1185

Val Leu  Ser Arg Asp Lys Thr  Leu Leu Asp Ser Lys  Gly Asn Val
    1190                1195                1200

Lys Arg  Phe Asp Ile Val Leu  Asp Arg Val Leu Tyr  Gly Gln Leu
    1205                1210                1215

Ile Glu  Asp Gly Asn Glu Leu  Phe Thr Leu Gly Ser  Ser Lys Tyr
    1220                1225                1230

Lys Arg  Asn Phe Arg Gln Leu  Phe Leu Asp Lys Gln  Cys Ile Glu
    1235                1240                1245

Ile Leu  Asp Ser Ser Ala Thr  Pro Gln Pro Thr Asp  Glu Glu Leu
    1250                1255                1260

Ile Trp  Val Tyr Asp Gln Ile  Leu Asp Lys Val Asp  Lys Tyr Phe
    1265                1270                1275

Glu Leu  Tyr Asp Ile Asn Arg  Gln Arg Glu Thr Leu  Arg Lys Gly
    1280                1285                1290

Arg Ala  Ala Phe Cys Ser Leu  Pro Asn Ile Ser Met  Lys Lys Asp
    1295                1300                1305

Asp Val  Thr Lys Lys Lys Ile  Leu Asn Glu Ile Leu  Val Ala Leu
    1310                1315                1320

His Ala  Asn Glu Ser Glu Ser  Asn Cys Glu Lys Ile  Gly Lys Lys
    1325                1330                1335

Val Phe  Gly Arg Leu Gln Val  Pro Gly Gly Ile Lys  Leu Ser Lys
    1340                1345                1350

Glu Ala  Lys Leu Ile Tyr Gln  Ser Pro Thr Gly Leu  Phe Glu Arg
    1355                1360                1365
```

```
Val Val  Tyr Leu Lys Asp Leu
    1370                1375


<210>  203
<211>  1391
<212>  PRT
<213>  Prevotella oralis

<400>  203

Met Lys Lys Ile Leu Gly Leu Asp Leu Gly Thr Thr Ser Ile Gly Trp
1               5                   10                  15


Ala Leu Val Asn Glu Lys Glu Asn Asn Glu Glu Leu Ser Ser Ile Ile
            20                  25                  30


Arg Leu Gly Val Arg Val Asn Pro Leu Thr Val Asp Glu Lys Ser Asn
        35                  40                  45


Phe Glu Lys Gly Lys Asp Ile Thr Thr Asn Ala Asp Arg Thr Lys Cys
    50                  55                  60


Arg Ser Ala Arg Arg Asn Leu Gln Arg Phe Lys Leu Arg Arg Glu Ala
65                  70                  75                  80


Leu Ala Asp Cys Leu Lys Arg His Gly Leu Met Thr Asp Glu Thr Pro
                85                  90                  95


Leu Cys Glu Thr Asn Asn Ser Ile Ile Phe Lys Thr Tyr Ser Asn Arg
            100                 105                 110


Ala Lys Ala Val Cys Glu Lys Ile Ala Leu Asp Asp Phe Val Arg Val
        115                 120                 125


Leu Phe Met Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Leu
    130                 135                 140


Asn Thr Asp Asp Glu Gly Thr Leu Val Asp Gly Met Asp Val Ala Lys
```

```
145                 150                 155                 160

Leu Leu Tyr Asn Glu Gln Ile Thr Pro Gly Glu Tyr Leu Leu Arg Leu
                165                 170                 175

Phe Lys Lys Gly Lys Lys Thr Arg Pro Asp Phe Tyr Leu Ser Asp Leu
            180                 185                 190

Lys Ala Glu Leu Glu Arg Ile Trp Asp Phe Gln Arg Thr Phe Tyr Pro
        195                 200                 205

Glu Ile Leu Cys Asn Ala Leu Lys Glu Asp Leu Lys Gly Lys Ser Arg
    210                 215                 220

Thr Gln Ser Ser Ala Ile Phe Tyr Ala Lys Tyr Lys Val Ser Thr Ala
225                 230                 235                 240

Lys Ile Ala Gly Lys Asp Lys Arg Leu Gln Glu Leu Thr Trp Arg Thr
                245                 250                 255

Asp Ala Leu Arg Lys Gln Leu Thr Ile Asp Glu Val Ala Tyr Val Ile
            260                 265                 270

Cys Ser Ile Asn Gly Glu Val Asn Gly Ser Ser Gln Arg Leu Ser Met
        275                 280                 285

Ile Ser Asp Arg Ser Lys Leu Leu Tyr Phe Asn His Gln Thr Ile Gly
    290                 295                 300

Gln Tyr Leu Met Gln Arg Leu Glu Glu Asn Pro Asn Ala Gly Leu Lys
305                 310                 315                 320

Asn Ile Ile Phe Tyr Arg Gln Asp Tyr Glu Asp Glu Phe Asn Asp Ile
                325                 330                 335

Trp Asn Ser Gln Ala Thr Tyr His Lys Glu Leu Thr Pro Glu Leu Lys
            340                 345                 350
```

```
Lys Glu Val Lys Asp Ile Ile Phe Tyr Gln Arg Gly Leu Lys Ser Cys
        355                 360                 365

Lys Trp Leu Ile Asn Tyr Cys Glu Leu Glu His Glu Glu Ile Glu Val
    370                 375                 380

Lys Thr Pro Glu Gly Lys Leu Arg Lys Ile Thr Ile Gly Ser Lys Thr
385                 390                 395                 400

Cys Pro Lys Ser Ser Pro Leu Phe Gln Glu Phe Lys Ile Trp Gln Val
                405                 410                 415

Leu Asn Asn Leu Gln Val Ser Pro Leu Asn Ser Arg Arg Lys Ala Lys
            420                 425                 430

Arg Lys Lys Asp Glu Glu Pro Ser Leu Phe Ser Asp Glu Asp Met Asn
        435                 440                 445

Thr Ala Cys Arg Tyr Leu Asn Glu Glu Glu Lys Leu Thr Leu Phe Lys
    450                 455                 460

Glu Leu Ser Ile Lys Lys Glu Leu Lys Lys Lys Asp Ala Leu Lys Leu
465                 470                 475                 480

Leu Phe Glu Asn Tyr Lys Glu Leu Asp Leu Asn Tyr Lys Val Ile Ser
                485                 490                 495

Gly Asn Val Thr Met Ala Asn Leu Tyr Arg Ala Phe Gln Asp Ile Ile
            500                 505                 510

Ser Leu Thr Gly Asn Gly Glu Phe Asp Phe Gln Ala Met Pro Ala Glu
        515                 520                 525

Glu Ala Glu Lys Thr Val Glu Glu Ile Phe Gly Gly Leu Gly Tyr Lys
    530                 535                 540

Thr Ala Phe Leu His Phe Asp Ala Ser Leu His Asp Lys Glu Phe Glu
```

```
545                 550                 555                 560

Arg Gln Pro Ala Tyr Arg Leu Trp His Leu Leu Tyr Ser Tyr Ala Gly
                565                 570                 575

Asp Gln Ser Lys Thr Gly Ile Glu Ala Leu Val Lys Arg Ile Gln Glu
            580                 585                 590

Leu Cys Gly Phe Glu Pro Glu Tyr Ala Arg Ile Leu Ala Asn Ile Ser
        595                 600                 605

Phe Ile Pro Asp Tyr Gly Asn Leu Ser Ser Lys Ala Met Arg Lys Ile
    610                 615                 620

Leu Pro Tyr Met Gln Asp Gly Tyr Glu Tyr Ser Glu Ala Cys Ser Lys
625                 630                 635                 640

Ala Gly Tyr Arg His Ser Ala Ser Ser Leu Thr Lys Glu Glu Ile Asn
                645                 650                 655

Lys Lys Asn Tyr Lys Thr His Leu Asp Glu Ile Lys Arg Asn Ser Leu
            660                 665                 670

Arg Asn Pro Ile Val Glu Lys Ile Leu Asn Gln Met Val Asn Val Val
        675                 680                 685

Asn Ser Val Ile Asp Thr Tyr Ser Asn Ile Asp Glu Ile Arg Ile Glu
    690                 695                 700

Met Ala Arg Glu Leu Lys Lys Ser Lys Pro Glu Arg Glu Asp Met Ser
705                 710                 715                 720

Phe Ala Ile Ser Lys Ala Thr Lys Glu Thr Glu Arg Ile Lys Gly Ile
                725                 730                 735

Leu Glu Gln Glu Phe Lys Ile Gln His Val Thr Arg Asn Asp Ile Ile
            740                 745                 750
```

```
Arg Tyr Arg Leu Tyr Glu Glu Leu Lys Pro Asn Gly Tyr Lys Thr Leu
        755                 760                 765

Tyr Ser Asn Thr Tyr Ile Pro Arg Glu Asp Leu Phe Ser Lys Lys Phe
    770                 775                 780

Asp Ile Glu His Ile Ile Pro Lys Ala Arg Leu Phe Asp Asp Ser Tyr
785                 790                 795                 800

Ser Asn Lys Thr Leu Glu Leu Arg Asp Ile Asn Ile Glu Lys Gly Asn
                805                 810                 815

Gln Thr Ala Tyr Asp Phe Val Leu Ser Lys Tyr Gly Glu Glu Gly Leu
            820                 825                 830

Tyr Lys Tyr Glu Gln Arg Val Glu Glu Phe Lys Lys Asn Asn Glu Gln
        835                 840                 845

Ala Gly Thr Lys Cys Arg Lys Leu Leu Met Arg Glu Ala Asp Ile Pro
    850                 855                 860

Ser Asp Phe Leu Asn Arg Asp Leu Asn Asp Ser Gln Tyr Ile Ala Lys
865                 870                 875                 880

Lys Ala His Glu Leu Leu Arg Glu Ile Val Pro Thr Val Thr Ala Thr
                885                 890                 895

Thr Gly Ser Ile Thr Asn Arg Leu Arg Glu Asp Trp Lys Leu Val Asn
            900                 905                 910

Val Met Lys Glu Leu Asn Trp Glu Lys Tyr Asp Lys Leu Gly Leu Thr
        915                 920                 925

Glu Glu Tyr Lys Asp Lys Asp Gly Asn Thr Val Arg His Ile Lys Asp
    930                 935                 940

Trp Thr Lys Arg Asn Asp His Arg His His Ala Met Asp Ala Leu Thr
```

945 950 955 960

Ile Ala Phe Thr Lys Pro Ser Phe Ile Gln Tyr Leu Asn Asn Leu Asn
965 970 975

Ala Arg Ser Asn Arg Gly Gly Ser Ile Tyr Gly Ile Glu Gln Lys Glu
980 985 990

Leu Glu Arg Glu Asn Asn Lys Leu Val Phe Ile Pro Pro Ile Asp Pro
995 1000 1005

Lys Ile Phe Arg Lys Gln Ala Lys Glu His Leu Ser Asn Ile Leu
1010 1015 1020

Ile Ser Ile Lys Ala Lys Asn Lys Val Val Thr Lys Asn Val Asn
1025 1030 1035

Lys Thr Lys Ser Lys Ser Gly Thr Asn Arg Lys Val Gln Leu Thr
1040 1045 1050

Pro Arg Gly Gln Leu His Leu Glu Thr Val Tyr Gly Lys Ile Arg
1055 1060 1065

Thr Tyr Lys Thr Glu Glu Ile Lys Val Gly Thr Lys Leu Thr Glu
1070 1075 1080

Glu Leu Ile Ala Lys Val Ala Asp Lys Lys Ile Arg Glu Ala Leu
1085 1090 1095

Met Gln Arg Leu Ser Glu Tyr Gly Gly Asn Ile Lys Lys Ala Phe
1100 1105 1110

Gln Asn Ile Ser Lys His Pro Ile Trp Leu Asn Gly Ser His Thr
1115 1120 1125

Lys His Val Pro Glu Lys Val Lys Ile Val Phe Phe Glu Asp Val
1130 1135 1140

```
Phe Thr  Ile Arg Lys Ala Ile  Thr Pro Asp Ile Lys  Ile Asp Lys
    1145                1150                1155

Val Ile  Asp Ser Lys Ile Arg  Arg Ile Leu Gln Glu  Arg Leu Asn
    1160                1165                1170

Glu Phe  Gly Gly Glu Ala Ser  Lys Ala Phe Ser Asn  Leu Asp Glu
    1175                1180                1185

Asn Pro  Ile Trp Phe Asn Arg  Asp Lys Gly Ile Ala  Ile Lys Ser
    1190                1195                1200

Val Lys  Ile Arg Gly Ile Ala  Lys Gly Thr Ala Ile  Arg Val Lys
    1205                1210                1215

Lys Asp  Ile His Gly Lys Thr  Ile Ile Gly Asn Asn  Gly Tyr Pro
    1220                1225                1230

Val Ala  Asn Asp Tyr Val Asn  Thr Gly Asn Asn His  His Val Ala
    1235                1240                1245

Ile Phe  Arg Asp Lys Asp Gly  Asn Leu Gln Glu His  Ile Val Ser
    1250                1255                1260

Phe Tyr  Glu Ala Thr Ala Arg  Ala Ile Gln Asn Leu  Pro Ile Val
    1265                1270                1275

Asp Arg  Asn Tyr Asn Ser Glu  Lys Asp Trp Lys Phe  Leu Phe Ser
    1280                1285                1290

Met Lys  Gln Asn Glu Tyr Phe  Val Phe Pro Asn Pro  Asn Thr Gly
    1295                1300                1305

Phe Asn  Pro Ser Glu Ile Ser  Leu Lys Asp Glu Lys  Asn Tyr Ala
    1310                1315                1320

Leu Ile  Ser Pro Asn Leu Phe  Arg Val Gln Lys Leu  Ser His Tyr
```

```
    1325                1330                1335

Tyr Tyr  Val Phe Arg His His  Leu Glu Thr Asn Val  Asp Thr Asn
    1340                1345                1350

Leu Gln  Leu Lys Asp Ile Thr  Trp Lys Arg Ile Thr  Ala Val Asn
    1355                1360                1365

Asn Leu  Thr Gly Ala Val Lys  Val Arg Ile Asp His  Leu Gly Arg
    1370                1375                1380

Ile Val  Asp Val Gly Glu Tyr  Lys
    1385                1390
```

<210> 204
<211> 1167
<212> PRT
<213> Streptococcus sanguinis

<400> 204

```
Met Leu Phe Gly Leu Lys Thr Lys Phe Lys Asp Cys Phe Glu Leu Glu
1               5                   10                  15

Glu Glu Pro Asp Leu Asn Phe Ser Lys Glu Asn Tyr Asp Asp Asn Leu
            20                  25                  30

Glu Lys Leu Leu Gly Glu Leu Gly Glu Asp Phe Ser Asp Val Phe Asp
        35                  40                  45

Lys Leu Lys Ile Leu Arg Asp Thr Ile Leu Leu Ser Gly Met Leu Thr
    50                  55                  60

Tyr Thr Gly Ala Thr His Ala Arg Phe Ser Ala Thr Met Val Glu Arg
65                  70                  75                  80

Tyr Glu Glu His Arg Lys Asp Leu Gln Arg Phe Lys Ser Phe Ile Lys
                85                  90                  95
```

```
Gln Asn Leu Ser Glu Gln Asp Tyr Leu Asp Ile Phe Gly Arg Lys Thr
            100                 105                 110

Gln Asn Gly Phe Asp Val Asp Lys Glu Thr Lys Gly Tyr Val Gly Tyr
        115                 120                 125

Ile Thr Asn Lys Met Val Leu Thr Asn Pro Gln Lys Gln Lys Thr Ile
    130                 135                 140

Gln Gln Asn Phe Tyr Asp Tyr Ile Ser Gly Lys Ile Thr Gly Ile Glu
145                 150                 155                 160

Gly Ser Glu Tyr Phe Leu Asn Lys Ile Ser Asp Arg Thr Phe Leu Arg
                165                 170                 175

Lys Leu Arg Thr Ser Asp Asn Gly Ala Ile Pro Asn Gln Ile His Ala
            180                 185                 190

Tyr Glu Leu Glu Lys Ile Ile Glu Arg Gln Gly Lys Asp Tyr Pro Phe
        195                 200                 205

Leu Leu Glu Asn Lys Asp Lys Leu Leu Ser Ile Leu Thr Phe Lys Ile
    210                 215                 220

Pro Tyr Tyr Val Gly Pro Leu Ala Lys Gly Asn Asn Ser Arg Phe Ala
225                 230                 235                 240

Trp Ile Lys Arg Ala Asn Ser Ser Asp Ile Leu Asp Asp Asn Asp Glu
                245                 250                 255

Asp Thr Arg Asn Gly Lys Ile Arg Pro Trp Asn Tyr His Lys Leu Ile
            260                 265                 270

Asn Met Asp Glu Thr Arg Asp Ala Phe Ile Thr Asn Leu Ile Gly Asn
        275                 280                 285

Asp Thr Ile Leu Leu Asn Glu Lys Val Leu Pro Lys Arg Ser Leu Ile
    290                 295                 300
```

```
Tyr Glu Glu Val Met Leu Gln Asn Glu Leu Thr Arg Val Lys Tyr Lys
305                 310                 315                 320

Asp Lys Tyr Gly Lys Ala His Phe Phe Asp Ser Glu His Arg Gln Asn
                325                 330                 335

Ile Ile Asn Gly Leu Phe Lys Ile Asn Ser Lys Arg Val Asn Ala Glu
            340                 345                 350

Arg Leu Ile Lys Tyr Leu Ser Asp Asn His Lys Asp Leu Asn Ala Ile
        355                 360                 365

Glu Ile Val Ser Gly Val Glu Lys Gly Lys Ser Phe Asn Ser Thr Leu
    370                 375                 380

Lys Thr Tyr Asn Asp Phe Lys Thr Ile Phe Ser Glu Glu Phe Leu Asp
385                 390                 395                 400

Ser Glu Ile Tyr Gln Lys Glu Leu Glu Glu Ile Ile Lys Val Ile Thr
                405                 410                 415

Val Phe Asp Asp Lys Lys Ser Ile Lys Asn Tyr Leu Thr Lys Tyr Phe
            420                 425                 430

Gly His Leu Glu Phe Leu Asp Glu Glu Lys Ile Asn Gln Leu Ser Lys
        435                 440                 445

Leu Arg Tyr Thr Gly Trp Gly Arg Tyr Ser Ala Lys Leu Leu Leu Asp
    450                 455                 460

Ile Arg Asp Glu Asp Thr Gly Phe Asn Leu Leu Gln Phe Leu Arg Asn
465                 470                 475                 480

Asp Glu Glu Asn Arg Asn Leu Thr Asn Leu Ile Ser Asp Asn Thr Leu
                485                 490                 495
```

```
Ser Phe Asp Pro Lys Ile Lys Ala Ile Gln Ser Lys Ser Thr Val Glu
            500                 505                 510

Asp Asp Val Phe Asp Glu Ile Lys Lys Leu Ala Gly Ser Pro Ala Ile
        515                 520                 525

Lys Arg Gly Ile Leu Asn Ser Ile Lys Ile Val Asp Glu Leu Val Gln
    530                 535                 540

Ile Ile Gly Tyr Pro Pro Gln Asn Ile Val Ile Glu Met Ala Arg Glu
545                 550                 555                 560

Asn Met Thr Thr Glu Glu Gly Gln Lys Lys Thr Lys Thr Arg Lys Ser
                565                 570                 575

Lys Leu Glu Ser Ala Leu Lys Asn Ile Glu Asn Ser Val Leu Glu Asn
            580                 585                 590

Gly Lys Val Leu His Ser Asp Glu Gln Leu Gln Ser Glu Lys Leu Tyr
        595                 600                 605

Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Ile Tyr Ser Leu Asp Glu Thr
    610                 615                 620

Gly Ser Pro Ala Pro Ile Tyr Leu Asp Gln Leu Asp Gln Tyr Glu Val
625                 630                 635                 640

Asp His Ile Ile Pro Tyr Ser Phe Leu Pro Ile Asp Ser Ile Asp Asn
                645                 650                 655

Lys Val Leu Thr His Arg Lys Asn Asn Gln Arg Lys Leu Asp Asn Ile
            660                 665                 670

Pro Asp Lys Glu Thr Val Ala His Met Lys Pro Phe Trp Glu Ala Leu
        675                 680                 685

Tyr Asn Ala Lys Leu Ile Ser Gln Thr Lys Tyr Gln Arg Leu Thr Thr
    690                 695                 700
```

```
Ser Glu Arg Thr Pro Asp Gly Val Leu Thr Glu Ser Met Lys Ala Gly
705                 710                 715                 720


Phe Ile Glu Arg Gln Leu Val Glu Thr Arg Gln Ile Ile Lys His Val
                725                 730                 735


Ala Arg Ile Leu Asp Asn Arg Phe Ser Asp Thr Lys Ile Ile Thr Leu
            740                 745                 750


Lys Ser Gln Leu Val Thr Asn Phe Arg Asn Thr Phe His Ile Ala Lys
        755                 760                 765


Ile Arg Glu Leu Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Ala
    770                 775                 780


Val Val Val Gly Gln Thr Leu Leu Lys Ala Tyr Pro Lys Leu Ala Pro
785                 790                 795                 800


Glu Leu Ile Tyr Gly His His Val His Phe Asn Arg His Glu Glu Asn
                805                 810                 815


Lys Ala Thr Leu Arg Lys His Leu Tyr Ser Asn Ile Met Arg Phe Phe
            820                 825                 830


Asn Asn Pro Asp Ser Lys Val Ser Lys Asp Ile Trp Asp Cys Asn Arg
        835                 840                 845


Asp Leu Pro Ile Ile Lys His Val Ile Tyr Asn Ser Gln Ile Asn Phe
    850                 855                 860


Val Lys Arg Thr Met Ile Lys Lys Gly Ala Phe Tyr Asn Gln Asn Pro
865                 870                 875                 880


Val Gly Lys Phe Asn Lys Gln Leu Ala Ala Asn Asn Arg Tyr Pro Leu
                885                 890                 895
```

```
Lys Thr Lys Ala Leu Cys Leu Asp Thr Ser Ile Tyr Gly Gly Tyr Gly
            900                 905                 910

Pro Met Asn Ser Thr Leu Ser Ile Ile Ile Ile Ala Glu Arg Phe Asn
        915                 920                 925

Glu Lys Lys Gly Lys Ile Glu Thr Val Lys Glu Phe His Asp Ile Phe
    930                 935                 940

Ile Ile Asp Tyr Glu Lys Phe Asn Asn Asn Pro Phe Gln Phe Leu Asn
945                 950                 955                 960

Asp Thr Ser Glu Asn Gly Phe Leu Lys Lys Asn Asn Ile Asn Arg Val
                965                 970                 975

Leu Gly Phe Tyr Arg Ile Pro Lys Tyr Ser Leu Met Gln Lys Ile Asp
            980                 985                 990

Gly Thr Arg Met Leu Phe Glu Ser  Lys Leu Asn Leu His  Lys Ala Thr
        995                 1000                1005

Gln Phe  Lys Leu Thr Lys Thr  Gln Asn Glu Leu Phe  Phe His Met
    1010                1015                1020

Lys Arg  Leu Leu Thr Asn Ser  Asn Leu Met Asp Leu  Lys Ser Glu
    1025                1030                1035

Ser Ala  Ile Lys Glu Ser Gln  Asn Phe Ile Leu Lys  His Lys Glu
    1040                1045                1050

Glu Phe  Asp Asn Ile Ser Asn  Gln Leu Ser Ala Phe  Ser Gln Lys
    1055                1060                1065

Met Leu  Gly Asn Thr Thr Ser  Leu Lys Asn Leu Ile  Lys Gly Tyr
    1070                1075                1080

Asn Glu  Arg Lys Ile Lys Glu  Ile Asp Ile Arg Glu  Glu Thr Ile
    1085                1090                1095
```

```
Lys Tyr  Phe Tyr Asp Asn Phe  Ile Lys Met Phe Ser  Phe Val Lys
    1100                1105                1110


Ser Gly  Ala Pro Lys Asp Ile  Asn Asp Phe Phe Asp  Asn Lys Tyr
    1115                1120                1125


Thr Val  Ala Arg Met Arg Pro  Lys Pro Asp Lys Arg  Leu Leu Asn
    1130                1135                1140


Ala Thr  Leu Ile His Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg
    1145                1150                1155


Ile Asp  Leu Ser Lys Leu Gly  Glu Asp
    1160                1165
```

<210> 205
<211> 1334
<212> PRT
<213> Staphylococcus pseudintermedius

<400> 205

```
Met Gly Arg Lys Pro Tyr Ile Leu Ser Leu Asp Ile Gly Thr Gly Ser
1               5                   10                  15


Val Gly Tyr Ala Cys Met Asp Lys Gly Phe Asn Val Leu Lys Tyr His
            20                  25                  30


Asp Lys Asp Ala Leu Gly Val Tyr Leu Phe Asp Gly Ala Leu Thr Ala
        35                  40                  45


Gln Glu Arg Arg Gln Phe Arg Thr Ser Arg Arg Arg Lys Asn Arg Arg
    50                  55                  60


Ile Lys Arg Leu Gly Leu Leu Gln Glu Leu Leu Ala Pro Leu Val Gln
65                  70                  75                  80


Asn Pro Asn Phe Tyr Gln Phe Gln Arg Gln Phe Ala Trp Lys Asn Asp
```

```
                85                  90                  95

Asn Met Asp Phe Lys Asn Lys Ser Leu Ser Glu Val Leu Ser Phe Leu
            100                 105                 110

Gly Tyr Glu Ser Lys Lys Tyr Pro Thr Ile Tyr His Leu Gln Glu Ala
        115                 120                 125

Leu Leu Leu Lys Asp Glu Lys Phe Asp Pro Glu Leu Ile Tyr Met Ala
    130                 135                 140

Leu Tyr His Leu Val Lys Tyr Arg Gly His Phe Leu Phe Asp His Leu
145                 150                 155                 160

Lys Ile Glu Asn Leu Thr Asn Asn Asp Asn Met His Asp Phe Val Glu
                165                 170                 175

Leu Ile Glu Thr Tyr Glu Asn Leu Asn Asn Ile Lys Leu Asn Leu Asp
            180                 185                 190

Tyr Glu Lys Thr Lys Val Ile Tyr Glu Ile Leu Lys Asp Asn Glu Met
        195                 200                 205

Thr Lys Asn Asp Arg Ala Lys Arg Val Lys Asn Met Glu Lys Lys Leu
    210                 215                 220

Glu Gln Phe Ser Ile Met Leu Leu Gly Leu Lys Phe Asn Glu Gly Lys
225                 230                 235                 240

Leu Phe Asn His Ala Asp Asn Ala Glu Glu Leu Lys Gly Ala Asn Gln
                245                 250                 255

Ser His Thr Phe Ala Asp Asn Tyr Glu Glu Asn Leu Thr Pro Phe Leu
            260                 265                 270

Thr Val Glu Gln Ser Glu Phe Ile Glu Arg Ala Asn Lys Ile Tyr Leu
        275                 280                 285
```

```
Ser Leu Thr Leu Gln Asp Ile Leu Lys Gly Lys Lys Ser Met Ala Met
    290                 295                 300

Ser Lys Val Ala Ala Tyr Asp Lys Phe Arg Asn Glu Leu Lys Gln Val
305                 310                 315                 320

Lys Asp Ile Val Tyr Lys Ala Asp Ser Thr Arg Thr Gln Phe Lys Lys
                325                 330                 335

Ile Phe Val Ser Ser Lys Lys Ser Leu Lys Gln Tyr Asp Ala Thr Pro
            340                 345                 350

Asn Asp Gln Thr Phe Ser Ser Leu Cys Leu Phe Asp Gln Tyr Leu Ile
        355                 360                 365

Arg Pro Lys Lys Gln Tyr Ser Leu Leu Ile Lys Glu Leu Lys Lys Ile
    370                 375                 380

Ile Pro Gln Asp Ser Glu Leu Tyr Phe Glu Ala Glu Asn Asp Thr Leu
385                 390                 395                 400

Leu Lys Val Leu Asn Thr Thr Asp Asn Ala Ser Ile Pro Met Gln Ile
                405                 410                 415

Asn Leu Tyr Glu Ala Glu Thr Ile Leu Arg Asn Gln Gln Lys Tyr His
            420                 425                 430

Ala Glu Ile Thr Asp Glu Met Ile Glu Lys Val Leu Ser Leu Ile Gln
        435                 440                 445

Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Val Asn Asp His Thr Ala
    450                 455                 460

Ser Lys Phe Gly Trp Met Glu Arg Lys Ser Asn Glu Ser Ile Lys Pro
465                 470                 475                 480

Trp Asn Phe Asp Glu Val Val Asp Arg Ser Lys Ser Ala Thr Gln Phe
```

```
                485                 490                 495

Ile Arg Arg Met Thr Asn Lys Cys Ser Tyr Leu Ile Asn Glu Asp Val
            500                 505                 510

Leu Pro Lys Asn Ser Leu Leu Tyr Gln Glu Met Glu Val Leu Asn Glu
        515                 520                 525

Leu Asn Ala Thr Gln Ile Arg Leu Gln Thr Asp Pro Lys Asn Arg Lys
    530                 535                 540

Tyr Arg Met Met Pro Gln Ile Lys Leu Phe Ala Val Glu His Ile Phe
545                 550                 555                 560

Lys Lys Tyr Lys Thr Val Ser His Ser Lys Phe Leu Glu Ile Met Leu
                565                 570                 575

Asn Ser Asn His Arg Glu Asn Phe Met Asn His Gly Glu Lys Leu Ser
            580                 585                 590

Ile Phe Gly Thr Gln Asp Asp Lys Lys Phe Ala Ser Lys Leu Ser Ser
        595                 600                 605

Tyr Gln Asp Met Thr Lys Ile Phe Gly Asp Ile Glu Gly Lys Arg Ala
    610                 615                 620

Gln Ile Glu Glu Ile Ile Gln Trp Ile Thr Ile Phe Glu Asp Lys Lys
625                 630                 635                 640

Ile Leu Val Gln Lys Leu Lys Glu Cys Tyr Pro Glu Leu Thr Ser Lys
                645                 650                 655

Gln Ile Asn Gln Leu Lys Lys Leu Asn Tyr Ser Gly Trp Gly Arg Leu
            660                 665                 670

Ser Glu Lys Leu Leu Thr His Ala Tyr Gln Gly His Ser Ile Ile Glu
        675                 680                 685
```

```
Leu Leu Arg His Ser Asp Glu Asn Phe Met Glu Ile Leu Thr Asn Asp
    690                 695                 700

Val Tyr Gly Phe Gln Asn Phe Ile Lys Glu Glu Asn Gln Val Gln Ser
705                 710                 715                 720

Asn Lys Ile Gln His Gln Asp Ile Ala Asn Leu Thr Thr Ser Pro Ala
                725                 730                 735

Leu Lys Lys Gly Ile Trp Ser Thr Ile Lys Leu Val Arg Glu Leu Thr
            740                 745                 750

Ser Ile Phe Gly Glu Pro Glu Lys Ile Ile Met Glu Phe Ala Thr Glu
        755                 760                 765

Asp Gln Gln Lys Gly Lys Lys Gln Lys Ser Arg Lys Gln Leu Trp Asp
    770                 775                 780

Asp Asn Ile Lys Lys Asn Lys Leu Lys Ser Val Asp Glu Tyr Lys Tyr
785                 790                 795                 800

Ile Ile Asp Val Ala Asn Lys Leu Asn Asn Glu Gln Leu Gln Gln Glu
                805                 810                 815

Lys Leu Trp Leu Tyr Leu Ser Gln Asn Gly Lys Cys Met Tyr Ser Gly
            820                 825                 830

Gln Ser Ile Asp Leu Asp Ala Leu Leu Ser Pro Asn Ala Thr Lys His
        835                 840                 845

Tyr Glu Val Asp His Ile Phe Pro Arg Ser Phe Ile Lys Asp Asp Ser
    850                 855                 860

Ile Asp Asn Lys Val Leu Val Ile Lys Lys Met Asn Gln Thr Lys Gly
865                 870                 875                 880

Asp Gln Val Pro Leu Gln Phe Ile Gln Gln Pro Tyr Glu Arg Ile Ala
```

```
               885                 890                 895

Tyr Trp Lys Ser Leu Asn Lys Ala Gly Leu Ile Ser Asp Ser Lys Leu
            900                 905                 910

His Lys Leu Met Lys Pro Glu Phe Thr Ala Met Asp Lys Glu Gly Phe
        915                 920                 925

Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Ser Val His Val Arg
    930                 935                 940

Asp Phe Leu Lys Glu Glu Tyr Pro Asn Thr Lys Val Ile Pro Met Lys
945                 950                 955                 960

Ala Lys Met Val Ser Glu Phe Arg Lys Lys Phe Asp Ile Pro Lys Ile
               965                 970                 975

Arg Gln Met Asn Asp Ala His His Ala Ile Asp Ala Tyr Leu Asn Gly
            980                 985                 990

Val Val Tyr His Gly Ala Gln Leu  Ala Tyr Pro Asn Val  Asp Leu Phe
        995                 1000                1005

Asp Phe  Asn Phe Lys Trp Glu  Lys Val Arg Glu Lys  Trp Lys Ala
    1010                1015                1020

Leu Gly  Glu Phe Asn Thr Lys  Gln Lys Ser Arg Glu  Leu Phe Phe
    1025                1030                1035

Phe Lys  Lys Leu Glu Lys Met  Glu Val Ser Gln Gly  Glu Arg Leu
    1040                1045                1050

Ile Ser  Lys Ile Lys Leu Asp  Met Asn His Phe Lys  Ile Asn Tyr
    1055                1060                1065

Ser Arg  Lys Leu Ala Asn Ile  Pro Gln Gln Phe Tyr  Asn Gln Thr
    1070                1075                1080
```

```
Ala Val  Ser Pro Lys Thr Ala  Glu Leu Lys Tyr Glu  Ser Asn Lys
    1085                1090                1095

Ser Asn  Glu Val Val Tyr Lys  Gly Leu Thr Pro Tyr  Gln Thr Tyr
    1100                1105                1110

Val Val  Ala Ile Lys Ser Val  Asn Lys Lys Gly Lys  Glu Lys Met
    1115                1120                1125

Glu Tyr  Gln Met Ile Asp His  Tyr Val Phe Asp Phe  Tyr Lys Phe
    1130                1135                1140

Gln Asn  Gly Asn Glu Lys Glu  Leu Ala Leu Tyr Leu  Ala Gln Arg
    1145                1150                1155

Glu Asn  Lys Asp Glu Val Leu  Asp Ala Gln Ile Val  Tyr Ser Leu
    1160                1165                1170

Asn Lys  Gly Asp Leu Leu Tyr  Ile Asn Asn His Pro  Cys Tyr Phe
    1175                1180                1185

Val Ser  Arg Lys Glu Val Ile  Asn Ala Lys Gln Phe  Glu Leu Thr
    1190                1195                1200

Val Glu  Gln Gln Leu Ser Leu  Tyr Asn Val Met Asn  Asn Lys Glu
    1205                1210                1215

Thr Asn  Val Glu Lys Leu Leu  Ile Glu Tyr Asp Phe  Ile Ala Glu
    1220                1225                1230

Lys Val  Ile Asn Glu Tyr His  His Tyr Leu Asn Ser  Lys Leu Lys
    1235                1240                1245

Glu Lys  Arg Val Arg Thr Phe  Phe Ser Glu Ser Asn  Gln Thr His
    1250                1255                1260

Glu Asp  Phe Ile Lys Ala Leu  Asp Glu Leu Phe Lys  Val Val Thr
```

```
    1265                1270                1275

Ala Ser  Ala Thr Arg Ser Asp  Lys Ile Gly Ser Arg  Lys Asn Ser
    1280                1285                1290

Met Thr  His Arg Ala Phe Leu  Gly Lys Gly Lys Asp  Val Lys Ile
    1295                1300                1305

Ala Tyr  Thr Ser Ile Ser Gly  Leu Lys Thr Thr Lys  Pro Lys Ser
    1310                1315                1320

Leu Phe  Lys Leu Ala Glu Ser  Arg Asn Glu Leu
    1325                1330
```

<210> 206
<211> 1156
<212> PRT
<213> Ruminococcus albus

<400> 206

```
Met Gly Asn Tyr Tyr Leu Gly Leu Asp Val Gly Ile Gly Ser Ile Gly
1               5                   10                  15

Trp Ala Val Ile Asn Ile Glu Lys Lys Arg Ile Glu Asp Phe Asn Val
            20                  25                  30

Arg Ile Phe Lys Ser Gly Glu Ile Gln Glu Lys Asn Arg Asn Ser Arg
        35                  40                  45

Ala Ser Gln Gln Cys Arg Arg Ser Arg Gly Leu Arg Arg Leu Tyr Arg
    50                  55                  60

Arg Lys Ser His Arg Lys Leu Arg Leu Lys Asn Tyr Leu Ser Ile Ile
65                  70                  75                  80

Gly Leu Thr Thr Ser Glu Lys Ile Asp Tyr Tyr Tyr Glu Thr Ala Asp
                85                  90                  95
```

```
Asn Asn Val Ile Gln Leu Arg Asn Lys Gly Leu Ser Glu Lys Leu Thr
            100                 105                 110

Pro Glu Glu Ile Ala Ala Cys Leu Ile His Ile Cys Asn Asn Arg Gly
        115                 120                 125

Tyr Lys Asp Phe Tyr Glu Val Asn Val Glu Asp Ile Glu Asp Pro Asp
    130                 135                 140

Glu Arg Asn Glu Tyr Lys Glu Glu His Asp Ser Ile Val Leu Ile Ser
145                 150                 155                 160

Asn Leu Met Asn Glu Gly Gly Tyr Cys Thr Pro Ala Glu Met Ile Cys
                165                 170                 175

Asn Cys Arg Glu Phe Asp Glu Pro Asn Ser Val Tyr Arg Lys Phe His
            180                 185                 190

Asn Ser Ala Ala Ser Lys Asn His Tyr Leu Ile Thr Arg His Met Leu
        195                 200                 205

Val Lys Glu Val Asp Leu Ile Leu Glu Asn Gln Ser Lys Tyr Tyr Gly
    210                 215                 220

Ile Leu Asp Asp Lys Thr Ile Ala Lys Ile Lys Asp Ile Ile Phe Ala
225                 230                 235                 240

Gln Arg Asp Phe Glu Ile Gly Pro Gly Lys Asn Glu Arg Phe Arg Arg
                245                 250                 255

Phe Thr Gly Tyr Leu Asp Ser Ile Gly Lys Cys Gln Phe Phe Lys Asp
            260                 265                 270

Gln Glu Arg Gly Ser Arg Phe Thr Val Ile Ala Asp Ile Tyr Ala Phe
        275                 280                 285

Val Asn Val Leu Ser Gln Tyr Thr Tyr Thr Asn Asn Arg Gly Glu Ser
    290                 295                 300
```

```
Val Phe Asp Thr Ser Phe Ala Asn Asp Leu Ile Asn Ser Ala Leu Lys
305                 310                 315                 320

Asn Gly Ser Met Asp Lys Arg Glu Leu Lys Ala Ile Ala Lys Ser Tyr
                325                 330                 335

His Ile Asp Ile Ser Asp Lys Asn Ser Asp Thr Ser Leu Thr Lys Cys
            340                 345                 350

Phe Lys Tyr Ile Lys Val Val Lys Pro Leu Phe Glu Lys Tyr Gly Tyr
        355                 360                 365

Asp Trp Asp Lys Leu Ile Glu Asn Tyr Thr Asp Thr Asp Asn Asn Val
    370                 375                 380

Leu Asn Arg Ile Gly Ile Val Leu Ser Gln Ala Gln Thr Pro Lys Arg
385                 390                 395                 400

Arg Arg Glu Lys Leu Lys Ala Leu Asn Ile Gly Leu Asp Asp Gly Leu
                405                 410                 415

Ile Asn Glu Leu Thr Lys Leu Lys Leu Ser Gly Thr Ala Asn Val Ser
            420                 425                 430

Tyr Lys Tyr Met Gln Gly Ser Ile Glu Ala Phe Cys Glu Gly Asp Leu
        435                 440                 445

Tyr Gly Lys Tyr Gln Ala Lys Phe Asn Lys Glu Ile Pro Asp Ile Asp
    450                 455                 460

Glu Asn Ala Lys Pro Gln Lys Leu Pro Pro Phe Lys Asn Glu Asp Asp
465                 470                 475                 480

Cys Glu Phe Phe Lys Asn Pro Val Val Phe Arg Ser Ile Asn Glu Thr
                485                 490                 495
```

```
Arg Lys Leu Ile Asn Ala Ile Ile Asp Lys Tyr Gly Tyr Pro Ala Ala
            500                 505                 510

Val Asn Ile Glu Thr Ala Asp Glu Leu Asn Lys Thr Phe Glu Asp Arg
        515                 520                 525

Ala Ile Asp Thr Lys Arg Asn Asn Asp Asn Gln Lys Glu Asn Asp Arg
    530                 535                 540

Ile Val Lys Glu Ile Ile Glu Cys Ile Lys Cys Asp Glu Val His Ala
545                 550                 555                 560

Arg His Leu Ile Glu Lys Tyr Lys Leu Trp Glu Ala Gln Glu Gly Lys
                565                 570                 575

Cys Leu Tyr Ser Gly Glu Thr Ile Thr Lys Glu Asp Met Leu Arg Asp
            580                 585                 590

Lys Asp Lys Leu Phe Glu Val Asp His Ile Val Pro Tyr Ser Leu Ile
        595                 600                 605

Leu Asp Asn Thr Ile Asn Asn Lys Ala Leu Val Tyr Ala Glu Glu Asn
    610                 615                 620

Gln Lys Lys Gly Gln Arg Thr Pro Leu Met Tyr Met Asn Glu Ala Gln
625                 630                 635                 640

Ala Ala Asp Tyr Arg Val Arg Val Asn Thr Met Phe Lys Ser Lys Lys
                645                 650                 655

Cys Ser Lys Lys Lys Tyr Gln Tyr Leu Met Leu Pro Asp Leu Asn Asp
            660                 665                 670

Gln Glu Leu Leu Gly Gly Trp Arg Ser Arg Asn Leu Asn Asp Thr Arg
        675                 680                 685

Tyr Ile Cys Lys Tyr Leu Val Asn Tyr Leu Arg Lys Asn Leu Arg Phe
    690                 695                 700
```

```
Asp Arg Ser Tyr Glu Ser Ser Asp Glu Asp Asp Leu Lys Ile Arg Asp
705                 710                 715                 720

His Tyr Arg Val Phe Pro Val Lys Ser Arg Phe Thr Ser Met Phe Arg
                725                 730                 735

Arg Trp Trp Leu Asn Glu Lys Thr Trp Gly Arg Tyr Asp Lys Ala Glu
            740                 745                 750

Leu Lys Lys Leu Thr Tyr Leu Asp His Ala Ala Asp Ala Ile Ile Ile
        755                 760                 765

Ala Asn Cys Arg Pro Glu Tyr Val Val Leu Ala Gly Glu Lys Leu Lys
    770                 775                 780

Leu Asn Lys Met Tyr His Gln Ala Gly Lys Arg Ile Thr Pro Glu Tyr
785                 790                 795                 800

Glu Gln Ser Lys Lys Ala Cys Ile Asp Asn Leu Tyr Lys Leu Phe Arg
                805                 810                 815

Met Asp Arg Arg Thr Ala Glu Lys Leu Leu Ser Gly His Gly Arg Leu
            820                 825                 830

Thr Pro Ile Ile Pro Asn Leu Ser Glu Glu Val Asp Lys Arg Leu Trp
        835                 840                 845

Asp Lys Asn Ile Tyr Glu Gln Phe Trp Lys Asp Asp Lys Asp Lys Lys
    850                 855                 860

Ser Cys Glu Glu Leu Tyr Arg Glu Asn Val Ala Ser Leu Tyr Lys Gly
865                 870                 875                 880

Asp Pro Lys Phe Ala Ser Ser Leu Ser Met Pro Val Ile Ser Leu Lys
                885                 890                 895
```

```
Pro Asp His Lys Tyr Arg Gly Thr Ile Thr Gly Glu Glu Ala Ile Arg
            900                 905                 910

Val Lys Glu Ile Asp Gly Lys Leu Ile Lys Leu Lys Arg Lys Ser Ile
        915                 920                 925

Ser Glu Ile Thr Ala Glu Ser Ile Asn Ser Ile Tyr Thr Asp Asp Lys
    930                 935                 940

Ile Leu Ile Asp Ser Leu Lys Thr Ile Phe Glu Gln Ala Asp Tyr Lys
945                 950                 955                 960

Asp Val Gly Asp Tyr Leu Lys Lys Thr Asn Gln His Phe Phe Thr Thr
                965                 970                 975

Ser Ser Gly Lys Arg Val Asn Lys Val Thr Val Ile Glu Lys Val Pro
            980                 985                 990

Ser Arg Trp Leu Arg Lys Glu Ile  Asp Asp Asn Asn Phe  Ser Leu Leu
        995                 1000                1005

Asn Asp  Ser Ser Tyr Tyr Cys  Ile Glu Leu Tyr Lys  Asp Ser Lys
    1010                1015                1020

Gly Asp  Asn Asn Leu Gln Gly  Ile Ala Met Ser Asp  Ile Val His
    1025                1030                1035

Asp Arg  Lys Thr Lys Lys Leu  Tyr Leu Lys Pro Asp  Phe Asn Tyr
    1040                1045                1050

Pro Asp  Asp Tyr Tyr Thr His  Val Met Tyr Ile Phe  Pro Gly Asp
    1055                1060                1065

Tyr Leu  Arg Ile Lys Ser Thr  Ser Lys Lys Ser Gly  Glu Gln Leu
    1070                1075                1080

Lys Phe  Glu Gly Tyr Phe Ile  Ser Val Lys Asn Val  Asn Glu Asn
    1085                1090                1095
```

Ser Phe Arg Phe Ile Ser Asp Asn Lys Pro Cys Ala Lys Asp Lys
    1100   1105   1110

Arg Val Ser Ile Thr Lys Lys Asp Ile Val Ile Lys Leu Ala Val
    1115   1120   1125

Asp Leu Met Gly Lys Val Gln Gly Glu Asn Asn Gly Lys Gly Ile
    1130   1135   1140

Ser Cys Gly Glu Pro Leu Ser Leu Leu Lys Glu Lys Asn
    1145   1150   1155

<210> 207
<211> 1440
<212> PRT
<213> Weeksella virosa

<400> 207

Met Lys Thr Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1   5   10   15

Ala Leu Val Glu Gln Asp Phe Glu Asn Lys Gln Gly Leu Ile Leu Gly
            20   25   30

Met Gly Ser Arg Ile Ile Pro Met Asp Ala Gly Ile Ile Gly Lys Phe
        35   40   45

Ala Glu Gly Ser Ser Ile Ser Gln Thr Ala Glu Arg Thr Gly Tyr Arg
    50   55   60

Ser Ile Arg Arg Leu Arg Glu Arg His Leu Leu Arg Arg Glu Arg Leu
65   70   75   80

His Arg Val Leu Asn Ile Leu Lys Phe Leu Pro Glu His Tyr Ala Ala
                85   90   95

Glu Ile Asp Phe Glu Lys Arg Phe Gly Gln Phe Leu Ala Glu Thr Glu

```
            100                 105                 110

Pro Lys Leu Ala Trp Lys Lys Asn Ala Glu Gly Lys Phe Glu Phe Leu
        115                 120                 125

Phe Gln Arg Ser Phe Asp Glu Met Val Ala Asp Phe Lys Ala Asn Gly
    130                 135                 140

Gln Asp Ile Lys Ile Pro Tyr Asp Trp Thr Ile Tyr Tyr Leu Arg Lys
145                 150                 155                 160

Lys Ala Leu Thr Gln Lys Ile Ser Pro Gln Glu Leu Ala Trp Ile Ile
                165                 170                 175

Leu Asn Phe Asn Gln Lys Arg Gly Tyr Tyr Gln Leu Arg Gly Glu Glu
            180                 185                 190

Glu Glu Glu Asn Pro Asn Lys Lys Val Glu Phe Tyr Ser Leu Lys Ile
        195                 200                 205

Val Asp Val Val Ala Asp Glu Gln Pro Asn Lys Lys Gly Asp Thr Trp
    210                 215                 220

Tyr Ser Leu His Leu Glu Asn Gly Trp Val Tyr Arg Arg Ser Ser Lys
225                 230                 235                 240

Ile Pro Leu Tyr Asp Trp Lys Asp Lys Val Arg Asp Phe Ile Val Thr
                245                 250                 255

Thr Asp Ile Asn Glu Asp Gly Ser Glu Lys Leu Asp Lys Asp Gly Glu
            260                 265                 270

Val Lys Arg Ser Phe Arg Ala Pro Lys Glu Asp Asp Trp Thr Leu Ile
        275                 280                 285

Lys Lys Lys Thr Glu Gln Glu Ile Glu Gln Phe Asn Gln Thr Val Gly
    290                 295                 300
```

```
Ser Tyr Ile Tyr Glu Ala Leu Leu Asp Asn Pro Thr Gln Lys Ile Arg
305                 310                 315                 320

Gly Lys Leu Val Arg Thr Ile Glu Arg Lys Phe Tyr Lys Ser Glu Leu
                325                 330                 335

Lys Lys Ile Leu Glu Lys Gln Ile Glu Leu Gln Pro Glu Leu Phe Thr
            340                 345                 350

Glu Asp Leu Tyr Asn Ala Cys Ala Arg Glu Leu Tyr Arg Arg Asn Val
        355                 360                 365

Ala His Gln Gln Gln Leu Ser Ser Arg Asp Phe Val Tyr Leu Phe Leu
    370                 375                 380

Asn Asp Ile Ile Phe Tyr Gln Arg Pro Leu Arg Ser Gln Lys Ser Leu
385                 390                 395                 400

Ile Ser Asn Cys Ser Leu Glu Phe Arg Thr Ile Lys Asp Lys Asp Gly
                405                 410                 415

Asn Gly Gln Ile Ile Tyr Leu Lys Ala Ile Pro Lys Ser Asn Pro Tyr
            420                 425                 430

Tyr Gln Glu Phe Arg Val Trp Gln Trp Leu Tyr Asn Leu Lys Ile Phe
        435                 440                 445

Thr Lys Glu Asp Asp Lys Asp Val Thr Asn Gln Phe Ile Asn Lys Val
    450                 455                 460

Glu Asp Leu Glu Ala Leu Phe Glu Phe Leu Met Asn Gln Lys Glu Val
465                 470                 475                 480

Asn His Thr Asp Ile Leu Thr Tyr Leu Ile Glu Pro Ile Val Lys Ser
                485                 490                 495

Lys Tyr Pro Asn Ala Lys Gly Lys Ala Phe Lys Asp Glu Leu Lys Lys
```

```
            500                 505                 510

Glu Leu Lys Lys Tyr Arg Trp Asn Tyr Val Tyr Asp Ala Asp Lys Asp
        515                 520                 525

Glu Ser Lys Ser Tyr Pro Met Asn Glu Thr Arg Tyr Glu Leu Arg Lys
    530                 535                 540

Arg Leu Asp Lys Val Glu Asn Val Pro Ala Asp Phe Met Thr Arg Lys
545                 550                 555                 560

Ile Glu Gln His Leu Trp His Ile Ile Tyr Ser Val Thr Asp Lys Ile
                565                 570                 575

Glu Phe Glu Lys Ala Leu Lys Ser Phe Ala Asn Lys Tyr Asp Leu His
            580                 585                 590

Gln Glu Ser Phe Val Glu Asn Phe Lys Arg Phe Lys Pro Phe Asp Ser
        595                 600                 605

Asp Tyr Gly Thr Tyr Ser Glu Lys Ala Ile Lys Lys Leu Leu Pro Leu
    610                 615                 620

Met Arg Val Gly Lys Tyr Trp Ser Trp Asp Ile Ile Asp Asp Lys Thr
625                 630                 635                 640

Lys Thr Arg Ile Gly Lys Ile Ile Thr Gly Glu Tyr Asp Glu Thr Ile
                645                 650                 655

Lys Asn Arg Val Arg Glu Lys Ala Ile Asp Leu Thr Glu Glu Asn His
            660                 665                 670

Phe Gln Gly Leu Gln Leu Trp Leu Ala Gln Tyr Ile Val Tyr Asp Arg
        675                 680                 685

His Ser Glu Ala Asp Ile Ala Gly Lys Trp Asn Ser Val Ala Asp Leu
    690                 695                 700
```

```
Glu Gln Tyr Leu Ser Glu Phe Lys Gln His Ser Leu Arg Asn Pro Ile
705                 710                 715                 720

Val Glu Gln Val Ile Thr Glu Thr Leu Arg Val Val Arg Asp Ile Trp
                725                 730                 735

Lys Gln Tyr Gly Lys Gly Ala Lys Asp Tyr Phe Asp Glu Ile His Ile
            740                 745                 750

Glu Leu Gly Arg Glu Met Lys Asn Thr Ala Glu Glu Arg Lys Arg Leu
        755                 760                 765

Ser Ser Ile Ile Ser Glu Asn Glu Thr Thr Asn Leu Arg Ile Arg Ala
    770                 775                 780

Ile Leu Glu Glu Leu Met Tyr Asp Glu Asn Met Glu Asn Val Arg Pro
785                 790                 795                 800

Tyr Ser Pro Met Gln Gln Glu Ala Leu Lys Ile Tyr Glu Asp Gly Val
                805                 810                 815

Leu Ser Ser Ser Val Glu Ile Pro Glu Asp Ile Glu Lys Ile Ser Lys
            820                 825                 830

Lys Ser Glu Pro Thr Lys Ser Glu Ile Gln Arg Tyr Lys Leu Trp Leu
        835                 840                 845

Glu Gln Lys Tyr Arg Ser Pro Tyr Thr Gly Arg Pro Ile Pro Leu Ser
    850                 855                 860

Lys Leu Phe Thr Pro Ala Tyr Gln Ile Glu His Ile Ile Pro Gln Ala
865                 870                 875                 880

Arg Phe Phe Asp Asp Gly Phe Ser Asn Lys Val Ile Cys Glu Ser Glu
                885                 890                 895

Val Asn Ala Leu Lys Asp Lys Met Leu Gly Leu Glu Phe Ile Gln Asn
```

```
            900                 905                 910

Tyr Tyr Gly Gln Lys Val Thr Thr Ser Phe Gly Glu Val Thr Ile Leu
        915                 920                 925

Thr Glu Asp Ala Tyr Lys Ala Phe Val Lys Glu His Tyr Asp Lys Asn
    930                 935                 940

Arg Ser Lys Arg Asn Lys Leu Leu Leu Glu Glu Ile Pro Glu Lys Met
945                 950                 955                 960

Ile Asp Arg Gln Met Asn Asp Thr Arg Tyr Ile Ser Lys Tyr Ile Ser
                965                 970                 975

Lys Val Leu Ser Asn Leu Val Arg Gly Glu Lys Asp Asp Glu Gly Val
            980                 985                 990

Asn Ser Lys Asn Ile Ile Pro Gly  Asn Gly Lys Ile Thr  Gly Ile Leu
        995                 1000                1005

Lys Gln  Asp Trp Gly Leu Asn  Asp Val Trp Asn Asp  Leu Ile Leu
    1010                1015                1020

Pro Arg  Phe Glu Arg Met Asn  Gln Leu Thr Asn Ser  Thr Asp Phe
    1025                1030                1035

Thr Ala  Trp Asn Glu Lys His  Gln Lys Phe Leu Pro  Ser Val Pro
    1040                1045                1050

Leu Glu  Leu Ser Lys Gly Phe  Gln Lys Lys Arg Ile  Asp His Arg
    1055                1060                1065

His His  Ala Leu Asp Ala Leu  Ile Ile Ala Cys Ala  Thr Arg Asp
    1070                1075                1080

His Val  Asn Leu Leu Asn Asn  Lys His Ala Lys Ser  Arg Asn Glu
    1085                1090                1095
```

```
Arg Tyr  Asp Leu Gln His Lys  Leu Arg His Thr Thr  Pro Trp Gln
    1100                1105                1110

Asp Lys  Glu Gly Lys Val Arg  Thr Lys Phe Thr Glu  Phe Lys Lys
    1115                1120                1125

Pro Trp  Glu Thr Phe Thr Gln  Asp Thr Lys Lys Glu  Leu Glu Lys
    1130                1135                1140

Ile Val  Val Asn Phe Lys Gln  Asn Leu Arg Val Ile  Asn Lys Ala
    1145                1150                1155

Thr Asn  Tyr Tyr Glu Lys Ile  Val Asp Gly Lys Lys  Val Met Phe
    1160                1165                1170

Lys Gln  Glu Gly Val Asn Trp  Ala Ile Arg Lys Pro  Met His Lys
    1175                1180                1185

Glu Thr  Val Ser Gly Lys Ile  Asp Leu Pro Arg Val  Lys Val Ser
    1190                1195                1200

Lys Gly  Lys Ile Leu Thr Ala  Thr Arg Lys Ser Leu  Asp Thr Ser
    1205                1210                1215

Phe Asn  Ala Lys Thr Ile Leu  Ser Ile Thr Asp Thr  Gly Ile Gln
    1220                1225                1230

Lys Ile  Leu Leu Asn Tyr Leu  Lys Ala Lys Gly Asn  Pro Glu Leu
    1235                1240                1245

Ala Phe  Ser Pro Glu Gly Ile  Glu Glu Met Asn Gln  Asn Ile Ser
    1250                1255                1260

Leu Tyr  Asn Asp Gly Lys Pro  His Gln Pro Ile Leu  Lys Val Arg
    1265                1270                1275

Val Phe  Glu Gln Gly Ser Lys  Phe Pro Leu Gly Glu  Thr Gly Asn
```

```
    1280                1285                1290

Lys Thr  Thr Lys Tyr Val Glu  Ala Ala Lys Gly Thr  Asn Leu Phe
    1295                1300                1305

Phe Gly  Val Tyr Glu Asp Asn  Gln Gly Lys Arg Ser  Tyr Asp Thr
    1310                1315                1320

Ile Pro  Leu Asn Ile Val Ile  Glu Arg Gln Lys Gln  Gly Leu Asn
    1325                1330                1335

Ser Val  Pro Glu Thr Asn Glu  Lys Gly His Arg Leu  Leu Phe Ser
    1340                1345                1350

Leu Ser  Pro Asn Asp Leu Val  Tyr Val Pro Ile Glu  Gly Glu Val
    1355                1360                1365

Phe Asp  Glu Thr Asn Pro Asp  Val Asn Arg Ile Tyr  Lys Val Val
    1370                1375                1380

Ser Phe  Ser Gly Ser Gln Met  Phe Cys Val Arg Gln  Asp Val Ala
    1385                1390                1395

Thr Ser  Ile Val Tyr Lys Leu  Glu Phe Ser Ser Leu  Asn Lys Met
    1400                1405                1410

Glu Arg  Thr Ile Asp Gly Ile  Met Ile Lys Glu Ile  Cys Ile Lys
    1415                1420                1425

Leu Lys  Val Asp Arg Leu Gly  Asn Ile Ser Lys Ala
    1430                1435                1440
```

<210> 208
<211> 1179
<212> PRT
<213> Sphaerochaeta globus

<400> 208

```
Met Ser Lys Lys Val Ser Arg Arg Tyr Glu Glu Gln Ala Gln Glu Ile
1               5                  10                  15

Cys Gln Arg Leu Gly Ser Arg Pro Tyr Ser Ile Gly Leu Asp Leu Gly
            20                  25                  30

Val Gly Ser Ile Gly Val Ala Val Ala Ala Tyr Asp Pro Ile Lys Lys
        35                  40                  45

Gln Pro Ser Asp Leu Val Phe Val Ser Ser Arg Ile Phe Ile Pro Ser
    50                  55                  60

Thr Gly Ala Ala Glu Arg Arg Gln Lys Arg Gly Gln Arg Asn Ser Leu
65                  70                  75                  80

Arg His Arg Ala Asn Arg Leu Lys Phe Leu Trp Lys Leu Leu Ala Glu
                85                  90                  95

Arg Asn Leu Met Leu Ser Tyr Ser Glu Gln Asp Val Pro Asp Pro Ala
            100                 105                 110

Arg Leu Arg Phe Glu Asp Ala Val Val Arg Ala Asn Pro Tyr Glu Leu
        115                 120                 125

Arg Leu Lys Gly Leu Asn Glu Gln Leu Thr Leu Ser Glu Leu Gly Tyr
    130                 135                 140

Ala Leu Tyr His Ile Ala Asn His Arg Gly Ser Ser Ser Val Arg Thr
145                 150                 155                 160

Phe Leu Asp Glu Glu Lys Ser Ser Asp Asp Lys Lys Leu Glu Glu Gln
                165                 170                 175

Gln Ala Met Thr Glu Gln Leu Ala Lys Glu Lys Gly Ile Ser Thr Phe
            180                 185                 190

Ile Glu Val Leu Thr Ala Phe Asn Thr Asn Gly Leu Ile Gly Tyr Arg
        195                 200                 205
```

```
Asn Ser Glu Ser Val Lys Ser Lys Gly Val Pro Val Pro Thr Arg Asp
    210                 215                 220

Ile Ile Ser Asn Glu Ile Asp Val Leu Leu Gln Thr Gln Lys Gln Phe
225                 230                 235                 240

Tyr Gln Glu Ile Leu Ser Asp Glu Tyr Cys Asp Arg Ile Val Ser Ala
                245                 250                 255

Ile Leu Phe Glu Asn Glu Lys Ile Val Pro Glu Ala Gly Cys Cys Pro
            260                 265                 270

Tyr Phe Pro Asp Glu Lys Lys Leu Pro Arg Cys His Phe Leu Asn Glu
        275                 280                 285

Glu Arg Arg Leu Trp Glu Ala Ile Asn Asn Ala Arg Ile Lys Met Pro
    290                 295                 300

Met Gln Glu Gly Ala Ala Lys Arg Tyr Gln Ser Ala Ser Phe Ser Asp
305                 310                 315                 320

Glu Gln Arg His Ile Leu Phe His Ile Ala Arg Ser Gly Thr Asp Ile
                325                 330                 335

Thr Pro Lys Leu Val Gln Lys Glu Phe Pro Ala Leu Lys Thr Ser Ile
            340                 345                 350

Ile Val Leu Gln Gly Lys Glu Lys Ala Ile Gln Lys Ile Ala Gly Phe
        355                 360                 365

Arg Phe Arg Arg Leu Glu Glu Lys Ser Phe Trp Lys Arg Leu Ser Glu
    370                 375                 380

Glu Gln Lys Asp Asp Phe Phe Ser Ala Trp Thr Asn Thr Pro Asp Asp
385                 390                 395                 400
```

```
Lys Arg Leu Ser Lys Tyr Leu Met Lys His Leu Leu Leu Thr Glu Asn
                405                 410                 415

Glu Val Val Asp Ala Leu Lys Thr Val Ser Leu Ile Gly Asp Tyr Gly
            420                 425                 430

Pro Ile Gly Lys Thr Ala Thr Gln Leu Leu Met Lys His Leu Glu Asp
        435                 440                 445

Gly Leu Thr Tyr Thr Glu Ala Leu Glu Arg Gly Met Glu Thr Gly Glu
    450                 455                 460

Phe Gln Glu Leu Ser Val Trp Glu Gln Gln Ser Leu Leu Pro Tyr Tyr
465                 470                 475                 480

Gly Gln Ile Leu Thr Gly Ser Thr Gln Ala Leu Met Gly Lys Tyr Trp
                485                 490                 495

His Ser Ala Phe Lys Glu Lys Arg Asp Ser Glu Gly Phe Phe Lys Pro
            500                 505                 510

Asn Thr Asn Ser Asp Glu Glu Lys Tyr Gly Arg Ile Ala Asn Pro Val
        515                 520                 525

Val His Gln Thr Leu Asn Glu Leu Arg Lys Leu Met Asn Glu Leu Ile
    530                 535                 540

Thr Ile Leu Gly Ala Lys Pro Gln Glu Ile Thr Val Glu Leu Ala Arg
545                 550                 555                 560

Glu Leu Lys Val Gly Ala Glu Lys Arg Glu Asp Ile Ile Lys Gln Gln
                565                 570                 575

Thr Lys Gln Glu Lys Glu Ala Val Leu Ala Tyr Ser Lys Tyr Cys Glu
            580                 585                 590

Pro Asn Asn Leu Asp Lys Arg Tyr Ile Glu Arg Phe Arg Leu Leu Glu
        595                 600                 605
```

```
Asp Gln Ala Phe Val Cys Pro Tyr Cys Leu Glu His Ile Ser Val Ala
    610                 615                 620

Asp Ile Ala Ala Gly Arg Ala Asp Val Asp His Ile Phe Pro Arg Asp
625                 630                 635                 640

Asp Thr Ala Asp Asn Ser Tyr Gly Asn Lys Val Val Ala His Arg Gln
                645                 650                 655

Cys Asn Asp Ile Lys Gly Lys Arg Thr Pro Tyr Ala Ala Phe Ser Asn
            660                 665                 670

Thr Ser Ala Trp Gly Pro Ile Met His Tyr Leu Asp Glu Thr Pro Gly
        675                 680                 685

Met Trp Arg Lys Arg Arg Lys Phe Glu Thr Asn Glu Glu Glu Tyr Ala
    690                 695                 700

Lys Tyr Leu Gln Ser Lys Gly Phe Val Ser Arg Phe Glu Ser Asp Asn
705                 710                 715                 720

Ser Tyr Ile Ala Lys Ala Ala Lys Glu Tyr Leu Arg Cys Leu Phe Asn
                725                 730                 735

Pro Asn Asn Val Thr Ala Val Gly Ser Leu Lys Gly Met Glu Thr Ser
            740                 745                 750

Ile Leu Arg Lys Ala Trp Asn Leu Gln Gly Ile Asp Asp Leu Leu Gly
        755                 760                 765

Ser Arg His Trp Ser Lys Asp Ala Asp Thr Ser Pro Thr Met Arg Lys
    770                 775                 780

Asn Arg Asp Asp Asn Arg His His Gly Leu Asp Ala Ile Val Ala Leu
785                 790                 795                 800
```

```
Tyr Cys Ser Arg Ser Leu Val Gln Met Ile Asn Thr Met Ser Glu Gln
                805                 810                 815

Gly Lys Arg Ala Val Glu Ile Glu Ala Met Ile Pro Ile Pro Gly Tyr
            820                 825                 830

Ala Ser Glu Pro Asn Leu Ser Phe Glu Ala Gln Arg Glu Leu Phe Arg
        835                 840                 845

Lys Lys Ile Leu Glu Phe Met Asp Leu His Ala Phe Val Ser Met Lys
    850                 855                 860

Thr Asp Asn Asp Ala Asn Gly Ala Leu Leu Lys Asp Thr Val Tyr Ser
865                 870                 875                 880

Ile Leu Gly Ala Asp Thr Gln Gly Glu Asp Leu Val Phe Val Val Lys
                885                 890                 895

Lys Lys Ile Lys Asp Ile Gly Val Lys Ile Gly Asp Tyr Glu Glu Val
            900                 905                 910

Ala Ser Ala Ile Arg Gly Arg Ile Thr Asp Lys Gln Pro Lys Trp Tyr
        915                 920                 925

Pro Met Glu Met Lys Asp Lys Ile Glu Gln Leu Gln Ser Lys Asn Glu
    930                 935                 940

Ala Ala Leu Gln Lys Tyr Lys Glu Ser Leu Val Gln Ala Ala Ala Val
945                 950                 955                 960

Leu Glu Glu Ser Asn Arg Lys Leu Ile Glu Ser Gly Lys Lys Pro Ile
                965                 970                 975

Gln Leu Ser Glu Lys Thr Ile Ser Lys Lys Ala Leu Glu Leu Val Gly
            980                 985                 990

Gly Tyr Tyr Tyr Leu Ile Ser Asn  Asn Lys Arg Thr Lys  Thr Phe Val
        995                 1000                1005
```

```
Val Lys  Glu Pro Ser Asn Glu  Val Lys Gly Phe Ala  Phe Asp Thr
    1010                1015                1020

Gly Ser  Asn Leu Cys Leu Asp  Phe Tyr His Asp Ala  Gln Gly Lys
    1025                1030                1035

Leu Cys  Gly Glu Ile Ile Arg  Lys Ile Gln Ala Met  Asn Pro Ser
    1040                1045                1050

Tyr Lys  Pro Ala Tyr Met Lys  Gln Gly Tyr Ser Leu  Tyr Val Arg
    1055                1060                1065

Leu Tyr  Gln Gly Asp Val Cys  Glu Leu Arg Ala Ser  Asp Leu Thr
    1070                1075                1080

Glu Ala  Glu Ser Asn Leu Ala  Lys Thr Thr His Val  Arg Leu Pro
    1085                1090                1095

Asn Ala  Lys Pro Gly Arg Thr  Phe Val Ile Ile Ile  Thr Phe Thr
    1100                1105                1110

Glu Met  Gly Ser Gly Tyr Gln  Ile Tyr Phe Ser Asn  Leu Ala Lys
    1115                1120                1125

Ser Lys  Lys Gly Gln Asp Thr  Ser Phe Thr Leu Thr  Thr Ile Lys
    1130                1135                1140

Asn Tyr  Asp Val Arg Lys Val  Gln Leu Ser Ser Ala  Gly Leu Val
    1145                1150                1155

Arg Tyr  Val Ser Pro Leu Leu  Val Asp Lys Ile Glu  Lys Asp Glu
    1160                1165                1170

Val Ala  Leu Cys Gly Glu
    1175
```

<210> 209
<211> 1370
<212> PRT
<213> Streptococcus gallolyticus

<400> 209

Met Thr Lys Lys Asn Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser
1 5 10 15

Val Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys
20 25 30

Met Lys Val Leu Gly Asn Thr Asp Lys Lys Tyr Ile Lys Lys Asn Leu
35 40 45

Leu Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg
50 55 60

Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu
65 70 75 80

Arg Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Thr Lys Val Asp Glu
85 90 95

Ser Phe Phe Tyr Arg Leu Asp Glu Ser Phe Leu Thr Thr Asp Glu Lys
100 105 110

Asp Phe Glu Arg His Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala
115 120 125

Tyr His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Asn Tyr Leu Ala
130 135 140

Asp Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala
145 150 155 160

His Met Ile Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Asn
165 170 175

```
Ala Glu Asn Thr Asp Val Gln Lys Leu Phe Thr Asp Phe Val Gly Val
            180                 185                 190

Tyr Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp
        195                 200                 205

Val Ala Ser Thr Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu
    210                 215                 220

Asn Leu Ile Lys Tyr Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly
225                 230                 235                 240

Asn Leu Ile Ala Leu Ala Leu Gly Leu Gln Pro Asn Phe Lys Met Asn
                245                 250                 255

Phe Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala
        275                 280                 285

Asp Leu Phe Thr Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Asp Asp Asn Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Lys Arg Tyr Val Glu His His Glu Asp Leu Glu Lys Leu
                325                 330                 335

Lys Glu Phe Ile Lys Ala Asn Lys Ser Glu Leu Tyr His Asp Ile Phe
            340                 345                 350

Lys Asp Lys Asn Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val
        355                 360                 365

Lys Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Asn Thr Leu Ser Lys Ile
```

```
    370                 375                 380

Asp Gly Ser Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His
                405                 410                 415

Leu Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Asp Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Lys Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Val Arg Lys Asp Ser Arg Phe Ala
    450                 455                 460

Trp Ala Glu Tyr Arg Ser Asp Glu Lys Ile Thr Pro Trp Asn Phe Asp
465                 470                 475                 480

Lys Val Ile Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met
                485                 490                 495

Thr Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser His Val Tyr Glu Thr Tyr Ala Val Tyr Asn Glu Leu Thr Lys Ile
        515                 520                 525

Lys Tyr Val Asn Glu Gln Gly Lys Glu Ser Phe Phe Asp Ser Asn Met
    530                 535                 540

Lys Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys Val Thr
545                 550                 555                 560

Lys Glu Lys Leu Leu Asn Tyr Leu Asn Lys Glu Phe Pro Glu Tyr Arg
                565                 570                 575
```

```
Ile Lys Asp Leu Ile Gly Leu Asp Lys Glu Asn Lys Ser Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Ala Phe
        595                 600                 605

Leu Asp Asp Lys Val Asn Glu Glu Val Ile Glu Asp Ile Ile Lys Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Lys Asp Met Ile His Glu Arg Leu Gln Lys
625                 630                 635                 640

Tyr Ser Asp Ile Phe Thr Ala Asn Gln Leu Lys Lys Leu Glu Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asn Lys Glu Asn Asn Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Ser Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Thr Leu
    690                 695                 700

Pro Phe Lys Gln Ile Ile Gln Lys Ser Gln Val Val Gly Asp Val Asp
705                 710                 715                 720

Asp Ile Glu Ala Val Val His Asp Leu Pro Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Asp Asn Pro Asp Asn Ile Val Ile Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Arg Gly Arg Ser Gln Ser Gln Gln Arg Leu Lys Lys
```

```
    770                 775                 780

Leu Gln Ser Ser Leu Lys Glu Leu Gly Ser Asn Ile Leu Asn Glu Glu
785                 790                 795                 800

Lys Pro Ser Tyr Ile Glu Asp Lys Val Glu Asn Ser His Leu Gln Asn
                805                 810                 815

Asp Gln Leu Phe Leu Tyr Tyr Ile Gln Asn Gly Lys Asp Met Tyr Thr
            820                 825                 830

Gly Asp Glu Leu Asp Ile Asp His Leu Ser Asp Tyr Asp Ile Asp His
        835                 840                 845

Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp Ser Ile Asp Asn Arg Val
    850                 855                 860

Leu Thr Ser Ser Ala Lys Asn Arg Gly Lys Ser Asp Asp Val Pro Ser
865                 870                 875                 880

Leu Asp Ile Val Arg Ala Arg Lys Ala Glu Trp Val Arg Leu Tyr Lys
                885                 890                 895

Ser Gly Leu Ile Ser Lys Arg Lys Phe Asp Asn Leu Thr Lys Ala Glu
            900                 905                 910

Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Gly Phe Ile Lys Arg Gln
        915                 920                 925

Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln Ile Leu Asp
    930                 935                 940

Ala Arg Phe Asn Thr Glu His Asp Glu Asn Asp Lys Val Ile Arg Asp
945                 950                 955                 960

Val Lys Val Ile Thr Leu Lys Ser Asn Leu Val Ser Gln Phe Arg Lys
                965                 970                 975
```

```
Asp Phe Glu Phe Tyr Lys Val Arg Glu Ile Asn Asp Tyr His His Ala
            980                 985                 990

His Asp Ala Tyr Leu Asn Ala Val  Val Gly Thr Ala Leu  Leu Lys Lys
        995                 1000                1005

Tyr Pro  Lys Leu Ala Ser Glu  Phe Val Tyr Gly Glu  Tyr Lys Lys
    1010                1015                1020

Tyr Asp  Ile Arg Lys Phe Ile  Thr Asn Ser Ser Asp  Lys Ala Thr
    1025                1030                1035

Ala Lys  Tyr Phe Phe Tyr Ser  Asn Leu Met Asn Phe  Phe Lys Thr
    1040                1045                1050

Lys Val  Lys Tyr Ala Asp Gly  Thr Val Phe Glu Arg  Pro Ile Ile
    1055                1060                1065

Glu Thr  Asn Ala Asp Gly Glu  Ile Ala Trp Asn Lys  Gln Ile Asp
    1070                1075                1080

Phe Glu  Lys Val Arg Lys Val  Leu Ser Tyr Pro Gln  Val Asn Ile
    1085                1090                1095

Val Lys  Lys Val Glu Thr Gln  Thr Gly Gly Phe Ser  Lys Glu Ser
    1100                1105                1110

Ile Leu  Pro Lys Gly Asp Ser  Asp Lys Leu Ile Pro  Arg Lys Thr
    1115                1120                1125

Lys Lys  Val Tyr Trp Asp Thr  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1130                1135                1140

Pro Thr  Val Ala Tyr Ser Val  Phe Val Val Ala Asp  Val Glu Lys
    1145                1150                1155

Gly Lys  Ala Lys Lys Leu Lys  Thr Val Lys Glu Leu  Val Gly Ile
```

```
    1160                1165                1170

Ser Ile  Met Glu Arg Ser Phe  Phe Glu Glu Asn Pro  Val Glu Phe
    1175                1180                1185

Leu Glu  Asn Lys Gly Tyr His  Asn Ile Arg Glu Asp  Lys Leu Ile
    1190                1195                1200

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Phe Glu Gly  Gly Arg Arg
    1205                1210                1215

Arg Leu  Leu Ala Ser Ala Ser  Glu Leu Gln Lys Gly  Asn Glu Met
    1220                1225                1230

Val Leu  Pro Gly Tyr Leu Val  Glu Leu Leu Tyr His  Ala His Arg
    1235                1240                1245

Ala Asp  Asn Phe Asn Ser Thr  Glu Tyr Leu Asn Tyr  Val Ser Glu
    1250                1255                1260

His Lys  Lys Glu Phe Glu Lys  Val Leu Ser Cys Val  Glu Asp Phe
    1265                1270                1275

Ala Asn  Leu Tyr Val Asp Val  Glu Lys Asn Leu Ser  Lys Ile Arg
    1280                1285                1290

Ala Val  Ala Asp Ser Met Asp  Asn Phe Ser Ile Glu  Glu Ile Ser
    1295                1300                1305

Asn Ser  Phe Ile Asn Leu Leu  Thr Leu Thr Ala Leu  Gly Ala Pro
    1310                1315                1320

Ala Asp  Phe Asn Phe Leu Gly  Glu Lys Ile Pro Arg  Lys Arg Tyr
    1325                1330                1335

Thr Ser  Thr Lys Glu Cys Leu  Thr Ala Thr Leu Ile  His Gln Ser
    1340                1345                1350
```

```
Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Lys Leu Gly
    1355                1360                1365


Glu Glu
    1370
```

<210> 210
<211> 1044
<212> PRT
<213> Nitrosomonas sp.

<400> 210

```
Met Leu His Lys Met Arg Tyr Arg Leu Ala Leu Asp Leu Gly Ser Thr
1               5                   10                  15


Ser Leu Gly Trp Ala Met Val Arg Leu Asn Ala Asn Gln Gln Pro Cys
            20                  25                  30


Ala Val Ile Lys Ala Gly Val Arg Ile Phe Ser Asn Gly Arg Asn Pro
        35                  40                  45


Lys Asp Gly Ser Ser Leu Ala Val Thr Arg Arg Glu Ala Arg Ser Met
    50                  55                  60


Arg Arg Arg Arg Asp Arg Leu Leu Lys Arg Lys Ala Arg Met Met Arg
65                  70                  75                  80


Thr Leu Ile Glu Tyr Gly Phe Phe Pro Ala Asn Glu Thr Gln Arg Lys
                85                  90                  95


Ala Leu Glu Asn Leu Asn Pro Tyr Ala Leu Arg Ala Lys Gly Leu Asp
            100                 105                 110


Glu Ala Leu Thr Pro Ser Glu Phe Ala Arg Ala Leu Phe His Ile Asn
        115                 120                 125


Gln Arg Arg Gly Phe Lys Ser Asn Arg Lys Thr Asp Lys Lys Asp Ser
    130                 135                 140
```

```
Asp Ser Gly Ala Leu Lys Thr Ala Ile Lys Gln Leu His Ser Val Leu
145                 150                 155                 160

Asp Pro Gln Gly Asn Asp Gly Lys Pro Arg Thr Val Gly Glu Leu Leu
                165                 170                 175

Tyr Lys Arg Phe Thr Asp Leu Ser Lys Leu Pro Lys Asp Arg Thr Val
            180                 185                 190

Arg Ala Arg Tyr Arg Gln Asp Lys Ile Val Lys Asp Asp Gly Lys Thr
        195                 200                 205

Lys Ile Asp Lys Tyr Tyr Asp Leu Tyr Ile Asp Arg Ala Met Ile Glu
    210                 215                 220

Gln Glu Phe Asp Ala Leu Trp Lys Lys Gln Ser Glu Leu Asn Pro Ile
225                 230                 235                 240

Leu Phe Thr Glu Asn Ala Arg Ala Asp Leu Lys Asp Val Leu Leu Tyr
                245                 250                 255

Gln Arg Ser Leu Lys Pro Val Lys Pro Gly Arg Cys Thr Phe Met Ser
            260                 265                 270

Glu Glu Glu Arg Ala Pro Leu Ala Leu Pro Ser Thr Gln Arg Phe Arg
        275                 280                 285

Met Tyr Gln Glu Val Asn Asn Leu Arg Ile Leu Arg Glu Gly Leu Lys
    290                 295                 300

Glu Glu Ser Leu Thr Leu Gln Gln Arg Asp Asp Leu Ile Asn Ala Leu
305                 310                 315                 320

Glu Lys Asn Asn Arg Arg Thr Phe Thr Gln Ile Lys Lys Leu Leu Gly
                325                 330                 335
```

```
Val Gly Gly Ser Val Gln Phe Asn Phe Glu Asp Pro Lys Arg Glu Glu
            340                 345                 350

Leu Lys Gly Asn Thr Thr Ser Ala Ile Leu Gly Lys Ser Glu His Phe
        355                 360                 365

Gly Glu Ala Trp Phe Ala Phe Asn Glu Ala Lys Gln Asp Ala Ile Val
    370                 375                 380

Leu Gln Leu Ile Lys Glu Glu Asn Glu Ala Lys Leu Val Arg Trp Leu
385                 390                 395                 400

Gln Asp Glu Thr Gly Ile Asp Glu Lys Arg Ala Glu Val Ile Ala Asn
                405                 410                 415

Ala Gly Leu Pro Glu Gly Tyr Gly Ser Leu Cys Ile Glu Ala Leu Ala
            420                 425                 430

Arg Ile Leu Pro Glu Leu Arg Arg Asp Val Val Thr Tyr Asp Lys Ala
        435                 440                 445

Val Gln Ala Ala Gly Phe Glu His His Ser Lys Leu Asn Arg Asn Glu
    450                 455                 460

Glu Ile Pro Asp Ile Thr Phe Lys Ile Glu Ser Ile Asp Arg Asn Ser
465                 470                 475                 480

Gly Glu Ile Lys Gln Phe His Leu His Lys Glu Leu Pro Tyr Tyr Gly
                485                 490                 495

Glu Tyr Leu Gln Arg His Val Gly Phe Gly Ser Gly Lys Pro Glu Asp
            500                 505                 510

Ser Ile Glu Lys Arg Tyr Gly Lys Ile Ala Asn Pro Thr Val His Ile
        515                 520                 525

Gly Leu Asn Gln Val Arg Val Val Val Asn Ala Leu Ile Lys Arg Tyr
    530                 535                 540
```

```
Gly His Pro Ser Glu Ile Ile Val Glu Val Ala Arg Asp Leu Lys Gln
545                 550                 555                 560

Ser Lys Asp Arg Arg Asp Glu Glu Asn Lys Arg Gln Ala Glu Asn Gln
                565                 570                 575

Lys Arg Asn Glu Arg Leu Arg Lys Asp Ile Ala Asp Ile Leu Gly Ile
            580                 585                 590

Ser Glu Glu Arg Val Arg Arg Asp Asp Ile Glu Lys Met Ile Leu Trp
        595                 600                 605

Glu Glu Leu Ser Phe Asp Pro Ala Asp Arg Arg Cys Pro Tyr Ser Gly
    610                 615                 620

Val Gln Val Ser Thr Val Met Leu Leu Ser Asp Glu Val Glu Val Glu
625                 630                 635                 640

His Ile Leu Pro Phe Ser Gln Thr Leu Asp Asp Ser Leu Asn Asn Lys
                645                 650                 655

Thr Val Ala Leu Arg Gln Ala Asn Arg Ile Lys Gly Asn Arg Thr Pro
            660                 665                 670

Trp Glu Ala Phe Gly Thr Ser Asn Ile Ser Gly Phe Asp Tyr Ser Gly
        675                 680                 685

Ile Leu Thr Arg Ala Glu Leu Met Pro Lys Ala Lys Arg Tyr Arg Phe
    690                 695                 700

Ala Glu Asp Gly Tyr Gln Arg Trp Leu Lys Asp Asp Ala Gly Phe Leu
705                 710                 715                 720

Ala Arg Ala Leu Asn Asp Thr Arg His Leu Ser Lys Ile Ala Arg Glu
                725                 730                 735
```

```
Tyr Met Ser Leu Ile Cys Pro Asn Thr Arg Val Ile Pro Gly Gln Met
            740                 745                 750

Thr Ala Met Leu Arg Arg Asn Phe Gly Leu Asn Asp Val Leu Gly Leu
        755                 760                 765

Asn Gly Glu Lys Asn Arg Asn Asp His Arg His His Ala Val Asp Ala
    770                 775                 780

Cys Val Ile Ala Val Thr Asp Gln Gly Leu Leu Gln Arg Phe Ala Ala
785                 790                 795                 800

Ala Ser Ala Ser Ala Arg Glu Arg Gln Leu Asn Arg Leu Val Glu Asn
                805                 810                 815

Met Pro Leu Pro Trp Glu Ser Tyr Arg Glu His Val Arg Arg Ala Ile
            820                 825                 830

Asp Gly Ile Trp Val Ser His Arg Pro Asp His Ser His Glu Gly Ala
        835                 840                 845

Met His Asn Asp Thr Ala Tyr Gly Leu Arg Gly Asn Gly Arg Val Ser
    850                 855                 860

Phe His Lys Met Val Glu Gly Lys Arg Glu Tyr Ile Glu Asp Asn Leu
865                 870                 875                 880

Lys Val Ile Glu Ile Thr Asp Thr Lys Ala Ile Asp Arg His Gly Leu
                885                 890                 895

Leu Pro Thr Gly Lys Pro Arg Pro Tyr Lys Gly Tyr Lys Gly Asp Ser
            900                 905                 910

Asn Tyr Cys Ile Glu Ile Val Arg Asn Glu Lys Gly Arg Trp Glu Gly
        915                 920                 925

Glu Ile Ile Ser Thr Phe Asp Ala Tyr Gln Leu Val Arg Lys Tyr Gly
    930                 935                 940
```

```
Ile Val Gln Leu Arg Tyr Pro Val Leu Ser Val Ser Gly Lys Pro Leu
945                 950                 955                 960


Val Met Arg Leu Ile Arg Asn Asp Phe Val Arg Leu Glu His Glu Gly
                965                 970                 975


Ile Thr Arg Thr Leu Arg Val Cys Lys Met Arg Glu Asp Gly Gln Val
            980                 985                 990


Ala Leu Ala Asp Val Thr Glu Ala  Asn Val Asp Ala Arg  Thr Arg Thr
        995                 1000                1005


Lys Glu  Ile Cys Tyr Val Phe  Lys Thr Gly Gly Ser  Leu Gln Lys
    1010                1015                1020


Ala Lys  Ala Arg Arg Ile Thr  Ile Ser Pro Ile Gly  Glu Leu Arg
    1025                1030                1035


Asp Pro  Gly Phe Lys Glu
    1040
```

<210> 211
<211> 1045
<212> PRT
<213> Acidovorax avenae

<400> 211

```
Met Gln Lys Glu Lys Pro Leu Ala Tyr Arg Leu Ala Leu Asp Leu Gly
1               5                   10                  15


Ser Thr Ser Leu Gly Trp Ala Val Leu Arg Leu Ser Ala Pro Gly Glu
            20                  25                  30


Pro Ser Ala Val Ile Arg Ala Gly Ser Arg Ile Phe Ser Asp Gly Arg
        35                  40                  45


Asn Pro Lys Asp Gly Ser Ser Leu Ala Val Thr Arg Arg Ala Ala Arg
```

```
    50                  55                  60

Ala Met Arg Arg Arg Arg Asp Arg Leu Leu Lys Arg Lys Ala Arg Met
65                  70                  75                  80

Leu Ala Ala Leu Glu Arg His Gly Phe Phe Pro Gln Asp Glu Ala Ala
                85                  90                  95

Arg Lys Ala Leu Glu Lys Leu Asn Pro Tyr Gly Leu Arg Ala Arg Gly
            100                 105                 110

Leu Glu Ser Ala Leu Lys Pro Glu Glu Phe Gly Arg Ala Leu Phe His
        115                 120                 125

Leu Asn Gln Arg Arg Gly Phe Gln Ser Asn Arg Lys Thr Asp Arg Lys
    130                 135                 140

Asp Ser Asp Ser Gly Ala Leu Lys Gln Ala Ile Gly Thr Leu Arg Ala
145                 150                 155                 160

Gln Met His Glu Ser Gly Cys Arg Thr Val Gly Glu Trp Phe Trp Lys
                165                 170                 175

Val Arg Met Glu Arg Lys Pro Glu Gly Val Lys Gly Gln Gly Val Arg
            180                 185                 190

Ala Arg Tyr Arg Glu Thr Pro Phe Thr Thr Asp Glu Gly Lys Lys Arg
        195                 200                 205

Ile Asp Lys Arg Tyr Asp Leu Tyr Val Asp Arg Ala Met Val Ala Gln
    210                 215                 220

Glu Phe Asp Ala Leu Trp Ala Ala Gln Ala Thr Phe Ala Pro Ala Leu
225                 230                 235                 240

Phe Asn Glu Ala Ala Arg Ala Glu Leu Arg Asp Ile Leu Leu His Gln
                245                 250                 255
```

```
Arg Lys Leu Arg Pro Val Gln Pro Gly Arg Cys Thr Leu Val Pro Glu
            260                 265                 270

Glu Pro Arg Ala Leu Leu Ala Leu Pro Ser Thr Gln Arg Phe Arg Ile
        275                 280                 285

Tyr Gln Glu Val Asn His Leu Arg Val Leu His Asp Glu Leu Arg Glu
    290                 295                 300

Glu Ala Leu Thr Leu Ala Gln Arg Asp Gln Ile Val Ala Leu Leu Glu
305                 310                 315                 320

Arg Gln Ala Lys Val Thr Phe Thr Ala Met Arg Lys Ala Leu Gly Phe
                325                 330                 335

Ser Ala Leu Phe Asn Leu Glu Asp Ala Lys Arg Asp Gly Leu Lys Gly
            340                 345                 350

Asn Ala Thr Thr Ala Ala Leu Gly Lys Lys Asp Leu Phe Gly Pro Leu
        355                 360                 365

Trp Ala Gly Phe Asp Thr Ala Leu Gln Asp Glu Ile Val Thr Gln Leu
    370                 375                 380

Met Thr Glu Glu Ser Glu Pro Arg Leu Ile Ala Trp Leu Gln Glu His
385                 390                 395                 400

Thr Gly Val Asp Glu Ala Arg Ala Gln Ala Ile Ala Asn Ala Gly Leu
                405                 410                 415

Pro Glu Gly Tyr Gly Ser Leu Gly Arg Thr Ala Leu Ala Arg Ile Val
            420                 425                 430

Pro Glu Leu Gln Arg Asp Val Ile Thr Tyr Asp Lys Ala Val Gln Ala
        435                 440                 445

Ala Gly Phe Ala His His Ser Asp Leu Gly Phe Ser Phe Glu His Asp
```

```
    450                 455                 460

Ala Asp Glu Val Glu Arg Ile Gly Glu Arg Thr Ile Ala Ser Thr Gly
465                 470                 475                 480

Glu Ile Lys Pro Val Phe Ala Phe Lys Gln Leu Pro Tyr Tyr Gly Arg
                485                 490                 495

Ala Leu Gln Arg His Val Ala Phe Ala Lys Glu Asn Pro Arg Asn Asp
            500                 505                 510

Glu Glu Arg Tyr Gly Lys Ile Ala Asn Pro Thr Val His Ile Gly Leu
        515                 520                 525

Asn Gln Val Arg Val Val Val Asn Ala Leu Met Cys Arg Tyr Gly Arg
    530                 535                 540

Pro Thr Glu Val Val Ile Glu Leu Ala Arg Asp Leu Lys Gln Ser Arg
545                 550                 555                 560

Glu Gln Lys Leu Glu Ala Gln Gln Arg Gln Ala Asp Asn Gln Lys Arg
                565                 570                 575

Asn Ala Arg Ile Arg Arg Ser Ile Ala Glu Val Leu Gly Ile Ser Glu
            580                 585                 590

Glu Arg Val Arg Thr Leu Asp Ile Gln Lys Trp Ile Leu Trp Glu Glu
        595                 600                 605

Leu Ser His Asp Ala Ala Asp Arg Arg Cys Pro Tyr Ser Gly Val Gln
    610                 615                 620

Ile Ser Ala Ser Met Leu Leu Gly Glu Arg Val Glu Ile Glu His Ile
625                 630                 635                 640

Leu Pro Phe Ser Met Thr Leu Asp Asp Ser Leu Asn Asn Arg Thr Val
                645                 650                 655
```

```
Ala Leu Arg Glu Ala Asn Arg Ile Lys Arg Asn Arg Thr Pro Trp Asp
            660                 665                 670

Ala Arg Thr Asp Phe Glu Ala His Gly Trp Ser Tyr Asp Gly Ile Leu
        675                 680                 685

Gln Arg Ala Glu Arg Met Pro Gln Arg Lys Arg His Arg Phe Ala Pro
    690                 695                 700

Asp Gly Tyr Glu Arg Trp Leu Gly Glu Asp Lys Asp Phe Leu Ala Arg
705                 710                 715                 720

Ala Leu Asn Asp Thr Arg Tyr Leu Ser Arg Val Ala Ala Glu Tyr Leu
                725                 730                 735

Arg Leu Val Cys Pro Gly Ser Ala Thr Arg Val Ile Pro Gly Gln Met
            740                 745                 750

Thr Ala Leu Leu Arg Gly Lys Phe Gly Leu Asn Asp Val Leu Gly Leu
        755                 760                 765

Asp Gly Glu Lys Asn Arg Asn Asp His Arg His His Ala Val Asp Ala
    770                 775                 780

Cys Val Ile Gly Val Thr Asp Gln Arg Met Met Gln Arg Phe Ala Gln
785                 790                 795                 800

Ala Asn Ala Gln Ala Arg Glu Asp Gly Leu Thr Arg Leu Val Glu Asp
                805                 810                 815

Met Pro Leu Pro Trp Pro Thr Tyr Arg Ala His Val Glu Arg Ala Val
            820                 825                 830

Arg His Ile Trp Val Ser His Lys Pro Asp His Gly Phe Glu Gly Ala
        835                 840                 845

Met Met Glu Glu Thr Ser Tyr Gly Ile Leu Arg Asp Gly Thr Ile Lys
```

```
    850                 855                 860

Gln Arg Arg Lys Ala Asp Gly Ser Ala Gly Arg Glu Ile Ser Arg Leu
865                 870                 875                 880

Ile Arg Ile Thr Glu Pro Ser Gln Pro Gln Arg His Gly Val Asp Ala
                885                 890                 895

Glu Gly Arg Pro Leu Pro Tyr Lys Gly Tyr Val Gly Gly Ser Asn Tyr
            900                 905                 910

Cys Leu Glu Ile Thr Val Asn Asp Lys Gly Lys Trp Glu Gly Gln Val
        915                 920                 925

Ile Ser Thr Phe Asp Ala Tyr Arg Ile Val Arg Glu Gly Gly Leu Arg
    930                 935                 940

Gln Leu Arg His Ser Thr Gln Gly Gln Asn Gly Gln Ala Leu Ala Met
945                 950                 955                 960

Arg Leu Val Ile Gly Asp Ser Val Arg Leu Glu Val Asp Glu Gln Glu
                965                 970                 975

Arg Val Met Arg Ile Val Lys Ile Asn Gly Asn Asn Gly Gln Val Phe
            980                 985                 990

Met Ala Pro Val His Glu Ala Asn  Val Asp Ala Arg Asn  Ser Asp Lys
        995                 1000                1005

Asn Glu  Ala Phe Ala Tyr Thr  Ser Lys Ile Ala Gly  Ser Phe Gln
    1010                1015                1020

Lys Thr  Lys Ala Arg Gln Val  Thr Ile Ser Pro Ile  Gly Glu Leu
    1025                1030                1035

Arg Asp  Pro Gly Phe Lys Gly
    1040                1045
```

<210> 212
<211> 1218
<212> PRT
<213> Prevotella denticola

<400> 212

```
Met Lys Ala Ser Glu Glu Lys Leu Ser Lys Gly Leu Ser Thr Tyr Met
1               5                  10                  15


Lys Glu Asn Asn Leu Leu Thr Val Gly Ala Ala Phe Ala Gln Leu Glu
            20                  25                  30


Asp Glu Gly Val Arg Ile Arg Asn Asn Asn Asn Tyr Arg Ala Ile Arg
        35                  40                  45


Ser Gln Phe Gln His Glu Ile Glu Thr Ile Phe Met Phe Gln Gln Gly
    50                  55                  60


Leu Ser Glu Asn Glu Leu Tyr Glu Arg Leu Val Ser Glu Lys Lys Asn
65                  70                  75                  80


Ile Gly Thr Ile Phe Tyr Lys Arg Pro Leu Arg Ser Gln Arg Gly Asn
                85                  90                  95


Val Gly Lys Cys Thr Leu Glu Arg Thr Lys Pro Arg Cys Ala Ile Gly
            100                 105                 110


His Pro Leu Phe Glu Lys Phe Arg Ala Trp Thr Leu Ile Asn Asn Ile
        115                 120                 125


Lys Ile Arg Met Ser Glu Glu Glu Gln Ala Glu Gln Leu Pro Met Lys
    130                 135                 140


Leu Arg Phe Glu Leu Tyr Asn Asp Cys Phe Leu Ala Phe Val Arg Ala
145                 150                 155                 160


Glu Phe Lys Phe Glu Asp Ile Arg Lys Tyr Leu Glu Lys Arg Leu Gly
                165                 170                 175
```

```
Val His Phe Ser Tyr Asn Asp Lys Thr Ile Asn Tyr Lys Asp Ser Thr
            180                 185                 190

Ser Val Ala Gly Cys Pro Ile Thr Ala Arg Phe Arg Lys Leu Leu Gly
        195                 200                 205

Glu Asp Trp Glu Ser Phe His Val Asp Gly Gln Lys Gln Arg Gln Ala
    210                 215                 220

His Gly Lys Asn Asn Ala Ser Phe His Thr Val Ser Tyr Ser Thr Asn
225                 230                 235                 240

Asp Ile Trp His Phe Cys Tyr Asp Ala Glu Glu Pro Glu Ala Val Leu
                245                 250                 255

Ser Phe Ala Gln Asp Asn Leu Lys Trp Glu Lys Lys Lys Ala Glu Glu
            260                 265                 270

Leu Val Arg Ile Trp Ser Ala Ile Pro Gln Gly Tyr Ala Met Leu Ser
        275                 280                 285

Gln Lys Ala Ile Arg Asn Ile Asn Lys Met Leu Ile Leu Gly Leu Lys
    290                 295                 300

Tyr Ser Asp Ala Val Leu Leu Ala Lys Val Pro Glu Ile Val Glu Ile
305                 310                 315                 320

Thr Asp Gly Glu Ile Leu Ser Val Thr Glu Asp Tyr His Arg Val Glu
                325                 330                 335

Ala Gln Val Gly Tyr Glu Lys Gln Ile Asn Asn Ile Val Asn Ala Leu
            340                 345                 350

Ile Ala Lys Tyr Lys Ser Ala Ser Glu Glu Tyr Arg Phe Ala Asp His
        355                 360                 365
```

```
Asn Tyr Glu Tyr Gln Leu Asp Lys Ser Asp Glu Lys Asp Ile Ile Lys
    370                 375                 380

Gln Ile Glu Ser Asn Ile Gly Thr Arg Lys Trp Ser Leu Leu Asp Ala
385                 390                 395                 400

Asp Glu Gln Thr Asp Ile Leu Gln Lys Val Arg Asp Lys Tyr Gln Asn
                405                 410                 415

Phe Phe Arg Ser His Glu Arg Lys Phe Val Glu Ser Pro Lys Leu Gly
            420                 425                 430

Glu Cys Phe Glu Glu Tyr Leu Met Lys Lys Phe Pro Met Val Glu Gly
        435                 440                 445

Glu Gln Trp Lys Lys Leu Tyr His Pro Ser Gln Ile Ala Ile Tyr Arg
    450                 455                 460

Pro Val Ser Ala Gly Lys Asp Arg Ser Ala Leu Arg Leu Gly Asn Pro
465                 470                 475                 480

Asp Ile Gly Ala Ile Lys Asn Pro Thr Val Leu Arg Val Leu Asn Thr
                485                 490                 495

Leu Arg Lys Arg Val Asn Gln Leu Leu Asp Asp Gly Leu Ile Ser Pro
            500                 505                 510

Asp Glu Thr Arg Val Val Val Glu Thr Ala Arg Glu Leu Asn Asp Ala
        515                 520                 525

Asn Arg Lys Trp Ala Leu Asp Asn Tyr Asn Arg Ile Arg His Asp Glu
    530                 535                 540

Asn Glu Lys Ile Lys Lys Ile Leu Glu Glu Phe Tyr Pro Lys Arg Asp
545                 550                 555                 560

Gly Ile Ser Thr Asp Asp Ile Asp Lys Ala Arg Tyr Val Ile Asp Gln
                565                 570                 575
```

```
Arg Glu Met Asp Tyr Phe Thr Glu Glu Lys Pro Tyr Asn Lys Asp Ile
            580                 585                 590

Lys Lys Tyr Lys Leu Trp Leu Glu Gln Gly Gly Gln Cys Met Tyr Thr
        595                 600                 605

Gly Arg Thr Ile Asn Leu Ser Asn Leu Phe Asp Pro Asn Ser Phe Asp
    610                 615                 620

Val Glu His Thr Ile Pro Glu Ser Ile Ser Phe Asp Ser Ser Asp Met
625                 630                 635                 640

Asn Leu Thr Leu Cys Asp Ala His Tyr Asn Arg Phe Ile Lys Lys Asn
                645                 650                 655

His Ile Pro Ala Asp Leu Pro Asn Tyr Asp Lys Ser Val Val Ile Asp
            660                 665                 670

Gly Lys Glu Tyr Ser Pro Ile Lys Pro Arg Leu Gln Arg Trp Ala Asp
        675                 680                 685

Arg Val Glu Arg Leu Asn Arg Asn Val Glu Tyr Trp Arg Gly Gln Ala
    690                 695                 700

Arg Arg Ala Gln Asn Lys Asp Arg Lys Asp Gln Cys Met Arg Glu Met
705                 710                 715                 720

His Leu Trp Lys Met Glu Leu Glu Tyr Trp Thr Lys Lys Leu Glu Arg
                725                 730                 735

Phe Thr Ile Thr Glu Val Thr Asp Glu Phe Lys Asn Ser Gln Leu Val
            740                 745                 750

Asp Thr Arg Val Ile Thr Arg His Ala Val Leu Tyr Leu Lys Ser Ile
        755                 760                 765
```

```
Phe Pro His Val Asp Val Gln Arg Gly Asp Val Thr Ala Lys Phe Arg
    770                 775                 780

Lys Ile Leu Gly Ile Gln Ser Val Asp Glu Lys Lys Asp Arg Ser Leu
785                 790                 795                 800

His Ser His His Ala Ile Asp Ala Thr Thr Leu Thr Ile Ile Pro Gly
                805                 810                 815

Ala Ala Lys Arg Glu Arg Met Leu Glu Leu Phe Ala Lys Ile Glu Glu
            820                 825                 830

Val Asn Lys Met Leu Ser Phe Ser Gly Asn Glu Asp Arg Thr Gly Leu
        835                 840                 845

Lys Gln Glu Leu Asp Gly Leu Lys Asn Gln Leu Asn Lys Glu Val Lys
    850                 855                 860

Ala Cys Arg Ile Gly His Asn Val Ser Glu Ile Gly Thr Phe Ile Asn
865                 870                 875                 880

Asp Asn Ile Ile Ile Asn His His Val Lys Asn Gln Ala Leu Thr Pro
                885                 890                 895

Val Arg Arg Arg Leu Arg Lys Arg Gly His Ile Val Gly Gly Met Asp
            900                 905                 910

Asn Pro Arg Trp Gln Thr Gly Asp Ala Leu Arg Gly Glu Ile His Lys
        915                 920                 925

Ala Ser Tyr Tyr Gly Ala Ile Thr Gln Phe Ala Lys Asp Lys Asp Gly
    930                 935                 940

Lys Val Leu Leu Lys Glu Gly His Pro Leu Val Asp Pro Thr Ile Lys
945                 950                 955                 960

Phe Val Ile Arg Arg Glu Leu Lys Tyr Lys Lys Ser Thr Ala Asp Ser
                965                 970                 975
```

```
Gly Phe Ala Ser Trp Asp Asp Leu Glu Lys Ala Ile Val Asp Lys Glu
            980                 985                 990


Leu Phe Ala Leu Met Lys Gly Gln  Phe Pro Glu Glu Thr  Ser Phe Lys
        995                 1000                1005


Asp Ala  Cys Glu Gln Gly Ile  Tyr Met Ile Lys Lys  Gly Lys Asn
    1010                1015                1020


Gly Glu  Val Asp Thr Lys Leu  Tyr Arg Ile Arg His  Ile Arg Cys
    1025                1030                1035


Lys Thr  Lys Gln Lys Asn Ala  Leu Lys Ile Lys Glu  Gln Ala Tyr
    1040                1045                1050


Lys Ser  Glu Lys Glu Tyr Lys  Arg Tyr Phe Tyr Ala  Ala Val Gly
    1055                1060                1065


Asp Leu  Tyr Ala Met Cys Cys  Tyr Thr Asn Gly Lys  Thr Arg Glu
    1070                1075                1080


Phe Lys  Ile Tyr Ser Leu Tyr  Asp Ile Ser Cys His  Arg Lys Val
    1085                1090                1095


Gly Val  Glu Asp Ile Pro Glu  Phe Ile Thr Asp Lys  Lys Gly Asn
    1100                1105                1110


Arg Leu  Met Leu Asp Tyr Lys  Leu His Thr Gly Asp  Met Ile Leu
    1115                1120                1125


Leu Tyr  Lys Glu Asn Pro Glu  Glu Leu Tyr Asp Leu  Asp Asn Val
    1130                1135                1140


Ser Leu  Ser Lys Leu Leu Tyr  Lys Ile Asn Gly Phe  Glu Asn Asp
    1145                1150                1155
```

```
Gly Leu  Arg Ile Arg Met Val  Asn His Leu Val Ala  Lys Glu Ala
    1160                1165                1170


Met Gly  Glu Ser Val Lys Asp  Tyr Ala Lys Leu Pro  Asp Ile Ile
    1175                1180                1185


Arg Cys  Gly Val Lys Thr Ile  Lys Phe Leu Val Met  Gly Glu Asn
    1190                1195                1200


Arg Asp  Phe Val Ile Lys Asn  Gly Lys Ile Ser Phe  Asn His Arg
    1205                1210                1215
```

<210> 213
<211> 1458
<212> PRT
<213> Fluviicola taffensis

<400> 213

```
Met Thr Lys Thr Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly
1               5                   10                  15


Trp Ala Leu Ile Asn Gln Asp Phe Asp Asn Lys Lys Gly Glu Ile Leu
            20                  25                  30


Gly Met Gly Ser Arg Ile Ile Pro Met Thr Gln Asp Ile Lys Asp Glu
        35                  40                  45


Phe Gly Lys Gly Asn Ser Ile Ser Gln Thr Ala Glu Arg Thr Arg Leu
    50                  55                  60


Arg Gly Val Arg Arg Leu Ile His Arg Thr Leu Leu Arg Arg Glu Arg
65                  70                  75                  80


Leu His Arg Val Leu Asn Ile Ile Gly Phe Leu Pro Glu His Tyr Ala
                85                  90                  95


Asn Gln Ile Asp Phe Glu Lys Arg Phe Gly Lys Phe Lys Pro Glu Ser
            100                 105                 110
```

```
Glu Pro Lys Ile Ser Phe Asp Gly Asn Asp Val Phe Leu Phe Glu Lys
        115                 120                 125

Ser Tyr Gln Glu Met Leu Val Asp Phe Lys Ile His Gln Pro Gln Leu
    130                 135                 140

Val Ser Asn Gly Lys Lys Ile Pro His Asp Trp Thr Ile Tyr Tyr Leu
145                 150                 155                 160

Arg Lys Lys Ala Leu Ser Lys Lys Ile Glu Lys Glu Glu Leu Ala Trp
                165                 170                 175

Ile Leu Leu Asn Phe Asn Gln Lys Arg Gly Tyr Tyr Gln Leu Arg Gly
            180                 185                 190

Glu Glu Glu Glu Glu Thr Pro Asn Lys Leu Val Glu Phe His Ser Leu
        195                 200                 205

Lys Ile Val Glu Val Asn Ala Asp Glu Pro Gln Lys Gly Lys Pro Glu
    210                 215                 220

Ile Trp Tyr Ser Leu Val Leu Glu Asn Gly Trp Val Tyr Arg Arg Ala
225                 230                 235                 240

Ser Lys Thr Pro Leu Phe Asp Trp Lys Asp Lys Ile Arg Glu Phe Ile
                245                 250                 255

Val Thr Thr Glu Ile Asn Asn Asp Gly Thr Val Lys Thr Asp Lys Glu
            260                 265                 270

Gly Thr Glu Lys Arg Ser Phe Arg Ala Pro Lys Pro Glu Asp Trp Thr
        275                 280                 285

Leu Gln Lys Lys Lys Thr Glu Phe Glu Leu Ser Lys Ser Gly Asn Glu
    290                 295                 300

Val Gly Ala Phe Ile Tyr Glu Ser Ile Leu Gln Lys Pro Asn Gln Lys
```

```
305                 310                 315                 320

Ile Arg Gly Lys Leu Ile Ser Thr Ile Glu Arg Lys Phe Tyr Lys Glu
                325                 330                 335

Glu Leu Lys Thr Ile Leu Lys Thr Gln Leu Phe Phe His Lys Glu Leu
            340                 345                 350

Lys Asp Glu Lys Leu Tyr Asn Ala Cys Ile Glu Glu Leu Tyr Lys Asn
        355                 360                 365

Asn Glu Ala His Arg Ser Leu Leu Ser Asn Lys Gly Phe Glu His Leu
    370                 375                 380

Phe Ile Asn Asp Ile Leu Phe Tyr Gln Arg Pro Leu Arg Ser Lys Lys
385                 390                 395                 400

Ser Gln Ile Ser Asn Cys Pro Leu Glu Lys Arg Thr Tyr Lys Lys Glu
                405                 410                 415

Gly Ile Glu Ile Thr Glu Gly Ile Lys Val Ile Ser Lys Ser Asn Pro
            420                 425                 430

Ile Tyr Gln Glu Phe Arg Leu Trp Gln Trp Ile Ser Asn Leu Ser Leu
        435                 440                 445

Tyr Cys Ile Glu Pro Thr Glu Thr Asn Val Thr Ser Thr Phe Leu Asn
    450                 455                 460

Ser Ile Glu Asp Tyr Glu Asn Leu Phe Glu Phe Leu Asn Asn Arg Lys
465                 470                 475                 480

Glu Ile Glu Gln Lys His Leu Leu Lys Tyr Leu Leu Glu Asn Gln Gly
                485                 490                 495

Phe Lys Gly Lys Leu Leu Thr Asn Glu Leu Glu Lys Phe Arg Trp Asn
            500                 505                 510
```

```
Phe Val Ala Asp Lys Lys Tyr Pro Cys Asn Glu Thr Gly Ser Leu Leu
        515                 520                 525

His Thr Arg Leu Ser Lys Val Lys Asn Ile Ser Pro Asp Phe Leu Thr
    530                 535                 540

Lys Glu Ile Glu His Gln Leu Trp His Ile Ile Tyr Ser Val Thr Asp
545                 550                 555                 560

Lys Ile Glu Tyr Glu Gln Ala Leu Lys Thr Phe Ala Arg Lys Asn Asn
                565                 570                 575

Leu Asp Val Asp Ser Phe Phe Glu His Phe Lys Lys Ile Pro Pro Phe
            580                 585                 590

Glu Ser Thr Tyr Gly Ala Tyr Ser Glu Lys Ala Ile Lys Lys Leu Leu
        595                 600                 605

Pro Leu Ile Arg Leu Gly Lys Tyr Trp Asn Trp Glu Ala Ile Asp Ser
    610                 615                 620

Ile Ser Lys Asp Arg Ile Ser Lys Ile Leu Ser Gly Glu Tyr Asp Glu
625                 630                 635                 640

Asn Ile Lys Asn Arg Val Arg Glu Lys Ala Val His Leu Thr Ser Glu
                645                 650                 655

Asn Asn Phe Gln Gly Leu Gln Glu Trp Leu Ala Lys Tyr Ile Val Tyr
            660                 665                 670

Asp Arg His Ser Glu Gly Asn Asp Leu Gly Lys Trp Thr Ser Val Ser
        675                 680                 685

Asp Leu Glu Thr Tyr Leu Lys Glu Phe Lys Gln His Ser Leu Arg Asn
    690                 695                 700

Pro Ile Val Glu Gln Val Ile Thr Glu Thr Leu Arg Val Val Lys Asp
```

```
705                 710                 715                 720

Ile Trp Ile Lys His Gly Lys Gly Thr Glu Asn Phe Phe Asp Glu Ile
                725                 730                 735

His Val Glu Leu Gly Arg Glu Met Lys Asn Asn Ser Glu Asp Arg Lys
            740                 745                 750

Arg Leu Thr Asn Thr Ile Thr Glu Asn Glu Asn Thr Asn Leu Arg Ile
        755                 760                 765

Lys Ala Leu Leu Met Glu Met Met Asn Asp Asn Asp Val Glu Asn Val
    770                 775                 780

Arg Pro Tyr Ser Pro Ser Gln Gln Glu Ile Leu Lys Ile Tyr Glu Asp
785                 790                 795                 800

Gly Ala Leu Asn Ser Asn Ile Glu Leu Asp Asp Glu Ile Val Lys Ile
                805                 810                 815

Ser Lys Lys Ala Glu Pro Thr Lys Ser Glu Leu Gln Arg Tyr Lys Leu
            820                 825                 830

Trp Leu Glu Gln Lys Tyr Arg Ser Pro Tyr Thr Gly Gln Val Ile Pro
        835                 840                 845

Leu Asn Lys Leu Phe Thr Ser Glu Tyr Glu Ile Glu His Val Val Pro
    850                 855                 860

Gln Ser Arg Phe Phe Asp Asp Ser Phe Ser Asn Lys Val Ile Cys Glu
865                 870                 875                 880

Ser Ala Val Asn Lys Arg Lys Asp Asn Gln Leu Gly Leu Gln Phe Ile
                885                 890                 895

Lys Asn His Ser Gly Glu Lys Val Glu Leu Gly Phe Gly Lys Val Val
            900                 905                 910
```

```
Gln Val Phe Thr Glu Glu Gln Tyr Leu Asp Phe Val Lys Glu His Tyr
        915                 920                 925

Ser Lys Asn Arg Ser Lys His Asn Lys Leu Leu Leu Glu Glu Ile Pro
    930                 935                 940

Glu Lys Met Ile Glu Arg Gln Leu Asn Asp Thr Arg Tyr Ile Ser Lys
945                 950                 955                 960

Phe Val Ser Ser Ile Leu Ser Asn Ile Val Arg Ser Glu Lys Asp Asp
                965                 970                 975

Asp Gly Leu Asn Ser Lys Asn Ile Leu Pro Gly Asn Gly Lys Ile Thr
            980                 985                 990

Thr Glu Leu Lys Arg Asp Trp Gly  Leu Asn Asp Val Trp  Asn Asp Leu
        995                 1000                1005

Ile Leu  Pro Arg Phe Glu Arg  Met Asn Thr Ile Thr  Asn Ser Asp
    1010                1015                1020

Leu Phe  Thr Thr Tyr Asn Asp  Lys Tyr Gln Lys His  Leu Pro Thr
    1025                1030                1035

Val Pro  Phe Glu Tyr Ser Lys  Gly Phe Gln Lys Lys  Arg Ile Asp
    1040                1045                1050

His Arg  His His Ala Met Asp  Ala Leu Val Ile Ala  Cys Ala Thr
    1055                1060                1065

Arg Asp  His Leu Asn Leu Met  Asn Asn Gln Ser Ala  Lys Ser Glu
    1070                1075                1080

Leu Lys  Arg Tyr Asp Leu Gln  Asn Lys Leu Arg Lys  Lys Glu Pro
    1085                1090                1095

Tyr Phe  Asn Gln Lys Glu Asn  Lys Gln Lys Glu Ala  Phe Lys Asp
```

```
    1100                1105                1110

Phe Ile  Lys Pro Trp Gly Thr  Phe Thr Glu Asp Ser  Lys Asn Ala
    1115                1120                1125

Leu Glu  Lys Ile Ile Ile Ser  Phe Lys Gln Asn Leu  Arg Val Ile
    1130                1135                1140

Asn Lys  Ala Thr Asn Ser Tyr  Glu Ser Tyr Lys Asp  Glu Asp Gly
    1145                1150                1155

Asn Leu  Arg Ile Gly Lys Asp  Gly Lys Pro Glu Lys  Gly Leu Ile
    1160                1165                1170

Lys Gln  Lys Gly Leu Asn Trp  Ala Ile Arg Lys Pro  Leu His Lys
    1175                1180                1185

Asp Thr  Val Ser Gly Gln Ile  Asn Leu Ser Arg Ile  Lys Leu Pro
    1190                1195                1200

Asn Gly  Lys Ile Leu Thr Ala  Thr Arg Lys Asn Leu  Asp Thr Ser
    1205                1210                1215

Phe Asp  Leu Lys Thr Ile Glu  Asn Ser Ile Thr Asp  Thr Gly Ile
    1220                1225                1230

Gln Lys  Ile Leu Lys Asn Tyr  Leu Leu Ser Lys Glu  Ser Pro Glu
    1235                1240                1245

Leu Ala  Phe Ser Pro Glu Gly  Leu Glu Glu Met Asn  Asn Glu Ile
    1250                1255                1260

Glu Lys  Tyr Asn Asn Gly Lys  Phe His His Pro Ile  Asn Lys Ala
    1265                1270                1275

Arg Ile  Tyr Glu Leu Gly Ser  Lys Phe Asn Val Gly  Gln Thr Gly
    1280                1285                1290
```

```
Asn Arg  Arg Asp Lys Phe Val  Glu Ala Ala Lys Gly  Thr Asn Leu
    1295                1300                1305

Phe Phe  Ala Ile Tyr Gln Asp  Glu Asn Lys Asn Arg  Ser Tyr Glu
    1310                1315                1320

Thr Ile  Pro Leu Asn Glu Val  Ile Glu His Gln Lys  Trp Arg Ala
    1325                1330                1335

Ser Leu  Pro Lys Glu Glu Gln  Glu Lys Ile Pro Leu  Val Pro Val
    1340                1345                1350

Asn Lys  Leu Lys Gly Thr Phe  Ile Phe Ser Leu Ser  Pro Asn Asp
    1355                1360                1365

Leu Val  Tyr Val Pro Ser Asn  Asp Glu Leu Glu Arg  Ser Ala Ser
    1370                1375                1380

Ile Asp  Phe Ser Lys Leu Lys  Lys Glu Gln Ile Asn  Arg Leu Tyr
    1385                1390                1395

Lys Met  Val Ser Ser Ser Gly  Ser Gln Cys Phe Phe  Val Lys Ser
    1400                1405                1410

Glu Val  Ala Thr Ser Val Val  Asn Lys Met Glu Tyr  Ser Ser Leu
    1415                1420                1425

Asn Lys  Met Glu Lys Ser Ile  Asp Asn Leu Met Val  Lys Glu Ile
    1430                1435                1440

Cys Ile  Lys Leu Lys Ile Asp  Arg Leu Gly Asn Ile  Ser Lys Ala
    1445                1450                1455
```

<210> 214
<211> 1384
<212> PRT
<213> Coriobacterium glomerans

<400> 214

```
Met Lys Leu Arg Gly Ile Glu Asp Asp Tyr Ser Ile Gly Leu Asp Met
1               5                  10                  15

Gly Thr Ser Ser Val Gly Trp Ala Val Thr Asp Glu Arg Gly Thr Leu
            20                  25                  30

Ala His Phe Lys Arg Lys Pro Thr Trp Gly Ser Arg Leu Phe Arg Glu
        35                  40                  45

Ala Gln Thr Ala Ala Val Ala Arg Met Pro Arg Gly Gln Arg Arg Arg
    50                  55                  60

Tyr Val Arg Arg Arg Trp Arg Leu Asp Leu Leu Gln Lys Leu Phe Glu
65                  70                  75                  80

Gln Gln Met Glu Gln Ala Asp Pro Asp Phe Phe Ile Arg Leu Arg Gln
                85                  90                  95

Ser Arg Leu Leu Arg Asp Asp Arg Ala Glu Glu His Ala Asp Tyr Arg
            100                 105                 110

Trp Pro Leu Phe Asn Asp Cys Lys Phe Thr Glu Arg Asp Tyr Tyr Gln
        115                 120                 125

Arg Phe Pro Thr Ile Tyr His Val Arg Ser Trp Leu Met Glu Thr Asp
    130                 135                 140

Glu Gln Ala Asp Ile Arg Leu Ile Tyr Leu Ala Leu His Asn Ile Val
145                 150                 155                 160

Lys His Arg Gly Asn Phe Leu Arg Glu Gly Gln Ser Leu Ser Ala Lys
                165                 170                 175

Ser Ala Arg Pro Asp Glu Ala Leu Asn His Leu Arg Glu Thr Leu Arg
            180                 185                 190
```

```
Val Trp Ser Ser Glu Arg Gly Phe Glu Cys Ser Ile Ala Asp Asn Gly
        195                 200                 205

Ser Ile Leu Ala Met Leu Thr His Pro Asp Leu Ser Pro Ser Asp Arg
    210                 215                 220

Arg Lys Lys Ile Ala Pro Leu Phe Asp Val Lys Ser Asp Asp Ala Ala
225                 230                 235                 240

Ala Asp Lys Lys Leu Gly Ile Ala Leu Ala Gly Ala Val Ile Gly Leu
                245                 250                 255

Lys Thr Glu Phe Lys Asn Ile Phe Gly Asp Phe Pro Cys Glu Asp Ser
            260                 265                 270

Ser Ile Tyr Leu Ser Asn Asp Glu Ala Val Asp Ala Val Arg Ser Ala
        275                 280                 285

Cys Pro Asp Asp Cys Ala Glu Leu Phe Asp Arg Leu Cys Glu Val Tyr
    290                 295                 300

Ser Ala Tyr Val Leu Gln Gly Leu Leu Ser Tyr Ala Pro Gly Gln Thr
305                 310                 315                 320

Ile Ser Ala Asn Met Val Glu Lys Tyr Arg Arg Tyr Gly Glu Asp Leu
                325                 330                 335

Ala Leu Leu Lys Lys Leu Val Lys Ile Tyr Ala Pro Asp Gln Tyr Arg
            340                 345                 350

Met Phe Phe Ser Gly Ala Thr Tyr Pro Gly Thr Gly Ile Tyr Asp Ala
        355                 360                 365

Ala Gln Ala Arg Gly Tyr Thr Lys Tyr Asn Leu Gly Pro Lys Lys Ser
    370                 375                 380

Glu Tyr Lys Pro Ser Glu Ser Met Gln Tyr Asp Asp Phe Arg Lys Ala
385                 390                 395                 400
```

```
Val Glu Lys Leu Phe Ala Lys Thr Asp Ala Arg Ala Asp Glu Arg Tyr
                405                 410                 415

Arg Met Met Met Asp Arg Phe Asp Lys Gln Gln Phe Leu Arg Arg Leu
            420                 425                 430

Lys Thr Ser Asp Asn Gly Ser Ile Tyr His Gln Leu His Leu Glu Glu
        435                 440                 445

Leu Lys Ala Ile Val Glu Asn Gln Gly Arg Phe Tyr Pro Phe Leu Lys
    450                 455                 460

Arg Asp Ala Asp Lys Leu Val Ser Leu Val Ser Phe Arg Ile Pro Tyr
465                 470                 475                 480

Tyr Val Gly Pro Leu Ser Thr Arg Asn Ala Arg Thr Asp Gln His Gly
                485                 490                 495

Glu Asn Arg Phe Ala Trp Ser Glu Arg Lys Pro Gly Met Gln Asp Glu
            500                 505                 510

Pro Ile Phe Pro Trp Asn Trp Glu Ser Ile Ile Asp Arg Ser Lys Ser
        515                 520                 525

Ala Glu Lys Phe Ile Leu Arg Met Thr Gly Met Cys Thr Tyr Leu Gln
    530                 535                 540

Gln Glu Pro Val Leu Pro Lys Ser Ser Leu Leu Tyr Glu Glu Phe Cys
545                 550                 555                 560

Val Leu Asn Glu Leu Asn Gly Ala His Trp Ser Ile Asp Gly Asp Asp
                565                 570                 575

Glu His Arg Phe Asp Ala Ala Asp Arg Glu Gly Ile Ile Glu Glu Leu
            580                 585                 590
```

```
Phe Arg Arg Lys Arg Thr Val Ser Tyr Gly Asp Val Ala Gly Trp Met
        595                 600                 605

Glu Arg Glu Arg Asn Gln Ile Gly Ala His Val Cys Gly Gly Gln Gly
    610                 615                 620

Glu Lys Gly Phe Glu Ser Lys Leu Gly Ser Tyr Ile Phe Phe Cys Lys
625                 630                 635                 640

Asp Val Phe Lys Val Glu Arg Leu Glu Gln Ser Asp Tyr Pro Met Ile
                645                 650                 655

Glu Arg Ile Ile Leu Trp Asn Thr Leu Phe Glu Asp Arg Lys Ile Leu
            660                 665                 670

Ser Gln Arg Leu Lys Glu Glu Tyr Gly Ser Arg Leu Ser Ala Glu Gln
        675                 680                 685

Ile Lys Thr Ile Cys Lys Lys Arg Phe Thr Gly Trp Gly Arg Leu Ser
    690                 695                 700

Glu Lys Phe Leu Thr Gly Ile Thr Val Gln Val Asp Glu Asp Ser Val
705                 710                 715                 720

Ser Ile Met Asp Val Leu Arg Glu Gly Cys Pro Val Ser Gly Lys Arg
                725                 730                 735

Gly Arg Ala Met Val Met Met Glu Ile Leu Arg Asp Glu Glu Leu Gly
            740                 745                 750

Phe Gln Lys Lys Val Asp Asp Phe Asn Arg Ala Phe Phe Ala Glu Asn
        755                 760                 765

Ala Gln Ala Leu Gly Val Asn Glu Leu Pro Gly Ser Pro Ala Val Arg
    770                 775                 780

Arg Ser Leu Asn Gln Ser Ile Arg Ile Val Asp Glu Ile Ala Ser Ile
785                 790                 795                 800
```

```
Ala Gly Lys Ala Pro Ala Asn Ile Phe Ile Glu Val Thr Arg Asp Glu
               805                 810                 815

Asp Pro Lys Lys Lys Gly Arg Arg Thr Lys Arg Arg Tyr Asn Asp Leu
            820                 825                 830

Lys Asp Ala Leu Glu Ala Phe Lys Lys Glu Asp Pro Glu Leu Trp Arg
        835                 840                 845

Glu Leu Cys Glu Thr Ala Pro Asn Asp Met Asp Glu Arg Leu Ser Leu
    850                 855                 860

Tyr Phe Met Gln Arg Gly Lys Cys Leu Tyr Ser Gly Arg Ala Ile Asp
865                 870                 875                 880

Ile His Gln Leu Ser Asn Ala Gly Ile Tyr Glu Val Asp His Ile Ile
               885                 890                 895

Pro Arg Thr Tyr Val Lys Asp Asp Ser Leu Glu Asn Lys Ala Leu Val
            900                 905                 910

Tyr Arg Glu Glu Asn Gln Arg Lys Thr Asp Met Leu Leu Ile Asp Pro
        915                 920                 925

Glu Ile Arg Arg Arg Met Ser Gly Tyr Trp Arg Met Leu His Glu Ala
    930                 935                 940

Lys Leu Ile Gly Asp Lys Lys Phe Arg Asn Leu Leu Arg Ser Arg Ile
945                 950                 955                 960

Asp Asp Lys Ala Leu Lys Gly Phe Ile Ala Arg Gln Leu Val Glu Thr
               965                 970                 975

Gly Gln Met Val Lys Leu Val Arg Ser Leu Leu Glu Ala Arg Tyr Pro
            980                 985                 990
```

```
Glu Thr Asn Ile Ile Ser Val Lys  Ala Ser Ile Ser His  Asp Leu Arg
        995                 1000                1005

Thr Ala  Ala Glu Leu Val Lys  Cys Arg Glu Ala Asn  Asp Phe His
    1010                1015                1020

His Ala  His Asp Ala Phe Leu  Ala Cys Arg Val Gly  Leu Phe Ile
    1025                1030                1035

Gln Lys  Arg His Pro Cys Val  Tyr Glu Asn Pro Ile  Gly Leu Ser
    1040                1045                1050

Gln Val  Val Arg Asn Tyr Val  Arg Gln Gln Ala Asp  Ile Phe Lys
    1055                1060                1065

Arg Cys  Arg Thr Ile Pro Gly  Ser Ser Gly Phe Ile  Val Asn Ser
    1070                1075                1080

Phe Met  Thr Ser Gly Phe Asp  Lys Glu Thr Gly Glu  Ile Phe Lys
    1085                1090                1095

Asp Asp  Trp Asp Ala Glu Ala  Glu Val Glu Gly Ile  Arg Arg Ser
    1100                1105                1110

Leu Asn  Phe Arg Gln Cys Phe  Ile Ser Arg Met Pro  Phe Glu Asp
    1115                1120                1125

His Gly  Val Phe Trp Asp Ala  Thr Ile Tyr Ser Pro  Arg Ala Lys
    1130                1135                1140

Lys Thr  Ala Ala Leu Pro Leu  Lys Gln Gly Leu Asn  Pro Ser Arg
    1145                1150                1155

Tyr Gly  Ser Phe Ser Arg Glu  Gln Phe Ala Tyr Phe  Phe Ile Tyr
    1160                1165                1170

Lys Ala  Arg Asn Pro Arg Lys  Glu Gln Thr Leu Phe  Glu Phe Ala
    1175                1180                1185
```

```
Gln Val  Pro Val Arg Leu Ser  Ala Gln Ile Arg Gln  Asp Glu Asn
    1190                1195                1200

Ala Leu  Glu Arg Tyr Ala Arg  Glu Leu Ala Lys Asp  Gln Gly Leu
    1205                1210                1215

Glu Phe  Ile Arg Ile Glu Arg  Ser Lys Ile Leu Lys  Asn Gln Leu
    1220                1225                1230

Ile Glu  Ile Asp Gly Asp Arg  Leu Cys Ile Thr Gly  Lys Glu Glu
    1235                1240                1245

Val Arg  Asn Ala Cys Glu Leu  Ala Phe Ala Gln Asp  Glu Met Arg
    1250                1255                1260

Val Ile  Arg Met Leu Val Ser  Glu Lys Pro Val Ser  Arg Glu Cys
    1265                1270                1275

Val Ile  Ser Leu Phe Asn Arg  Ile Leu Leu His Gly  Asp Gln Ala
    1280                1285                1290

Ser Arg  Arg Leu Ser Lys Gln  Leu Lys Leu Ala Leu  Leu Ser Glu
    1295                1300                1305

Ala Phe  Ser Glu Ala Ser Asp  Asn Val Gln Arg Asn  Val Val Leu
    1310                1315                1320

Gly Leu  Ile Ala Ile Phe Asn  Gly Ser Thr Asn Met  Val Asn Leu
    1325                1330                1335

Ser Asp  Ile Gly Gly Ser Lys  Phe Ala Gly Asn Val  Arg Ile Lys
    1340                1345                1350

Tyr Lys  Lys Glu Leu Ala Ser  Pro Lys Val Asn Val  His Leu Ile
    1355                1360                1365
```

Asp Gln Ser Val Thr Gly Met Phe Glu Arg Arg Thr Lys Ile Gly
    1370   1375   1380

Leu

<210> 215
<211> 1077
<212> PRT
<213> Neisseria bacilliformis

<400> 215

Met Gln Gln Lys Pro Gln Arg Tyr Ile Leu Gly Leu Asp Leu Gly Ile
1   5   10   15

Ala Ser Val Gly Trp Ala Cys Val Trp Ala Asp Glu Asn Glu His Pro
            20   25   30

Thr Gly Leu Leu Asp Cys Gly Val Arg Thr Phe Glu Arg Ala Glu Val
        35   40   45

Pro Lys Thr Gly Asp Ser Leu Ala Leu Ala Arg Arg Gln Ala Arg Ser
    50   55   60

Val Arg Arg Leu Ile Arg Arg Arg Ala His Arg Leu Leu Arg Leu Arg
65   70   75   80

Arg Leu Leu Lys Arg Glu Gly Val Leu Leu Ser Ala Asp Phe Asn Glu
                85   90   95

Asn Gly Leu Val Arg Gly Leu Pro Ile Asp Ala Trp Ala Leu Arg Val
            100   105   110

Ala Gly Leu Asp Arg Lys Leu Ser Asn Lys Glu Trp Ala Ala Val Leu
        115   120   125

Leu His Leu Val Lys His Arg Gly Tyr Leu Ser Gln Arg Lys Asn Glu
    130   135   140

```
Thr Gln Ser Lys Asp Lys Glu Leu Gly Arg Leu Leu Ala Gly Val Asn
145                 150                 155                 160

Gly Asn Arg Glu Ala Leu Gln Asn Arg Ser Asp Glu Tyr Arg Thr Ala
                165                 170                 175

Ala Glu Leu Ala Val Lys Lys Phe Ala Ala Glu Asn Asn Gly Ser Leu
            180                 185                 190

Arg Asn Lys Gly Gly Asp Tyr Ser His Thr Phe Asp Arg Lys Asp Leu
        195                 200                 205

Gln Arg Glu Leu His Leu Leu Phe Glu Arg Gln Arg Ala Leu Asp Asn
    210                 215                 220

Pro Phe Thr Ser Ser Glu Met Glu Ala Ala Val Asp Glu Leu Leu Met
225                 230                 235                 240

Lys Gln Arg Ser Ala Leu Gln Gly Glu Ala Val Leu Lys Met Leu Gly
                245                 250                 255

Arg Cys Thr Phe Glu Pro Ser Glu Tyr Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Ser Ala Glu Arg Phe Val Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Gln Tyr Asn Gly Glu Glu Arg Ala Leu Ser Glu Ala Glu Arg Arg Leu
    290                 295                 300

Leu Leu Asp Glu Pro Tyr Gln Lys Ala Lys Leu Thr Tyr Lys Gln Val
305                 310                 315                 320

Arg Thr Ile Leu Glu Leu Pro Glu Ser Ala Val Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly His Gly Glu Asp Gly Leu Lys Ala Glu Ser Gly Thr Leu Met
```

```
            340                 345                 350

Glu Met Lys Ala Tyr His Ala Val Arg Lys Ala Leu Lys Asp Ala Gly
        355                 360                 365

Leu Glu Gly Glu Trp Glu Asn Arg Ile Arg Asn Pro Glu Leu Leu Asp
    370                 375                 380

Ala Ile Gly Thr Ala Phe Ser Leu Tyr Lys Thr Asp Glu Asp Ile Arg
385                 390                 395                 400

Ala Asn Leu Ala Ala Phe Arg Leu Ser Glu Asn Val Leu Glu Ala Leu
                405                 410                 415

Leu Ala Gly Leu Asn Phe Asp Lys Phe Val His Leu Ser Leu Lys Ala
            420                 425                 430

Leu Ala Lys Ile Leu Pro Leu Met Glu Gln Gly Met Arg Tyr Asp Glu
        435                 440                 445

Ala Cys Lys Glu Ala Tyr Gly Asp His Tyr Gly Ala Lys Glu Gln Glu
    450                 455                 460

Asp His Arg Leu Leu Pro Pro Phe Val Ala Asp Asp Ile Arg Asn Pro
465                 470                 475                 480

Val Val Phe Arg Thr Leu Thr Gln Ala Arg Lys Ile Val Asn Glu Ile
                485                 490                 495

Val Arg Arg Tyr Gly Ser Pro Leu Arg Val His Ile Glu Thr Gly Arg
            500                 505                 510

Glu Val Gly Lys Ser Phe Ser Asp Arg Lys Glu Ile Glu Lys Arg Gln
        515                 520                 525

Glu Glu Asn Arg Lys Glu Arg Glu Arg Ala Ala Ala His Phe Lys Glu
    530                 535                 540
```

```
Leu Phe Pro Asn Phe Ala Gly Glu Pro Lys Ala Gln Asp Ile Leu Lys
545                 550                 555                 560

Leu Arg Leu Tyr Glu Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys
                565                 570                 575

Glu Ile Asp Leu Arg Arg Leu Pro Glu Lys Gly Tyr Val Glu Ile Asp
            580                 585                 590

His Ala Leu Pro Phe Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys
        595                 600                 605

Val Leu Val Leu Gly Lys Glu Asn Gln Asp Lys Arg Asn Arg Thr Pro
    610                 615                 620

Tyr Glu Tyr Leu Asp Gly Lys Gly Asn Ser Gly Ala Trp Arg Ala Phe
625                 630                 635                 640

Ala Glu Arg Val Ser Gly Cys Arg Phe Pro Tyr Ala Lys Lys Gln Arg
                645                 650                 655

Leu Leu Thr Gln Lys Leu Asp Glu Lys Thr Glu Gln Gly Phe Leu Glu
            660                 665                 670

Arg Asn Leu Asn Asp Thr Arg Tyr Val Ala Arg Phe Leu Cys Gln Phe
        675                 680                 685

Ile Glu Glu Lys Met His Leu Glu Gly Ala Gly Lys Lys Arg Val Phe
    690                 695                 700

Ala Ser Asn Gly Gln Ile Thr Ala Leu Leu Arg Gly Phe Trp Gly Leu
705                 710                 715                 720

Lys Lys Val Arg Glu Glu Asn Asp Arg His His Ala Leu Asp Ala Val
                725                 730                 735

Val Val Ala Cys Ser Ser Val Ser Met Gln Gln Lys Ile Thr Arg His
```

```
            740                 745                 750

Phe Arg Tyr Arg Glu Glu Leu Glu His Ile Asp Arg Glu Thr Gly Glu
        755                 760                 765

Val Ile His Gly Phe Pro Gln Pro Trp Glu Phe Phe Arg Gln Glu Val
    770                 775                 780

Met Thr Arg Val Phe Ser Asp Asp Pro Val Ser Glu Leu Ala Glu Lys
785                 790                 795                 800

Leu Asp Ser Arg Pro Glu Ala Val His Glu Phe Val Thr Pro Leu Phe
                805                 810                 815

Val Ser Arg Ala Pro His Arg Lys Val Thr Gly Gln Gly His Leu Glu
            820                 825                 830

Thr Ile Arg Ser Ala Lys Arg Leu Asp Glu Lys Ile Ser Val Val Lys
        835                 840                 845

Leu Pro Leu Thr Gln Leu Lys Thr Lys Asp Ile Glu Arg Ile Val Gly
    850                 855                 860

Tyr Pro Asn Arg Glu Pro Ala Leu Tyr Asp Ala Leu Ala Ala Arg Leu
865                 870                 875                 880

Ala Ala Phe Lys Asp Asp Pro Ala Lys Ala Phe Ser Glu Pro Phe Tyr
                885                 890                 895

Lys Thr Gly Lys Asp Gly Lys Cys Gly Val Leu Val Lys Ala Val Arg
            900                 905                 910

Val Glu Asn Val Gln Lys Ser Gly Leu Leu Val Arg Lys Asp Glu Ser
        915                 920                 925

Gly Lys Met Gln Gly Val Ala Asp Asn Ala Thr Met Val Arg Val Asp
    930                 935                 940
```

```
Val Phe Gly Lys Asn Gly Lys Asn Tyr Leu Val Pro Val Tyr Ala Trp
945                 950                 955                 960


Gln Val Glu Lys Gly Glu Leu Pro Asn Arg Ala Val Val Ala Tyr Ala
                965                 970                 975


Asp Glu Glu Asp Trp Asp Glu Met Asp Asp Ser Phe Glu Phe Lys Phe
            980                 985                 990


Ser Leu Tyr Pro Asn Asp Leu Val  Glu Val Val Thr Lys  Lys Asp Lys
        995                 1000                1005


Phe Phe  Gly Tyr Tyr Ser Gly  Phe Asn Arg Ala Thr  Gly Ala Ile
    1010                1015                1020


Asn Ile  Lys Glu His Asp Leu  Ser Lys Ser Lys Val  Lys Asn Gly
    1025                1030                1035


Val Tyr  Glu Gly Ile Gly Val  Lys Thr Ala Gln Ser  Phe Gln Lys
    1040                1045                1050


Tyr Gln  Val Asp Thr Leu Gly  Lys Thr Ile Arg Leu  Cys Lys Pro
    1055                1060                1065


Glu Lys  Arg Met Gly Phe Lys  Lys Lys
    1070                1075


<210>  216
<211>  1029
<212>  PRT
<213>  Alicycliphilus denitrificans

<400>  216

Met Arg Ser Leu Arg Tyr Arg Leu Ala Leu Asp Leu Gly Ser Thr Ser
1               5                   10                  15


Leu Gly Trp Ala Leu Phe Arg Leu Asp Ala Cys Asn Arg Pro Thr Ala
            20                  25                  30
```

```
Val Ile Lys Ala Gly Val Arg Ile Phe Ser Asp Gly Arg Asn Pro Lys
        35                  40                  45

Asp Gly Ser Ser Leu Ala Val Thr Arg Arg Ala Ala Arg Ala Met Arg
    50                  55                  60

Arg Arg Arg Asp Arg Leu Leu Lys Arg Lys Thr Arg Met Gln Ala Lys
65                  70                  75                  80

Leu Val Glu His Gly Phe Phe Pro Ala Asp Ala Gly Lys Arg Lys Ala
                85                  90                  95

Leu Glu Gln Leu Asn Pro Tyr Ala Leu Arg Ala Lys Gly Leu Gln Glu
            100                 105                 110

Ala Leu Leu Pro Gly Glu Phe Ala Arg Ala Leu Phe His Ile Asn Gln
        115                 120                 125

Arg Arg Gly Phe Lys Ser Asn Arg Lys Thr Asp Lys Lys Asp Asn Asp
    130                 135                 140

Ser Gly Val Leu Lys Lys Ala Ile Gly Gln Leu Arg Gln Gln Met Ala
145                 150                 155                 160

Glu Gln Gly Ser Arg Thr Val Gly Glu Tyr Leu Trp Thr Arg Leu Gln
                165                 170                 175

Gln Gly Gln Gly Val Arg Ala Arg Tyr Arg Glu Lys Pro Tyr Thr Thr
            180                 185                 190

Glu Glu Gly Lys Lys Arg Ile Asp Lys Ser Tyr Asp Leu Tyr Ile Asp
        195                 200                 205

Arg Ala Met Ile Glu Gln Glu Phe Asp Ala Leu Trp Ala Ala Gln Ala
    210                 215                 220
```

```
Ala Phe Asn Pro Thr Leu Phe His Glu Ala Ala Arg Ala Asp Leu Lys
225                 230                 235                 240

Asp Thr Leu Leu His Gln Arg Pro Leu Arg Pro Val Lys Pro Gly Arg
                245                 250                 255

Cys Thr Leu Leu Pro Glu Glu Glu Arg Ala Pro Leu Ala Leu Pro Ser
            260                 265                 270

Thr Gln Arg Phe Arg Ile His Gln Glu Val Asn His Leu Arg Leu Leu
        275                 280                 285

Asp Glu Asn Leu Arg Glu Val Ala Leu Thr Leu Ala Gln Arg Asp Ala
    290                 295                 300

Val Val Thr Ala Leu Glu Thr Lys Ala Lys Leu Ser Phe Glu Gln Ile
305                 310                 315                 320

Arg Lys Leu Leu Lys Leu Ser Gly Ser Val Gln Phe Asn Leu Glu Asp
                325                 330                 335

Ala Lys Arg Thr Glu Leu Lys Gly Asn Ala Thr Ser Ala Ala Leu Ala
            340                 345                 350

Arg Lys Glu Leu Phe Gly Ala Ala Trp Ser Gly Phe Asp Glu Ala Leu
        355                 360                 365

Gln Asp Glu Ile Val Trp Gln Leu Val Thr Glu Glu Gly Glu Gly Ala
    370                 375                 380

Leu Ile Ala Trp Leu Gln Thr His Thr Gly Val Asp Glu Ala Arg Ala
385                 390                 395                 400

Gln Ala Ile Val Asp Val Ser Leu Pro Glu Gly Tyr Gly Asn Leu Ser
                405                 410                 415

Arg Lys Ala Leu Ala Arg Ile Val Pro Ala Leu Arg Ala Ala Val Ile
            420                 425                 430
```

```
Thr Tyr Asp Lys Ala Val Gln Ala Ala Gly Phe Asp His His Ser Gln
        435                 440                 445

Leu Gly Phe Glu Tyr Asp Ala Ser Glu Val Glu Asp Leu Val His Pro
    450                 455                 460

Glu Thr Gly Glu Ile Arg Ser Val Phe Lys Gln Leu Pro Tyr Tyr Gly
465                 470                 475                 480

Lys Ala Leu Gln Arg His Val Ala Phe Gly Ser Gly Lys Pro Glu Asp
                485                 490                 495

Pro Asp Glu Lys Arg Tyr Gly Lys Ile Ala Asn Pro Thr Val His Ile
            500                 505                 510

Gly Leu Asn Gln Val Arg Met Val Val Asn Ala Leu Ile Arg Arg Tyr
        515                 520                 525

Gly Arg Pro Thr Glu Val Val Ile Glu Leu Ala Arg Asp Leu Lys Gln
    530                 535                 540

Ser Arg Glu Gln Lys Val Glu Ala Gln Arg Arg Gln Ala Asp Asn Gln
545                 550                 555                 560

Arg Arg Asn Ala Arg Ile Arg Arg Ser Ile Ala Glu Val Leu Gly Ile
                565                 570                 575

Gly Glu Glu Arg Val Arg Gly Ser Asp Ile Gln Lys Trp Ile Cys Trp
            580                 585                 590

Glu Glu Leu Ser Phe Asp Ala Ala Asp Arg Arg Cys Pro Tyr Ser Gly
        595                 600                 605

Val Gln Ile Ser Ala Ala Met Leu Leu Ser Asp Glu Val Glu Val Glu
    610                 615                 620
```

```
His Ile Leu Pro Phe Ser Lys Thr Leu Asp Asp Ser Leu Asn Asn Arg
625                 630                 635                 640

Thr Val Ala Met Arg Gln Ala Asn Arg Ile Lys Arg Asn Arg Thr Pro
                645                 650                 655

Trp Asp Ala Arg Ala Glu Phe Glu Ala Gln Gly Trp Ser Tyr Glu Asp
            660                 665                 670

Ile Leu Gln Arg Ala Glu Arg Met Pro Leu Arg Lys Arg Tyr Arg Phe
        675                 680                 685

Ala Pro Asp Gly Tyr Glu Arg Trp Leu Gly Asp Asp Lys Asp Phe Leu
    690                 695                 700

Ala Arg Ala Leu Asn Asp Thr Arg Tyr Leu Ser Arg Val Ala Ala Glu
705                 710                 715                 720

Tyr Leu Arg Leu Val Cys Pro Gly Thr Arg Val Ile Pro Gly Gln Leu
                725                 730                 735

Thr Ala Leu Leu Arg Gly Lys Phe Gly Leu Asn Asp Val Leu Gly Leu
            740                 745                 750

Asp Gly Glu Lys Asn Arg Asn Asp His Arg His His Ala Val Asp Ala
        755                 760                 765

Cys Val Ile Gly Val Thr Asp Gln Gly Leu Met Gln Arg Phe Ala Thr
    770                 775                 780

Ala Ser Ala Gln Ala Arg Gly Asp Gly Leu Thr Arg Leu Val Asp Gly
785                 790                 795                 800

Met Pro Met Pro Trp Pro Thr Tyr Arg Asp His Val Glu Arg Ala Val
                805                 810                 815

Arg His Ile Trp Val Ser His Arg Pro Asp His Gly Phe Glu Gly Ala
            820                 825                 830
```

```
Met Met Glu Glu Thr Ser Tyr Gly Ile Arg Lys Asp Gly Ser Ile Lys
        835                 840                 845

Gln Arg Arg Lys Ala Asp Gly Ser Ala Gly Arg Glu Ile Ser Asn Leu
    850                 855                 860

Ile Arg Ile His Glu Ala Thr Gln Pro Leu Arg His Gly Val Ser Ala
865                 870                 875                 880

Asp Gly Gln Pro Leu Ala Tyr Lys Gly Tyr Val Gly Gly Ser Asn Tyr
                885                 890                 895

Cys Ile Glu Ile Thr Val Asn Asp Lys Gly Lys Trp Glu Gly Glu Val
            900                 905                 910

Ile Ser Thr Phe Arg Ala Tyr Gly Val Val Arg Ala Gly Gly Met Gly
        915                 920                 925

Arg Leu Arg Asn Pro His Glu Gly Gln Asn Gly Arg Lys Leu Ile Met
    930                 935                 940

Arg Leu Val Ile Gly Asp Ser Val Arg Leu Glu Val Asp Gly Ala Glu
945                 950                 955                 960

Arg Thr Met Arg Ile Val Lys Ile Ser Gly Ser Asn Gly Gln Ile Phe
                965                 970                 975

Met Ala Pro Ile His Glu Ala Asn Val Asp Ala Arg Asn Thr Asp Lys
            980                 985                 990

Gln Asp Ala Phe Thr Tyr Thr Ser  Lys Tyr Ala Gly Ser  Leu Gln Lys
        995                 1000                1005

Ala Lys  Thr Arg Arg Val Thr  Ile Ser Pro Ile Gly  Glu Val Arg
    1010                1015                1020
```

Asp Pro Gly Phe Lys Gly
    1025

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<211> 1122
<212> PRT
<213> Streptococcus suis

<400> 217

Met Ser Asn Gly Lys Ile Leu Gly Leu Asp Ile Gly Ile Ala Ser Val
1   5   10   15

Gly Val Gly Val Ile Asp Ala Gln Thr Gly Glu Ile Ile His Ala Ser
            20   25   30

Ser Arg Ile Phe Pro Ser Ala Asn Ala Ala Asn Asn Ala Glu Arg Arg
        35   40   45

Thr Phe Arg Gly Ser Arg Arg Leu Ile Arg Arg Lys Lys His Arg Ile
    50   55   60

Lys Arg Leu Asp Asp Leu Phe Asn Asp Phe His Ile Asn Leu Asp Gly
65   70   75   80

Glu Met Ser Thr Asp Asn Pro Tyr Val Leu Arg Val Lys Gly Leu Ser
                85   90   95

Gln Lys Leu Thr Val Glu Glu Leu Tyr Ile Ser Ile Lys Asn Ile Met
            100   105   110

Lys Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Glu Ser Asp Asn Glu
        115   120   125

Ala Gly Arg Ser Asp Tyr Ala Lys Ala Ile Glu Arg Asn Arg Gln Leu
    130   135   140

Leu Thr Ser Lys Thr Pro Gly Glu Ile Gln Leu Glu Arg Leu Glu Lys
145   150   155   160

```
Tyr Gly Gln Leu Arg Gly Asn Phe Thr Ile Ile Asp Glu Glu Gly Gln
                165                 170                 175

Ser Gln Gln Ile Ile Asn Val Phe Ser Thr Ser Asp Tyr Val Lys Glu
            180                 185                 190

Val Glu Lys Ile Leu Asp Cys Gln Lys Met Tyr His Lys Phe Ile Ser
        195                 200                 205

Asp Glu Phe Cys Asp Lys Leu Ile Glu Leu Leu Arg Glu Lys Arg Lys
    210                 215                 220

Tyr Tyr Val Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Ile
225                 230                 235                 240

Tyr Arg Thr Asp Gly Thr Thr Leu Glu Asn Leu Phe Gly Ile Leu Ile
                245                 250                 255

Gly Lys Cys Thr Phe Tyr Pro Asp Gln Tyr Arg Ser Ser Arg Ala Ser
            260                 265                 270

Tyr Thr Ala Gln Glu Phe Asn Phe Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285

Val Pro Thr Glu Thr Lys Lys Leu Ser Gln Glu Gln Lys Glu Phe Leu
    290                 295                 300

Val Asn Tyr Ala Lys Glu Thr Ser Val Leu Gly Ala Gly Lys Ile Leu
305                 310                 315                 320

Gln Gln Ile Ala Lys Leu Ala Asp Cys Lys Val Glu Asp Ile Arg Gly
                325                 330                 335

Tyr Arg Leu Asp Asn Lys Asp Lys Pro Glu Leu His Thr Phe Glu Thr
            340                 345                 350

Tyr Arg Ala Met Lys Gly Leu Val Pro Leu Val Asp Ile Gly Val Leu
```

```
        355                 360                 365

Ser Arg Glu Gln Leu Asp Ile Leu Ala Asp Ile Leu Thr Leu Asn Thr
    370                 375                 380

Asp Phe Glu Gly Ile Arg Glu Ala Leu Lys Lys Gln Leu Pro Asn Val
385                 390                 395                 400

Phe Asp Glu Lys Gln Val Lys Gly Leu Ala Ser Phe Arg Lys Ser Lys
                405                 410                 415

Ser Gln Leu Phe Ala Lys Gly Trp His Asn Leu Ser Gln Lys Ile Met
            420                 425                 430

Leu Glu Val Ile Pro Glu Leu Tyr Ala Thr Ser Asp Glu Gln Met Thr
        435                 440                 445

Ile Leu Thr Arg Leu Gly Lys Phe Glu Lys Ser Ser Val Ala Glu Tyr
    450                 455                 460

Pro Ser Ser Ile Asn Val Asp Glu Ile Thr Asp Glu Ile Tyr Asn Pro
465                 470                 475                 480

Val Val Ala Lys Ser Ile Arg Gln Thr Ile Lys Ile Ile Asn Ala Ser
                485                 490                 495

Ile Lys Lys Trp Gly Glu Phe Asp Gln Ile Val Ile Glu Met Pro Arg
            500                 505                 510

Asp Arg Asn Glu Asp Glu Glu Lys Lys Arg Ile Ala Asp Gly Gln Lys
        515                 520                 525

Ala Asn Ala Lys Glu Lys Ala Asp Ser Ile Leu Arg Ala Ala Glu Leu
    530                 535                 540

Tyr Cys Ala Gly Lys Val Leu Pro Asp Tyr Val Tyr Asn Gly His Asn
545                 550                 555                 560
```

```
Gln Leu Ala Thr Lys Ile Arg Leu Trp Tyr Gln Gln Gly Glu Arg Cys
               565                 570                 575

Ile Tyr Thr Gly Gln Pro Ile Ser Ile His Asp Leu Ile His Asn Gln
            580                 585                 590

Asn Gln Tyr Glu Ile Asp His Ile Leu Pro Leu Ser Leu Thr Phe Asp
        595                 600                 605

Asp Ser Leu Ser Asn Lys Val Leu Val Leu Ala Thr Ala Asn Gln Glu
    610                 615                 620

Lys Ala Gln Arg Thr Pro Tyr Asn Tyr Leu Lys Ser Ala Thr Ser Ala
625                 630                 635                 640

Trp Ser Tyr Arg Glu Phe Lys Asp Tyr Val Thr Lys Arg Lys Gly Ile
               645                 650                 655

Gly Lys Lys Lys Cys Glu Tyr Leu Thr Phe Glu Glu Asp Ile Asn Gly
            660                 665                 670

Phe Glu Val Arg Ser Lys Phe Ile Gln Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Ala Ser Lys Val Ile Leu Asn Ala Leu Gln Asp Tyr Phe Lys Ile
    690                 695                 700

Ser Gly Ile Gln Thr Lys Val Ser Val Val Arg Gly Gln Phe Thr Ser
705                 710                 715                 720

Gln Leu Arg His Lys Trp Gly Ile Glu Lys Thr Arg Glu Thr Tyr His
               725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Arg
            740                 745                 750

Leu Trp Lys Lys Gln Glu Ser Pro Leu Val Val Asp Tyr Gln Glu Gly
```

```
        755                 760                 765

Arg Gln Val Asp Leu Glu Thr Gly Glu Ile Leu Glu Leu Thr Asp Glu
    770                 775                 780

Gln Tyr Lys Glu Leu Val Tyr Gln Pro Pro Tyr Gln Gly Phe Val Asn
785                 790                 795                 800

Thr Ile Ser Ser Ser Ala Phe Asp Asn Glu Ile Leu Phe Ser Tyr Gln
                805                 810                 815

Val Asp Ser Lys Val Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala
            820                 825                 830

Thr Arg Asn Ala Gln Leu Gly Lys Asp Lys Thr Glu Gly Ile Tyr Val
        835                 840                 845

Leu Gly Lys Ile Lys Asp Ile Tyr Thr Gln Ala Gly Tyr Glu Ala Phe
    850                 855                 860

Leu Lys Arg Tyr Thr Lys Asp Lys Thr Ser Phe Leu Met Tyr His Lys
865                 870                 875                 880

Asp Leu Asp Thr Trp Glu Lys Val Ile Glu Ile Ile Leu Arg Asp Tyr
                885                 890                 895

Arg Glu Tyr Asp Glu Lys Gly Lys Glu Ile Gly Asn Pro Phe Glu Arg
            900                 905                 910

Tyr Arg Arg Glu Asn Gly Tyr Val Lys Lys Tyr Ser Arg Lys Gly Asn
        915                 920                 925

Gly Thr Ala Ile Lys Ser Leu Lys Tyr Tyr Asp Asn Lys Leu Gly Asn
    930                 935                 940

His Ile Asp Ile Thr Pro Glu Asn Ser Arg Asn Ala Val Val Leu Gln
945                 950                 955                 960
```

```
Ser Leu Lys Pro Trp Arg Thr Asp Val Tyr Phe Asn Lys Glu Thr Gly
                965                 970                 975


Lys Tyr Glu Phe Leu Gly Ile Lys Tyr Ser Asp Leu Ser Phe Glu Lys
            980                 985                 990


Gly Thr Gly Glu Tyr Gly Ile Ser  Gln Glu Lys Tyr Asp  Ser Ile Lys
        995                 1000                1005


Ile Ala  Glu Gly Val Ala Lys  Lys Ser Ile Phe Lys  Phe Thr Leu
    1010                1015                1020


Tyr Lys  Gln Asp Leu Leu Phe  Ile Lys Asp Ile Glu  Asn Asn Phe
    1025                1030                1035


Gly Lys  Leu Leu Arg Phe Thr  Ser Lys Asn Asp Thr  Ser Lys His
    1040                1045                1050


Tyr Val  Glu Leu Lys Pro Tyr  Asp Lys Asn Lys Phe  Gly Thr Glu
    1055                1060                1065


Glu Pro  Leu Leu Pro Val Leu  Gly Asn Val Ala Lys  Ser Gly Gln
    1070                1075                1080


Cys Ile  Lys Gly Leu Asn Lys  Ser Asn Ile Ser Ile  Tyr Lys Val
    1085                1090                1095


Arg Thr  Asp Ile Leu Gly Tyr  Arg His Phe Ile Lys  Gln Glu Gly
    1100                1105                1110


Glu His  Pro Gln Leu Lys Phe  Lys Lys
    1115                1120


<210>  218
<211>  1428
<212>  PRT
<213>  Parasutterella excrementihominis
```

<400> 218

Met Gly Lys Thr His Ile Ile Gly Val Gly Leu Asp Leu Gly Gly Thr
1 5 10 15

Tyr Thr Gly Thr Phe Ile Thr Ser His Pro Ser Asp Glu Ala Glu His
20 25 30

Arg Asp His Ser Ser Ala Phe Thr Val Val Asn Ser Glu Lys Leu Ser
35 40 45

Phe Ser Ser Lys Ser Arg Thr Ala Val Arg His Arg Val Arg Ser Tyr
50 55 60

Lys Gly Phe Asp Leu Arg Arg Arg Leu Leu Leu Leu Val Ala Glu Tyr
65 70 75 80

Gln Leu Leu Gln Lys Lys Gln Thr Leu Ala Pro Glu Glu Arg Glu Asn
85 90 95

Leu Arg Ile Ala Leu Ser Gly Tyr Leu Lys Arg Arg Gly Tyr Ala Arg
100 105 110

Thr Glu Ala Glu Thr Asp Thr Ser Val Leu Glu Ser Leu Asp Pro Ser
115 120 125

Val Phe Ser Ser Ala Pro Ser Phe Thr Asn Phe Phe Asn Asp Ser Glu
130 135 140

Pro Leu Asn Ile Gln Trp Glu Ala Ile Ala Asn Ser Pro Glu Thr Thr
145 150 155 160

Lys Ala Leu Asn Lys Glu Leu Ser Gly Gln Lys Glu Ala Asp Phe Lys
165 170 175

Lys Tyr Ile Lys Thr Ser Phe Pro Glu Tyr Ser Ala Lys Glu Ile Leu
180 185 190

```
Ala Asn Tyr Val Glu Gly Arg Arg Ala Ile Leu Asp Ala Ser Lys Tyr
        195                 200                 205

Ile Ala Asn Leu Gln Ser Leu Gly His Lys His Arg Ser Lys Tyr Leu
    210                 215                 220

Ser Asp Ile Leu Gln Asp Met Lys Arg Asp Ser Arg Ile Thr Arg Leu
225                 230                 235                 240

Ser Glu Ala Phe Gly Ser Thr Asp Asn Leu Trp Arg Ile Ile Gly Asn
                245                 250                 255

Ile Ser Asn Leu Gln Glu Arg Ala Val Arg Trp Tyr Phe Asn Asp Ala
            260                 265                 270

Lys Phe Glu Gln Gly Gln Glu Gln Leu Asp Ala Val Lys Leu Lys Asn
        275                 280                 285

Val Leu Val Arg Ala Leu Lys Tyr Leu Arg Ser Asp Asp Lys Glu Trp
    290                 295                 300

Ser Ala Ser Gln Lys Gln Ile Ile Gln Ser Leu Glu Gln Ser Gly Asp
305                 310                 315                 320

Val Leu Asp Val Leu Ala Gly Leu Asp Pro Asp Arg Thr Ile Pro Pro
                325                 330                 335

Tyr Glu Asp Gln Asn Asn Arg Arg Pro Pro Glu Asp Gln Thr Leu Tyr
            340                 345                 350

Leu Asn Pro Lys Ala Leu Ser Ser Glu Tyr Gly Glu Lys Trp Lys Ser
        355                 360                 365

Trp Ala Asn Lys Phe Ala Gly Ala Tyr Pro Leu Leu Thr Glu Asp Leu
    370                 375                 380

Thr Glu Ile Leu Lys Asn Thr Asp Arg Lys Ser Arg Ile Lys Ile Arg
385                 390                 395                 400
```

```
Ser Asp Val Leu Pro Asp Ser Asp Tyr Arg Leu Ala Tyr Ile Leu Gln
                405                 410                 415

Arg Ala Phe Asp Arg Ser Ile Ala Leu Asp Glu Cys Ser Ile Arg Arg
            420                 425                 430

Thr Ala Glu Asp Phe Glu Asn Gly Val Val Ile Lys Asn Glu Lys Leu
        435                 440                 445

Glu Asp Val Leu Ser Gly His Gln Leu Glu Glu Phe Leu Glu Phe Ala
    450                 455                 460

Asn Arg Tyr Tyr Gln Glu Thr Ala Lys Ala Lys Asn Gly Leu Trp Phe
465                 470                 475                 480

Pro Glu Asn Ala Leu Leu Glu Arg Ala Asp Leu His Pro Pro Met Lys
                485                 490                 495

Asn Lys Ile Leu Asn Val Ile Val Gly Gln Ala Leu Gly Val Ser Pro
            500                 505                 510

Ala Glu Gly Thr Asp Phe Ile Glu Glu Ile Trp Asn Ser Lys Val Lys
        515                 520                 525

Gly Arg Ser Thr Val Arg Ser Ile Cys Asn Ala Ile Glu Asn Glu Arg
    530                 535                 540

Lys Thr Tyr Gly Pro Tyr Phe Ser Glu Asp Tyr Lys Phe Val Lys Thr
545                 550                 555                 560

Ala Leu Lys Glu Gly Lys Thr Glu Lys Glu Leu Ser Lys Lys Phe Ala
                565                 570                 575

Ala Val Ile Lys Val Leu Lys Met Val Ser Glu Val Val Pro Phe Ile
            580                 585                 590
```

```
Gly Lys Glu Leu Arg Leu Ser Asp Glu Ala Gln Ser Lys Phe Asp Asn
        595                 600                 605

Leu Tyr Ser Leu Ala Gln Leu Tyr Asn Leu Ile Glu Thr Glu Arg Asn
    610                 615                 620

Gly Phe Ser Lys Val Ser Leu Ala Ala His Leu Glu Asn Ala Trp Arg
625                 630                 635                 640

Met Thr Met Thr Asp Gly Ser Ala Gln Cys Cys Arg Leu Pro Ala Asp
                645                 650                 655

Cys Val Arg Pro Phe Asp Gly Phe Ile Arg Lys Ala Ile Asp Arg Asn
            660                 665                 670

Ser Trp Glu Val Ala Lys Arg Ile Ala Glu Glu Val Lys Lys Ser Val
        675                 680                 685

Asp Phe Thr Asn Gly Thr Val Lys Ile Pro Val Ala Ile Glu Ala Asn
    690                 695                 700

Ser Phe Asn Phe Thr Ala Ser Leu Thr Asp Leu Lys Tyr Ile Gln Leu
705                 710                 715                 720

Lys Glu Gln Lys Leu Lys Lys Lys Leu Glu Asp Ile Gln Arg Asn Glu
                725                 730                 735

Glu Asn Gln Glu Lys Arg Trp Leu Ser Lys Glu Glu Arg Ile Arg Ala
            740                 745                 750

Asp Ser His Gly Ile Cys Ala Tyr Thr Gly Arg Pro Leu Asp Asp Val
        755                 760                 765

Gly Glu Ile Asp His Ile Ile Pro Arg Ser Leu Thr Leu Lys Lys Ser
    770                 775                 780

Glu Ser Ile Tyr Asn Ser Glu Val Asn Leu Ile Phe Val Ser Ala Gln
785                 790                 795                 800
```

```
Gly Asn Gln Glu Lys Lys Asn Asn Ile Tyr Leu Leu Ser Asn Leu Ala
               805                 810                 815

Lys Asn Tyr Leu Ala Ala Val Phe Gly Thr Ser Asp Leu Ser Gln Ile
            820                 825                 830

Thr Asn Glu Ile Glu Ser Thr Val Leu Gln Leu Lys Ala Ala Gly Arg
        835                 840                 845

Leu Gly Tyr Phe Asp Leu Leu Ser Glu Lys Glu Arg Ala Cys Ala Arg
    850                 855                 860

His Ala Leu Phe Leu Asn Ser Asp Ser Glu Ala Arg Arg Ala Val Ile
865                 870                 875                 880

Asp Val Leu Gly Ser Arg Arg Lys Ala Ser Val Asn Gly Thr Gln Ala
               885                 890                 895

Trp Phe Val Arg Ser Ile Phe Ser Lys Val Arg Gln Ala Leu Ala Ala
            900                 905                 910

Trp Thr Gln Glu Thr Gly Asn Glu Leu Ile Phe Asp Ala Ile Ser Val
        915                 920                 925

Pro Ala Ala Asp Ser Ser Glu Met Arg Lys Arg Phe Ala Glu Tyr Arg
    930                 935                 940

Pro Glu Phe Arg Lys Pro Lys Val Gln Pro Val Ala Ser His Ser Ile
945                 950                 955                 960

Asp Ala Met Cys Ile Tyr Leu Ala Ala Cys Ser Asp Pro Phe Lys Thr
               965                 970                 975

Lys Arg Met Gly Ser Gln Leu Ala Ile Tyr Glu Pro Ile Asn Phe Asp
            980                 985                 990
```

```
Asn Leu Phe Thr Gly Ser Cys Gln  Val Ile Gln Asn Thr  Pro Arg Asn
        995                 1000                1005


Phe Ser  Asp Lys Thr Asn Ile  Ala Asn Ser Pro Ile  Phe Lys Glu
    1010                1015                1020


Thr Ile  Tyr Ala Glu Arg Phe  Leu Asp Ile Ile Val  Ser Arg Gly
    1025                1030                1035


Glu Ile  Phe Ile Gly Tyr Pro  Ser Asn Met Pro Phe  Glu Glu Lys
    1040                1045                1050


Pro Asn  Arg Ile Ser Ile Gly  Gly Lys Asp Pro Phe  Ser Ile Leu
    1055                1060                1065


Ser Val  Leu Gly Ala Tyr Leu  Asp Lys Ala Pro Ser  Ser Glu Lys
    1070                1075                1080


Glu Lys  Leu Thr Ile Tyr Arg  Val Val Lys Asn Lys  Ala Phe Glu
    1085                1090                1095


Leu Phe  Ser Lys Val Ala Gly  Ser Lys Phe Thr Ala  Glu Glu Asp
    1100                1105                1110


Lys Ala  Ala Lys Ile Leu Glu  Ala Leu His Phe Val  Thr Val Lys
    1115                1120                1125


Gln Asp  Val Ala Ala Thr Val  Ser Asp Leu Ile Lys  Ser Lys Lys
    1130                1135                1140


Glu Leu  Ser Lys Asp Ser Ile  Glu Asn Leu Ala Lys  Gln Lys Gly
    1145                1150                1155


Cys Leu  Lys Lys Val Glu Tyr  Ser Ser Lys Glu Phe  Lys Phe Lys
    1160                1165                1170


Gly Ser  Leu Ile Ile Pro Ala  Ala Val Glu Trp Gly  Lys Val Leu
    1175                1180                1185
```

```
Trp Asn  Val Phe Lys Glu Asn  Thr Ala Glu Glu Leu  Lys Asp Glu
    1190                1195                1200

Asn Ala  Leu Arg Lys Ala Leu  Glu Ala Ala Trp Pro  Ser Ser Phe
    1205                1210                1215

Gly Thr  Arg Asn Leu His Ser  Lys Ala Lys Arg Val  Phe Ser Leu
    1220                1225                1230

Pro Val  Val Ala Thr Gln Ser  Gly Ala Val Arg Ile  Arg Arg Lys
    1235                1240                1245

Thr Ala  Phe Gly Asp Phe Val  Tyr Gln Ser Gln Asp  Thr Asn Asn
    1250                1255                1260

Leu Tyr  Ser Ser Phe Pro Val  Lys Asn Gly Lys Leu  Asp Trp Ser
    1265                1270                1275

Ser Pro  Ile Ile His Pro Ala  Leu Gln Asn Arg Asn  Leu Thr Ala
    1280                1285                1290

Tyr Gly  Tyr Arg Phe Val Asp  His Asp Arg Ser Ile  Ser Met Ser
    1295                1300                1305

Glu Phe  Arg Glu Val Tyr Asn  Lys Asp Asp Leu Met  Arg Ile Glu
    1310                1315                1320

Leu Ala  Gln Gly Thr Ser Ser  Arg Arg Tyr Leu Arg  Val Glu Met
    1325                1330                1335

Pro Gly  Glu Lys Phe Leu Ala  Trp Phe Gly Glu Asn  Ser Ile Ser
    1340                1345                1350

Leu Gly  Ser Ser Phe Lys Phe  Ser Val Ser Glu Val  Phe Asp Asn
    1355                1360                1365
```

```
Lys Ile  Tyr Thr Glu Asn Ala  Glu Phe Thr Lys Phe  Leu Pro Lys
    1370                1375                1380


Pro Arg  Glu Asp Asn Lys His  Asn Gly Thr Ile Phe  Phe Glu Leu
    1385                1390                1395


Val Gly  Pro Arg Val Ile Phe  Asn Tyr Ile Val Gly  Gly Ala Ala
    1400                1405                1410


Ser Ser  Leu Lys Glu Ile Phe  Ser Glu Ala Gly Lys  Glu Arg Ser
    1415                1420                1425


<210>  219
<211>  1371
<212>  PRT
<213>  Lactobacillus buchneri

<400>  219

Met Lys Val Asn Asn Tyr His Ile Gly Leu Asp Ile Gly Thr Ser Ser
1               5                   10                  15


Ile Gly Trp Val Ala Ile Gly Glu Asp Gly Lys Pro Leu Arg Ile Lys
            20                  25                  30


Gly Lys Thr Ala Ile Gly Ala Arg Leu Phe Gln Glu Gly Asn Pro Ala
        35                  40                  45


Ala Asp Arg Arg Met Phe Arg Thr Thr Arg Arg Arg Leu Ser Arg Arg
    50                  55                  60


Lys Trp Arg Leu Lys Leu Leu Glu Glu Ile Phe Asp Pro Tyr Ile Thr
65                  70                  75                  80


Pro Val Asp Ser Thr Phe Phe Ala Arg Leu Lys Gln Ser Asn Leu Ser
                85                  90                  95


Pro Lys Asp Ser Arg Lys Glu Phe Lys Gly Ser Met Leu Phe Pro Asp
            100                 105                 110
```

```
Leu Thr Asp Met Gln Tyr His Lys Asp Tyr Pro Thr Ile Tyr His Leu
        115                 120                 125

Arg His Ala Leu Met Thr Gln Asp Glu Lys Phe Asp Ile Arg Met Val
    130                 135                 140

Tyr Leu Ala Ile His His Ile Val Lys Tyr Arg Gly Asn Phe Leu Asn
145                 150                 155                 160

Ser Thr Pro Val Asp Ser Phe Lys Ala Ser Lys Val Asn Phe Val Asp
                165                 170                 175

Gln Phe Lys Lys Leu Asn Glu Leu Tyr Thr Ala Ile Asn Pro Glu Glu
            180                 185                 190

Ser Phe Gln Ile Asn Leu Ala Asn Ser Glu Asp Ile Gly His Gln Phe
        195                 200                 205

Leu Asp Pro Ser Ile Arg Lys Phe Asp Lys Lys Lys Gln Ile Pro Lys
    210                 215                 220

Ile Val Pro Val Ser Val Asp Asp Lys Ala Thr Asp Lys Ile Asn Gly
225                 230                 235                 240

Lys Ile Ala Ser Glu Ile Ile Asn Ala Ile Leu Gly Tyr Lys Ser Lys
                245                 250                 255

Leu Asp Val Val Val Gln Cys Thr Pro Val Asp Ser Lys Ser Trp Ala
            260                 265                 270

Leu Lys Phe Asp Glu Glu Asp Ile Asp Ala Lys Leu Gln Lys Ile Leu
        275                 280                 285

Pro Glu Met Asp Glu Asn Gln Gln Ser Ile Ile Ala Ile Leu Gln Asn
    290                 295                 300

Leu Tyr Ser Gln Val Thr Leu Asn Gln Ile Val Pro Asn Gly Met Ser
```

```
305                 310                 315                 320

Leu Ser Glu Ser Met Ile Glu Lys Tyr Asn Asp His His Asp His Leu
                325                 330                 335

Lys Leu Tyr Lys Lys Ile Ile Asp Gln Leu Ala Asp Pro Lys Lys Lys
            340                 345                 350

Ala Ala Leu Lys Lys Ala Tyr Ser Gln Tyr Val Gly Asp Asp Gly Lys
        355                 360                 365

Val Ile Glu Gln Ala Asp Phe Trp Ser Ser Val Lys Lys Asn Leu Asp
    370                 375                 380

Asp Ser Asp Leu Ser Lys Gln Ile Met Asp Leu Ile Asp Ala Glu Lys
385                 390                 395                 400

Phe Met Pro Lys Gln Arg Thr Ser Gln Asn Gly Val Ile Pro His Gln
                405                 410                 415

Leu His Gln Arg Glu Leu Asp Glu Ile Ile Glu His Gln Ser Lys Tyr
            420                 425                 430

Tyr Pro Trp Leu Ala Glu Ile Asn Pro Asn Lys His Asp Leu His Leu
        435                 440                 445

Ala Lys Tyr Lys Ile Glu Glu Leu Val Ala Phe Arg Val Pro Tyr Tyr
    450                 455                 460

Val Gly Pro Met Ile Thr Pro Asp Asp Gln Ala Lys Ser Ala Glu Thr
465                 470                 475                 480

Val Phe Ser Trp Met Glu Arg Lys Gly Lys Glu Ala Gly Gln Ile Thr
                485                 490                 495

Pro Trp Asn Phe Asp Glu Lys Val Asp Arg Asn Ala Ser Ala Asn Arg
            500                 505                 510
```

```
Phe Ile Lys Arg Met Thr Thr Lys Asp Thr Tyr Leu Ile Gly Glu Asp
        515                 520                 525

Val Leu Pro Asp Glu Ser Leu Leu Tyr Glu Lys Phe Lys Val Leu Asn
    530                 535                 540

Glu Leu Asn Met Val Arg Val Asn Gly Lys Leu Leu Lys Val Ala Asp
545                 550                 555                 560

Lys Gln Ala Ile Phe Gln Asp Leu Phe Glu Asn Tyr Lys His Ile Ser
                565                 570                 575

Val Lys Lys Leu Gln Asn Tyr Ile Lys Ser Lys Thr Gly Leu Pro Ser
            580                 585                 590

Asp Pro Glu Ile Ser Gly Leu Ser Asp Pro Glu Tyr Phe Asn Asn Ser
        595                 600                 605

Leu Gly Thr Tyr Asn Asp Phe Lys Lys Leu Phe Gly Asn Lys Val Asp
    610                 615                 620

Glu Pro Asp Leu Gln Asp Asp Phe Glu Lys Ile Val Glu Trp Ser Thr
625                 630                 635                 640

Val Phe Glu Asp Lys Arg Ile Leu Arg Glu Lys Leu Asn Glu Ile Thr
                645                 650                 655

Trp Leu Ser Asp Gln Gln Lys Asp Val Leu Glu Ser Ser Arg Tyr Gln
            660                 665                 670

Gly Trp Gly Arg Leu Ser Lys Lys Leu Leu Thr Gly Ile Val Asn Asp
        675                 680                 685

Gln Gly Glu Arg Ile Ile Asp Glu Leu Trp Asn Thr Asn Lys Asn Phe
    690                 695                 700

Met Gln Ile Gln Ser Asp Asn Asp Phe Ala Lys Arg Ile His Glu Ala
```

```
705                 710                 715                 720

Asn Ala Asp Gln Met Lys Ala Val Asp Val Glu Asp Val Leu Ala Asp
                725                 730                 735

Ala Tyr Thr Ser Pro Gln Asn Lys Lys Ala Ile Arg Gln Val Val Lys
            740                 745                 750

Val Val Asp Asp Ile Gln Lys Ala Met Gly Gly Val Ala Pro Lys Tyr
        755                 760                 765

Ile Ser Ile Glu Phe Thr Arg Ser Glu Asp Arg Asn Pro Arg Arg Thr
    770                 775                 780

Ile Ser Arg Gln Arg Gln Leu Glu Asn Thr Leu Lys Asp Thr Ala Lys
785                 790                 795                 800

Ser Leu Ala Lys Ser Ile Asn Pro Glu Leu Leu Ser Glu Leu Asp Asn
                805                 810                 815

Ala Ala Lys Ser Lys Lys Gly Leu Thr Asp Arg Leu Tyr Leu Tyr Phe
            820                 825                 830

Thr Gln Leu Gly Lys Asp Ile Tyr Thr Gly Lys Pro Ile Asn Ile Asp
        835                 840                 845

Glu Ile Ser Thr Tyr Asp Ile Asp His Ile Leu Pro Gln Ala Phe Val
    850                 855                 860

Lys Asp Asp Ser Leu Asn Asn Arg Val Leu Val Ser Lys Ala Ile Asn
865                 870                 875                 880

Asn Gly Lys Ser Asp Asn Val Pro Val Gln Leu Phe Gly Ala Lys Met
                885                 890                 895

Gly His Phe Trp Lys Gln Leu Ala Glu Ala Gly Leu Ile Ser Lys Arg
            900                 905                 910
```

```
Lys Leu Lys Asn Leu Gln Thr Asp Pro Asp Thr Ile Ser Lys Tyr Ala
        915                 920                 925


Met His Gly Phe Ile Arg Arg Gln Leu Val Glu Thr Ser Gln Val Ile
    930                 935                 940


Lys Leu Val Ala Asn Ile Leu Gly Asp Lys Tyr Arg Asn Asp Asn Thr
945                 950                 955                 960


Lys Ile Ile Glu Ile Thr Ala Arg Met Asn His Gln Met Arg Asp Glu
                965                 970                 975


Phe Gly Phe Ile Lys Asn Arg Glu Ile Asn Asp Tyr His His Ala Phe
            980                 985                 990


Asp Ala Tyr Leu Thr Ala Phe Leu  Gly Arg Tyr Leu Tyr  His Arg Tyr
        995                 1000                1005


Ile Lys  Leu Arg Pro Tyr Phe  Val Tyr Gly Asp Phe  Lys Lys Phe
    1010                1015                1020


Lys Glu  Asp Lys Val Thr Met  Arg Asn Phe Asn Phe  Leu His Asp
    1025                1030                1035


Leu Thr  Asp Asp Thr Gln Glu  Lys Ile Ala Asp Ala  Glu Thr Gly
    1040                1045                1050


Glu Val  Ile Trp Asp Arg Glu  Asn Ser Ile Gln Gln  Leu Lys Asp
    1055                1060                1065


Val Tyr  His Tyr Lys Phe Met  Leu Ile Ser His Glu  Val Tyr Thr
    1070                1075                1080


Leu Arg  Gly Ala Met Phe Asn  Gln Thr Val Tyr Pro  Ala Ser Asp
    1085                1090                1095


Ala Gly  Lys Arg Lys Leu Ile  Pro Ile Lys Ala Asp  Arg Pro Ile
```

```
    1100                1105                1110

Asn Val  Tyr Gly Gly Tyr Ser  Gly Ser Ala Asp Ala  Tyr Met Ala
    1115                1120                1125

Ile Val  Arg Ile His Asn Lys  Lys Gly Asp Lys Tyr  Arg Val Val
    1130                1135                1140

Gly Val  Pro Met Arg Ala Arg  Asp Arg Leu Asp Ala  Ala Lys Lys
    1145                1150                1155

Val Ser  Asp Ala Asp Cys Asp  Arg Ala Leu Lys Asp  Val Leu Thr
    1160                1165                1170

Pro Gln  Leu Thr Lys Thr Lys  Lys Ser Arg Lys Thr  Gly Glu Ile
    1175                1180                1185

Thr Gln  Val Val Glu Asp Phe  Glu Ile Val Leu Gly  Lys Val Met
    1190                1195                1200

Tyr Arg  Gln Leu Met Ile Asp  Gly Asp Lys Lys Phe  Met Leu Gly
    1205                1210                1215

Ser Ser  Thr Tyr Gln Tyr Asn  Ala Lys Gln Leu Val  Leu Ser Asp
    1220                1225                1230

Gln Ser  Val Lys Thr Leu Ala  Ser Lys Gly Arg Leu  Asp Pro Leu
    1235                1240                1245

Gln Glu  Ser Met Asp Tyr Asn  Asn Val Tyr Thr Glu  Ile Leu Asp
    1250                1255                1260

Lys Val  Asn Gln Tyr Phe Ser  Leu Tyr Asp Met Asn  Lys Phe Arg
    1265                1270                1275

His Lys  Leu Asn Leu Gly Phe  Ser Lys Phe Ile Ser  Phe Pro Asn
    1280                1285                1290
```

```
His Asn  Val Phe Asp Gly Asn  Thr Lys Ala Ser Ser  Gly Lys Arg
    1295                1300                1305


Glu Ile  Leu Glu Glu Val Leu  Asn Gly Leu His Ala  Asn Pro Thr
    1310                1315                1320


Phe Gly  Asn Leu Lys Asp Ile  Gly Ile Thr Thr Pro  Phe Gly Gln
    1325                1330                1335


Leu Gln  Gln Pro Asn Gly Ile  Leu Leu Ser Asp Glu  Ala Lys Ile
    1340                1345                1350


Arg Tyr  Gln Ser Pro Thr Gly  Leu Phe Glu Arg Thr  Val Ser Leu
    1355                1360                1365


Lys Asp  Leu
    1370
```

<210> 220
<211> 1090
<212> PRT
<213> Sphingomonas sp.

<400> 220

```
Met Asp Trp Arg Leu Gly Leu Asp Leu Gly Ala Asn Ser Leu Gly Trp
1               5                   10                  15


Ala Ala Leu Arg Leu Asp Arg Ala Gly Asp Pro Ile Gly Ile Leu Ala
            20                  25                  30


Met Gly Ser Arg Ile Phe Ser Asp Gly Arg Asp Pro Lys Ser Gly Ala
        35                  40                  45


Ser Leu Ala Val Asp Arg Arg Ala Ala Arg Ala Met Arg Arg Arg Arg
    50                  55                  60


Asp Arg Phe Lys Gln Arg Gln Ala Ala Leu Leu Lys Tyr Leu Ile Arg
65                  70                  75                  80
```

```
Asp Gly Leu Phe Pro Ala Asp Gln Ala Asp Arg Gln Arg Leu Ala Asp
                85                  90                  95

Glu Asp Pro Tyr Ala Leu Arg Ala Arg Ala Leu Asp Glu Glu Leu Ser
            100                 105                 110

Leu Phe Glu Ile Gly Arg Ala Leu Phe His Leu Asn Gln Arg Arg Gly
        115                 120                 125

Phe Gln Ser Asn Arg Lys Ala Asp Arg Gly Gln Asp Asp Glu Ala Gly
    130                 135                 140

Lys Ile Ala Val Gly Val Asp Arg Leu Asn Gln Gln Met Glu Glu Gln
145                 150                 155                 160

Gly Ala Arg Thr Leu Gly Glu Phe Leu His Gln Arg Arg Arg Ala Ala
                165                 170                 175

Thr Asp Ala Asn His Ile Pro Ser Val Arg Thr Arg Leu Arg Pro Glu
            180                 185                 190

Thr Gly Glu Gly Ala Lys Gly Asp Gly Tyr Asp Phe Tyr Pro Ser Arg
        195                 200                 205

Ala Leu Ile Ala Glu Glu Phe Glu Glu Ile Trp Ala Ala Gln Ala Pro
    210                 215                 220

His Tyr Pro Asp Thr Leu Thr Gln Gln Val His Asp Arg Leu Tyr Glu
225                 230                 235                 240

Ile Ile Phe His Gln Arg Pro Leu Arg Ala Pro Gln Val Gly Gln Cys
                245                 250                 255

Thr Leu Val Ala Gly Glu Thr Arg Leu Pro Lys Ala His Pro Leu Phe
            260                 265                 270
```

```
Gln Lys Arg Arg Leu Leu Glu Glu Ile Asn Ala Leu Met Ile Val Arg
        275                 280                 285

Pro Gly Glu Ile Ala Gln Arg Leu Thr Pro Glu Glu Arg Asp Thr Leu
    290                 295                 300

Tyr Leu Lys Leu Lys Asp Lys Arg Thr Val Ser Phe Ala Thr Leu Arg
305                 310                 315                 320

Lys Thr Leu Lys Leu Asp Ser Ala Ala Arg Phe Asn Lys Glu Ser Glu
                325                 330                 335

Asn Arg Thr Glu Leu Lys Gly Asp Glu Val Ala Ala Glu Leu Gly Ala
            340                 345                 350

Lys Thr Arg Leu Gly Thr Arg Trp Gln His Leu Ser Gly Asp Gln Gln
        355                 360                 365

Trp Glu Val Val His Arg Leu Met Ala Leu Glu Ser Gln Ala Asp Glu
    370                 375                 380

Ala Ala Phe Arg Asp Trp Ile Ser Gln Thr Tyr Asp Leu Leu Pro Glu
385                 390                 395                 400

Gln Ala Ala Ala Val Leu Gly Ala Arg Leu Pro Gln Gly His Gly Arg
                405                 410                 415

Phe Gly Pro Thr Ala Thr Thr Thr Leu Ile Asp Ser Leu Leu His Asp
            420                 425                 430

Arg Thr Glu Asp Gly Arg Val Val Val Tyr Ser Glu Ala Val Gln Arg
        435                 440                 445

Ser Gly Leu Gly His His Ser Asp Leu Arg His Asp Arg Asp Asp Glu
    450                 455                 460

Asp Val Thr Glu Leu Pro Tyr Tyr Gly Val Ala Leu Glu Arg His Ile
465                 470                 475                 480
```

```
Met Pro Gly Thr Ala Glu Pro Thr Asp Pro Glu Glu Met Arg Ile Gly
                485                 490                 495

Arg Leu Thr Asn Pro Thr Val His Ile Gly Leu Asn Gln Leu Arg His
            500                 505                 510

Val Val Asn Arg Leu Ile Arg Ala Tyr Gly Pro Pro Lys Glu Ile Ala
        515                 520                 525

Ile Glu Leu Ala Arg Glu Leu Lys Leu Ser Glu Asp Glu Lys Lys Lys
    530                 535                 540

Arg Asn Ser Glu Asn Arg Asp Asn Arg Leu Ala Ala Glu Gly Arg Ser
545                 550                 555                 560

Lys Lys Leu Glu Glu Ile Arg Gln Arg Asp Thr Gly Ala Asn Arg Ala
                565                 570                 575

Leu Leu Lys Leu Trp Glu Glu Leu Asn Pro Gly Asn Val Leu Asp Arg
            580                 585                 590

Arg Cys Ile Tyr Thr Gly Glu Gln Ile Ser Ile Asp Met Leu Phe Ser
        595                 600                 605

Asp Arg Val Glu Val Asp His Ile Leu Pro Phe Ala Gln Thr Leu Asp
    610                 615                 620

Asp Ser Asn Gly Asn Lys Leu Leu Cys Leu Arg Glu Ala Asn Arg Glu
625                 630                 635                 640

Lys Arg Arg Arg Ser Pro Tyr Glu Ala Trp Gly His Thr Asp Arg Trp
                645                 650                 655

Pro Asp Ile Ala Glu Arg Ala Ser Arg Leu Pro Lys Pro Lys Arg Trp
            660                 665                 670
```

```
Arg Phe Glu Pro Asp Ala Met Gln Arg Phe Ala Thr Glu Asp Gly Phe
        675                 680                 685

Leu Ala Arg His Leu Val Asp Thr Gln Tyr Leu Gly Arg Leu Ala Arg
    690                 695                 700

Glu Tyr Leu Ser Trp Leu Tyr Pro Gly Arg Gly Glu Gly Ser Gly His
705                 710                 715                 720

Val Trp Val Ser Pro Gly Arg Leu Thr Glu Met Val Arg Arg Lys Leu
                725                 730                 735

Gly Leu Asn Asp Leu Leu Pro Asp His Asn Phe Gly Gly Gly Ala Asp
            740                 745                 750

Gln Pro Lys Asn Arg Leu Asp His Arg His His Ala Ile Asp Ala Leu
        755                 760                 765

Val Val Ala Ile Val Asp Arg Gly Met Leu Gln Ala Ile Ala Arg Ala
    770                 775                 780

Ser Gly Gln Asp Gly Ser Glu Gly Arg Glu Arg Ile His Ile Pro Ala
785                 790                 795                 800

Pro Trp Asp Gly Phe Arg Asp Asp Leu Arg Val Ala Val Asn Gly Ile
                805                 810                 815

Ile Val Ser His Arg Pro Asp His Gly Thr Val Ala Lys Ala Gly Leu
            820                 825                 830

Ala Arg Gly Arg Asp Gln Thr Ala Gly Arg Leu His Asn Asp Thr Ala
        835                 840                 845

Tyr Gly Leu Thr Gly Glu Thr Asp Ala Lys Gly Asn Ser Ile Val Val
    850                 855                 860

Arg Arg Ile Pro Leu Ser Ala Ile Lys Lys Pro Ala Asp Ile Ala Arg
865                 870                 875                 880
```

```
Val Arg Asp Pro Leu Leu Arg Asn Ala Leu Ala Glu Phe Thr Lys Gly
               885                 890                 895

Leu Asp Gly Lys Ala Phe Glu Ala Arg Ile Gly Arg Phe His Glu Leu
            900                 905                 910

Gly Pro Leu Leu Tyr Arg Gly Ile Arg Arg Val Arg Val Val Glu Thr
        915                 920                 925

Leu Thr Val Ile Pro Ile Arg Asp Ala Glu Gly Arg Ala Tyr Lys Gly
    930                 935                 940

Tyr Lys Gly Asp Ser Asn Tyr Arg Tyr Asp Val Trp Glu Met Pro Asp
945                 950                 955                 960

Gly Lys Trp Arg Cys Gln Val Val Ser Met Phe Asp Ala His Gln Ser
               965                 970                 975

Thr Glu Gln Ala Arg Pro His Pro Ala Ala Arg Lys Ile Leu Ser Leu
            980                 985                 990

Gln Arg Asn Asp Ile Leu Ala Ile  Glu Arg Thr Glu Gly  Asp Arg Glu
        995                 1000                1005

Leu Val  Arg Val Val Lys Phe  Ser Glu Lys Gln Phe  Ala Val Ala
    1010                1015                1020

Pro Pro  His Glu Gly Gly Ser  Leu Lys Thr Arg Asp  Gly Asn Ala
    1025                1030                1035

Asp Asp  Pro Phe Arg Tyr Leu  Tyr Pro Ser Pro Asn  Thr Leu Lys
    1040                1045                1050

Gly Trp  Arg Ala Arg Gln Val  Arg Ile Asp Glu Leu  Gly Arg Val
    1055                1060                1065
```

```
Leu Asp  Pro Gly Phe Pro Ala  Arg Lys Ser Val Arg  Arg Thr Arg
    1070                1075                1080


Pro Arg  Ala Ala Pro Val Asp
    1085                1090
```

<210> 221
<211> 1000
<212> PRT
<213> Kingella kingae

<400> 221

```
Met Ala Arg Ala Gln Arg Arg Leu Ile Ser Arg Arg Ala Asn Arg Met
1               5                   10                  15


Asn Lys Leu Arg Arg Leu Leu Lys Gln Glu Asn Val Leu Gln Ala Asn
            20                  25                  30


Asp Tyr Asp Glu Lys Gly Leu Ile Ile Gly Leu Pro Asn Gln Ala Trp
        35                  40                  45


Glu Leu Arg Ala Gln Gly Leu Asp Arg Lys Leu Glu Pro Lys Glu Trp
    50                  55                  60


Ala Ala Val Leu Ile Asn Leu Val Lys His Arg Gly Tyr Leu Ser Gln
65                  70                  75                  80


Arg Lys Asn Glu Ser Gln Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu
                85                  90                  95


Ser Gly Met Asn His Asn His Gln Leu Leu Gln Ser Gln Ser Asn Gln
            100                 105                 110


Tyr Arg Thr Pro Ala Glu Leu Ala Ile Lys Gln Phe Ala Thr Gln Asp
        115                 120                 125


Gly His Ile Arg Asn Gln Arg Gly Ala Tyr Thr His Thr Phe Asn Arg
    130                 135                 140
```

```
Leu Asp Leu Gln Asn Glu Leu Asn Gln Leu Phe Asp Ala Gln Thr Arg
145                 150                 155                 160

Leu Gly Asn Pro His Val Ser Gly Ser Leu Lys Thr Ala Ile Asn Asp
                165                 170                 175

Leu Leu Met Asn Gln Lys Ala Ala Leu Ser Gly Asp Ala Ile Leu Glu
            180                 185                 190

Met Leu Gly Arg Cys Thr Phe Glu Pro Ser Glu Tyr Lys Ala Ala Lys
        195                 200                 205

Asn Thr Tyr Ser Ala Glu Arg Phe Val Trp Leu Gly Lys Leu Thr Asn
    210                 215                 220

Leu Arg Ile Gln Asp Asn Gly Leu Glu Ser Ala Leu Ser Arg Glu Gln
225                 230                 235                 240

Arg Glu Leu Leu Leu Asn Glu Pro Tyr Asn Lys Thr Lys Leu Thr Tyr
                245                 250                 255

Gln Gln Val Arg Lys Leu Leu Arg Leu Pro Glu Thr Ala Phe Phe Lys
            260                 265                 270

Gly Leu Arg Tyr Gly Lys Asp Asn Ala Glu Ser Ala Thr Phe Met Glu
        275                 280                 285

Met Lys Ser Tyr His Ala Ile Arg Lys Ser Leu Glu Asn Lys Ser Leu
    290                 295                 300

Lys Ser Glu Trp Glu Lys Leu Lys Thr Gln Pro Lys Leu Leu Asp Leu
305                 310                 315                 320

Ile Gly Thr Ala Phe Ser Ile Tyr Lys Thr Asp Asp Glu Ile Ala Gly
                325                 330                 335

Cys Leu Lys Asn Gln Leu Pro Glu Asn Val Ile Ile Ala Leu Gln Glu
```

```
            340                 345                 350

Gln Leu Asn Phe Ser Asn Phe Met Glu Leu Ser Leu Lys Ala Leu Glu
        355                 360                 365

Lys Leu Leu Pro Leu Met Glu Gln Gly Leu Arg Tyr Asp Glu Ala Cys
    370                 375                 380

Thr Gln Ile Tyr Gly Asn Arg His Glu Lys Ile Ala Asp Lys Thr Glu
385                 390                 395                 400

Lys Phe Leu Pro Asn Ile Pro Ala Asp Lys Leu Arg Asn Pro Val Val
                405                 410                 415

Leu Arg Thr Leu Thr Gln Ala Arg Lys Val Ile Asn Ala Ile Ile Arg
            420                 425                 430

Arg Tyr Gly Ser Pro Ala Arg Val His Ile Glu Thr Gly Arg Glu Val
        435                 440                 445

Gly Lys Ser Phe Ser Asp Arg Asp Lys Leu Lys Lys Gln Gln Glu Glu
    450                 455                 460

Asn Gln Glu Gln Arg Arg Arg Ala Ile Asp Glu Trp Lys Gln Phe Phe
465                 470                 475                 480

Pro Asn Ala Ala His Glu Pro Lys Ala Val Asp Ile Leu Lys Leu Arg
                485                 490                 495

Leu Tyr Gln Leu Gln Gln Gly Lys Cys Leu Tyr Ser Gly Leu Pro Ile
            500                 505                 510

Asp Val Arg Arg Leu Pro Glu Lys Gly Tyr Val Glu Ile Asp His Ala
        515                 520                 525

Leu Pro Phe Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Ile Leu
    530                 535                 540
```

```
Val Leu Ala Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu
545                 550                 555                 560

Tyr Leu Arg Gly Ala Asp Asn Ser Glu Ser Trp Arg Leu Phe Val Glu
                565                 570                 575

Asn Val Gln Asn Cys Gln Phe Ser Pro Asn Lys Lys Gln Lys Ile Met
            580                 585                 590

Ala Lys Gln Leu Asp Glu Lys Gly Phe Leu Glu Arg Asn Leu Asn Asp
        595                 600                 605

Thr Arg Tyr Val Ser Arg Phe Leu Cys Gln Phe Ile Ser Glu His Leu
    610                 615                 620

His Leu Thr Gly Lys Gly Lys Lys Arg Val Phe Ala Ser Asn Gly Gln
625                 630                 635                 640

Ile Thr Ala Leu Leu Arg Gly Arg Trp Gly Leu Ser Lys Asn Arg Glu
                645                 650                 655

Glu Asn Asp Arg His His Ala Val Asp Ala Val Val Val Ala Cys Ser
            660                 665                 670

Thr Val Ala Met Gln Gln Lys Ile Thr Gln Phe Val Arg Tyr Gln Lys
        675                 680                 685

Gly Asn Val Phe Thr Gly Glu Arg Ile Asp Lys Glu Thr Gly Glu Val
    690                 695                 700

Ile Ser Ile His Phe Pro Thr Pro Trp Glu His Phe Arg Glu Glu Val
705                 710                 715                 720

Met Ile Arg Val Phe Asp Asp Asn Pro Leu Arg Thr Leu Pro Glu Lys
                725                 730                 735

Leu Pro Asn Arg Pro Glu Ala Leu His Glu Tyr Val Met Pro Leu Phe
```

```
            740                 745                 750

Val Ser Arg Met Pro Thr Arg Lys Met Thr Gly Gln Gly His Lys Glu
        755                 760                 765

Thr Ile Lys Ser Ala Lys Arg Leu Asp Glu Lys Ile Ser Val Leu Arg
    770                 775                 780

Val Pro Leu Thr Gln Leu Lys Leu Asn Asp Leu Glu Asn Met Val Asn
785                 790                 795                 800

Arg Glu Arg Glu Pro Ala Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu
                805                 810                 815

Gln Phe Lys Asn Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Phe Lys
            820                 825                 830

Gln Gly Gly Gln Gln Val Lys Ala Val Arg Val Glu Ile Val Gln Lys
        835                 840                 845

Ser Gly Met Leu Leu Arg Lys Ile Asn Gly Val Ala Asp Asn Gly Ser
    850                 855                 860

Met Val Arg Val Asp Val Phe Glu Lys Ser Gly Lys Phe Tyr Leu Val
865                 870                 875                 880

Pro Ile Tyr Ala Trp Gln Val Ala Glu Gly Ile Leu Pro Asn Tyr Ala
                885                 890                 895

Val Val Ala His Lys Asp Glu Ser Asp Trp Ile Leu Met Asp Glu Ser
            900                 905                 910

Tyr His Phe Lys Phe Ala Leu Tyr Lys Asn Asp Leu Leu Glu Val Gln
        915                 920                 925

Thr Lys Lys Gly Gly Ile Met Gly Tyr Phe Ala Ser Leu Asp Arg Ala
    930                 935                 940
```

```
Thr Gly Ala Ile Thr Ile Arg Glu His Asp Arg Asp Lys Lys Lys Cys
945                 950                 955                 960


Lys Asp Gly Glu His Arg Ser Ile Gly Val Lys Met Ala Ser Ser Phe
                965                 970                 975


Lys Lys Leu Gln Val Asp Glu Leu Gly Lys Asn Ile His Glu Thr Arg
            980                 985                 990


Ser Arg Lys Arg Pro Asn Ile Gly
        995                 1000
```

<210> 222
<211> 1130
<212> PRT
<213> Streptococcus pasteurianus

<400> 222

```
Met Thr Asn Gly Lys Ile Leu Gly Leu Asp Ile Gly Ile Ala Ser Val
1               5                   10                  15


Gly Val Gly Ile Ile Glu Ala Lys Thr Gly Lys Val Val His Ala Asn
            20                  25                  30


Ser Arg Leu Phe Ser Ala Ala Asn Ala Glu Asn Asn Ala Glu Arg Arg
        35                  40                  45


Gly Phe Arg Gly Ser Arg Arg Leu Asn Arg Arg Lys Lys His Arg Val
    50                  55                  60


Lys Arg Val Arg Asp Leu Phe Glu Lys Tyr Gly Ile Val Thr Asp Phe
65                  70                  75                  80


Arg Asn Leu Asn Leu Asn Pro Tyr Glu Leu Arg Val Lys Gly Leu Thr
                85                  90                  95


Glu Gln Leu Lys Asn Glu Glu Leu Phe Ala Ala Leu Arg Thr Ile Ser
            100                 105                 110
```

```
Lys Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Glu Asp Asp Ser Thr
        115                 120                 125

Gly Ser Thr Asp Tyr Ala Lys Ser Ile Asp Glu Asn Arg Arg Leu Leu
    130                 135                 140

Lys Asn Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Leu Glu Lys Tyr
145                 150                 155                 160

Gly Gln Leu Arg Gly Asn Phe Thr Val Tyr Asp Glu Asn Gly Glu Ala
                165                 170                 175

His Arg Leu Ile Asn Val Phe Ser Thr Ser Asp Tyr Glu Lys Glu Ala
            180                 185                 190

Arg Lys Ile Leu Glu Thr Gln Ala Asp Tyr Asn Lys Lys Ile Thr Ala
        195                 200                 205

Glu Phe Ile Asp Asp Tyr Val Glu Ile Leu Thr Gln Lys Arg Lys Tyr
    210                 215                 220

Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg Phe
225                 230                 235                 240

Arg Thr Asp Gly Thr Thr Leu Glu Asn Ile Phe Gly Ile Leu Ile Gly
                245                 250                 255

Lys Cys Asn Phe Tyr Pro Asp Glu Tyr Arg Ala Ser Lys Ala Ser Tyr
            260                 265                 270

Thr Ala Gln Glu Tyr Asn Phe Leu Asn Asp Leu Asn Asn Leu Lys Val
        275                 280                 285

Ser Thr Glu Thr Gly Lys Leu Ser Thr Glu Gln Lys Glu Ser Leu Val
    290                 295                 300
```

```
Glu Phe Ala Lys Asn Thr Ala Thr Leu Gly Pro Ala Lys Leu Leu Lys
305                 310                 315                 320

Glu Ile Ala Lys Ile Leu Asp Cys Lys Val Asp Glu Ile Lys Gly Tyr
                325                 330                 335

Arg Glu Asp Asp Lys Gly Lys Pro Asp Leu His Thr Phe Glu Pro Tyr
            340                 345                 350

Arg Lys Leu Lys Phe Asn Leu Glu Ser Ile Asn Ile Asp Asp Leu Ser
        355                 360                 365

Arg Glu Val Ile Asp Lys Leu Ala Asp Ile Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Glu Asp Ala Ile Lys Arg Asn Leu Pro Asn Gln Phe
385                 390                 395                 400

Thr Glu Glu Gln Ile Ser Glu Ile Ile Lys Val Arg Lys Ser Gln Ser
                405                 410                 415

Thr Ala Phe Asn Lys Gly Trp His Ser Phe Ser Ala Lys Leu Met Asn
            420                 425                 430

Glu Leu Ile Pro Glu Leu Tyr Ala Thr Ser Asp Glu Gln Met Thr Ile
        435                 440                 445

Leu Thr Arg Leu Glu Lys Phe Lys Val Asn Lys Lys Ser Ser Lys Asn
    450                 455                 460

Thr Lys Thr Ile Asp Glu Lys Glu Val Thr Asp Glu Ile Tyr Asn Pro
465                 470                 475                 480

Val Val Ala Lys Ser Val Arg Gln Thr Ile Lys Ile Ile Asn Ala Ala
                485                 490                 495

Val Lys Lys Tyr Gly Asp Phe Asp Lys Ile Val Ile Glu Met Pro Arg
            500                 505                 510
```

```
Asp Lys Asn Ala Asp Asp Glu Lys Lys Phe Ile Asp Lys Arg Asn Lys
        515                 520                 525

Glu Asn Lys Lys Glu Lys Asp Asp Ala Leu Lys Arg Ala Ala Tyr Leu
    530                 535                 540

Tyr Asn Ser Ser Asp Lys Leu Pro Asp Glu Val Phe His Gly Asn Lys
545                 550                 555                 560

Gln Leu Glu Thr Lys Ile Arg Leu Trp Tyr Gln Gln Gly Glu Arg Cys
                565                 570                 575

Leu Tyr Ser Gly Lys Pro Ile Ser Ile Gln Glu Leu Val His Asn Ser
            580                 585                 590

Asn Asn Phe Glu Ile Asp His Ile Leu Pro Leu Ser Leu Ser Phe Asp
        595                 600                 605

Asp Ser Leu Ala Asn Lys Val Leu Val Tyr Ala Trp Thr Asn Gln Glu
    610                 615                 620

Lys Gly Gln Lys Thr Pro Tyr Gln Val Ile Asp Ser Met Asp Ala Ala
625                 630                 635                 640

Trp Ser Phe Arg Glu Met Lys Asp Tyr Val Leu Lys Gln Lys Gly Leu
                645                 650                 655

Gly Lys Lys Lys Arg Asp Tyr Leu Leu Thr Thr Glu Asn Ile Asp Lys
            660                 665                 670

Ile Glu Val Lys Lys Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Ala Ser Arg Val Val Leu Asn Ser Leu Gln Ser Ala Leu Arg Glu
    690                 695                 700
```

```
Leu Gly Lys Asp Thr Lys Val Ser Val Val Arg Gly Gln Phe Thr Ser
705                 710                 715                 720

Gln Leu Arg Arg Lys Trp Lys Ile Asp Lys Ser Arg Glu Thr Tyr His
                725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Lys
            740                 745                 750

Leu Trp Glu Lys Gln Asp Asn Pro Met Phe Val Asp Tyr Gly Lys Asn
        755                 760                 765

Gln Val Val Asp Lys Gln Thr Gly Glu Ile Leu Ser Val Ser Asp Asp
    770                 775                 780

Glu Tyr Lys Glu Leu Val Phe Gln Pro Pro Tyr Gln Gly Phe Val Asn
785                 790                 795                 800

Thr Ile Ser Ser Lys Gly Phe Glu Asp Glu Ile Leu Phe Ser Tyr Gln
                805                 810                 815

Val Asp Ser Lys Tyr Asn Arg Lys Val Ser Asp Ala Thr Ile Tyr Ser
            820                 825                 830

Thr Arg Lys Ala Lys Ile Gly Lys Asp Lys Lys Glu Glu Thr Tyr Val
        835                 840                 845

Leu Gly Lys Ile Lys Asp Ile Tyr Ser Gln Asn Gly Phe Asp Thr Phe
    850                 855                 860

Ile Lys Lys Tyr Asn Lys Asp Lys Thr Gln Phe Leu Met Tyr Gln Lys
865                 870                 875                 880

Asp Ser Leu Thr Trp Glu Asn Val Ile Glu Val Ile Leu Arg Asp Tyr
                885                 890                 895

Pro Thr Thr Lys Lys Ser Glu Asp Gly Lys Asn Asp Val Lys Cys Asn
            900                 905                 910
```

```
Pro Phe Glu Glu Tyr Arg Arg Glu Asn Gly Leu Ile Cys Lys Tyr Ser
        915                 920                 925

Lys Lys Gly Lys Gly Thr Pro Ile Lys Ser Leu Lys Tyr Tyr Asp Lys
    930                 935                 940

Lys Leu Gly Asn Cys Ile Asp Ile Thr Pro Glu Glu Ser Arg Asn Lys
945                 950                 955                 960

Val Ile Leu Gln Ser Ile Asn Pro Trp Arg Ala Asp Val Tyr Phe Asn
                965                 970                 975

Pro Glu Thr Leu Lys Tyr Glu Leu Met Gly Leu Lys Tyr Ser Asp Leu
            980                 985                 990

Ser Phe Glu Lys Gly Thr Gly Asn  Tyr His Ile Ser Gln  Glu Lys Tyr
        995                 1000                1005

Asp Ala  Ile Lys Glu Lys Glu  Gly Ile Gly Lys Lys  Ser Glu Phe
    1010                1015                1020

Lys Phe  Thr Leu Tyr Arg Asn  Asp Leu Ile Leu Ile  Lys Asp Ile
    1025                1030                1035

Ala Ser  Gly Glu Gln Glu Ile  Tyr Arg Phe Leu Ser  Arg Thr Met
    1040                1045                1050

Pro Asn  Val Asn His Tyr Val  Glu Leu Lys Pro Tyr  Asp Lys Glu
    1055                1060                1065

Lys Phe  Asp Asn Val Gln Glu  Leu Val Glu Ala Leu  Gly Glu Ala
    1070                1075                1080

Asp Lys  Val Gly Arg Cys Ile  Lys Gly Leu Asn Lys  Pro Asn Ile
    1085                1090                1095
```

```
Ser Ile  Tyr Lys Val Arg Thr  Asp Val Leu Gly Asn  Lys Tyr Phe
    1100                1105                1110


Val Lys  Lys Lys Gly Asp Lys  Pro Lys Leu Asp Phe  Lys Asn Asn
    1115                1120                1125


Lys Lys
    1130
```

<210> 223
<211> 1119
<212> PRT
<213> Lactobacillus coryniformis

<400> 223

```
Met Gly Tyr Arg Ile Gly Leu Asp Val Gly Ile Thr Ser Thr Gly Tyr
1               5                   10                  15


Ala Val Leu Lys Thr Asp Lys Asn Gly Leu Pro Tyr Lys Ile Leu Thr
            20                  25                  30


Leu Asp Ser Val Ile Tyr Pro Arg Ala Glu Asn Pro Gln Thr Gly Ala
        35                  40                  45


Ser Leu Ala Glu Pro Arg Arg Ile Lys Arg Gly Leu Arg Arg Arg Thr
    50                  55                  60


Arg Arg Thr Lys Phe Arg Lys Gln Arg Thr Gln Gln Leu Phe Ile His
65                  70                  75                  80


Ser Gly Leu Leu Ser Lys Pro Glu Ile Glu Gln Ile Leu Ala Thr Pro
                85                  90                  95


Gln Ala Lys Tyr Ser Val Tyr Glu Leu Arg Val Ala Gly Leu Asp Arg
            100                 105                 110


Arg Leu Thr Asn Ser Glu Leu Phe Arg Val Leu Tyr Phe Phe Ile Gly
        115                 120                 125
```

```
His Arg Gly Phe Lys Ser Asn Arg Lys Ala Glu Leu Asn Pro Glu Asn
    130                 135                 140

Glu Ala Asp Lys Lys Gln Met Gly Gln Leu Leu Asn Ser Ile Glu Glu
145                 150                 155                 160

Ile Arg Lys Ala Ile Ala Glu Lys Gly Tyr Arg Thr Val Gly Glu Leu
                165                 170                 175

Tyr Leu Lys Asp Pro Lys Tyr Asn Asp His Lys Arg Asn Lys Gly Tyr
            180                 185                 190

Ile Asp Gly Tyr Leu Ser Thr Pro Asn Arg Gln Met Leu Val Asp Glu
        195                 200                 205

Ile Lys Gln Ile Leu Asp Lys Gln Arg Glu Leu Gly Asn Glu Lys Leu
    210                 215                 220

Thr Asp Glu Phe Tyr Ala Thr Tyr Leu Leu Gly Asp Glu Asn Arg Ala
225                 230                 235                 240

Gly Ile Phe Gln Ala Gln Arg Asp Phe Asp Glu Gly Pro Gly Ala Gly
                245                 250                 255

Pro Tyr Ala Gly Asp Gln Ile Lys Lys Met Val Gly Lys Asp Ile Phe
            260                 265                 270

Glu Pro Thr Glu Asp Arg Ala Ala Lys Ala Thr Tyr Thr Phe Gln Tyr
        275                 280                 285

Phe Asn Leu Leu Gln Lys Met Thr Ser Leu Asn Tyr Gln Asn Thr Thr
    290                 295                 300

Gly Asp Thr Trp His Thr Leu Asn Gly Leu Asp Arg Gln Ala Ile Ile
305                 310                 315                 320

Asp Ala Val Phe Ala Lys Ala Glu Lys Pro Thr Lys Thr Tyr Lys Pro
```

```
                325                 330                 335

Thr Asp Phe Gly Glu Leu Arg Lys Leu Leu Lys Leu Pro Asp Asp Ala
            340                 345                 350

Arg Phe Asn Leu Val Asn Tyr Gly Ser Leu Gln Thr Gln Lys Glu Ile
        355                 360                 365

Glu Thr Val Glu Lys Lys Thr Arg Phe Val Asp Phe Lys Ala Tyr His
    370                 375                 380

Asp Leu Val Lys Val Leu Pro Glu Glu Met Trp Gln Ser Arg Gln Leu
385                 390                 395                 400

Leu Asp His Ile Gly Thr Ala Leu Thr Leu Tyr Ser Ser Asp Lys Arg
                405                 410                 415

Arg Arg Arg Tyr Phe Ala Glu Glu Leu Asn Leu Pro Ala Glu Leu Ile
            420                 425                 430

Glu Lys Leu Leu Pro Leu Asn Phe Ser Lys Phe Gly His Leu Ser Ile
        435                 440                 445

Lys Ser Met Gln Asn Ile Ile Pro Tyr Leu Glu Met Gly Gln Val Tyr
    450                 455                 460

Ser Glu Ala Thr Thr Asn Thr Gly Tyr Asp Phe Arg Lys Lys Gln Ile
465                 470                 475                 480

Ser Lys Asp Thr Ile Arg Glu Glu Ile Thr Asn Pro Val Val Arg Arg
                485                 490                 495

Ala Val Thr Lys Thr Ile Lys Ile Val Glu Gln Ile Ile Arg Arg Tyr
            500                 505                 510

Gly Lys Pro Asp Gly Ile Asn Ile Glu Leu Ala Arg Glu Leu Gly Arg
        515                 520                 525
```

```
Asn Phe Lys Glu Arg Gly Asp Ile Gln Lys Arg Gln Asp Lys Asn Arg
    530                 535                 540

Gln Thr Asn Asp Lys Ile Ala Ala Glu Leu Thr Glu Leu Gly Ile Pro
545                 550                 555                 560

Val Asn Gly Gln Asn Ile Ile Arg Tyr Lys Leu His Lys Glu Gln Asn
                565                 570                 575

Gly Val Asp Pro Tyr Thr Gly Asp Gln Ile Pro Phe Glu Arg Ala Phe
            580                 585                 590

Ser Glu Gly Tyr Glu Val Asp His Ile Ile Pro Tyr Ser Ile Ser Trp
        595                 600                 605

Asp Asp Ser Tyr Thr Asn Lys Val Leu Thr Ser Ala Lys Cys Asn Arg
    610                 615                 620

Glu Lys Gly Asn Arg Ile Pro Met Val Tyr Leu Ala Asn Asn Glu Gln
625                 630                 635                 640

Arg Leu Asn Ala Leu Thr Asn Ile Ala Asp Asn Ile Ile Arg Asn Ser
                645                 650                 655

Arg Lys Arg Gln Lys Leu Leu Lys Gln Lys Leu Ser Asp Glu Glu Leu
            660                 665                 670

Lys Asp Trp Lys Gln Arg Asn Ile Asn Asp Thr Arg Phe Ile Thr Arg
        675                 680                 685

Val Leu Tyr Asn Tyr Phe Arg Gln Ala Ile Glu Phe Asn Pro Glu Leu
    690                 695                 700

Glu Lys Lys Gln Arg Val Leu Pro Leu Asn Gly Glu Val Thr Ser Lys
705                 710                 715                 720

Ile Arg Ser Arg Trp Gly Phe Leu Lys Val Arg Glu Asp Gly Asp Leu
```

```
                725                 730                 735

His His Ala Ile Asp Ala Thr Val Ile Ala Ala Ile Thr Pro Lys Phe
            740                 745                 750

Ile Gln Gln Val Thr Lys Tyr Ser Gln His Gln Glu Val Lys Asn Asn
        755                 760                 765

Gln Ala Leu Trp His Asp Ala Glu Ile Lys Asp Ala Glu Tyr Ala Ala
    770                 775                 780

Glu Ala Gln Arg Met Asp Ala Asp Leu Phe Asn Lys Ile Phe Asn Gly
785                 790                 795                 800

Phe Pro Leu Pro Trp Pro Glu Phe Leu Asp Glu Leu Leu Ala Arg Ile
                805                 810                 815

Ser Asp Asn Pro Val Glu Met Met Lys Ser Arg Ser Trp Asn Thr Tyr
            820                 825                 830

Thr Pro Ile Glu Ile Ala Lys Leu Lys Pro Val Phe Val Val Arg Leu
        835                 840                 845

Ala Asn His Lys Ile Ser Gly Pro Ala His Leu Asp Thr Ile Arg Ser
    850                 855                 860

Ala Lys Leu Phe Asp Glu Lys Gly Ile Val Leu Ser Arg Val Ser Ile
865                 870                 875                 880

Thr Lys Leu Lys Ile Asn Lys Lys Gly Gln Val Ala Thr Gly Asp Gly
                885                 890                 895

Ile Tyr Asp Pro Glu Asn Ser Asn Asn Gly Asp Lys Val Val Tyr Ser
            900                 905                 910

Ala Ile Arg Gln Ala Leu Glu Ala His Asn Gly Ser Gly Glu Leu Ala
        915                 920                 925
```

```
Phe Pro Asp Gly Tyr Leu Glu Tyr Val Asp His Gly Thr Lys Lys Leu
    930                 935                 940

Val Arg Lys Val Arg Val Ala Lys Lys Val Ser Leu Pro Val Arg Leu
945                 950                 955                 960

Lys Asn Lys Ala Ala Ala Asp Asn Gly Ser Met Val Arg Ile Asp Val
                965                 970                 975

Phe Asn Thr Gly Lys Lys Phe Val Phe Val Pro Ile Tyr Ile Lys Asp
            980                 985                 990

Thr Val Glu Gln Val Leu Pro Asn  Lys Ala Ile Ala Arg  Gly Lys Ser
        995                 1000                1005

Leu Trp  Tyr Gln Ile Thr Glu  Ser Asp Gln Phe Cys  Phe Ser Leu
    1010                1015                1020

Tyr Pro  Gly Asp Met Val His  Ile Glu Ser Lys Thr  Gly Ile Lys
    1025                1030                1035

Pro Lys  Tyr Ser Asn Lys Glu  Asn Asn Thr Ser Val  Val Pro Ile
    1040                1045                1050

Lys Asn  Phe Tyr Gly Tyr Phe  Asp Gly Ala Asp Ile  Ala Thr Ala
    1055                1060                1065

Ser Ile  Leu Val Arg Ala His  Asp Ser Ser Tyr Thr  Ala Arg Ser
    1070                1075                1080

Ile Gly  Ile Ala Gly Leu Leu  Lys Phe Glu Lys Tyr  Gln Val Asp
    1085                1090                1095

Tyr Phe  Gly Arg Tyr His Lys  Val His Glu Lys Lys  Arg Gln Leu
    1100                1105                1110

Phe Val  Lys Arg Asp Glu
```

1115

<210> 224
<211> 1126
<212> PRT
<213> Lactobacillus farciminis

<400> 224

Met Ala Asp Arg Ile Ser Leu Gly Leu Asp Ile Gly Val Ala Ser Val
1 5 10 15

Gly Phe Ser Val Leu Asp Ile Asp Lys Gly Lys Val Ile Glu Leu Gly
20 25 30

Ala Arg Leu Phe Ser Ala Thr Val Ala Ala Gly Asn Gln Asp Arg Arg
35 40 45

Asp Met Arg Gly Ala Arg Arg Leu Leu Asn Arg Asn Lys Gln Arg Arg
50 55 60

Gln Asp Thr Gly Lys Leu Phe Lys Lys Phe Gly Leu Ile Asp Asp Phe
65 70 75 80

Asp Lys Gly Ser Phe Tyr Asp Asn Phe Asn Gln Asn Leu Asn Pro Tyr
85 90 95

Glu Leu Arg Val Lys Gly Leu Thr Glu Gln Leu Thr Lys Glu Glu Leu
100 105 110

Ala Glu Ser Leu Tyr Gln Ile Val Lys His Arg Gly Ile Ser Tyr Ala
115 120 125

Leu Lys Asp Ala Asp Val Asp Glu Gly Gly Thr Asp Tyr Ser Val Ser
130 135 140

Leu Lys Ile Asn Ser Gln Glu Leu Ala Glu Lys Thr Pro Ala Gln Ile
145 150 155 160

```
Gln Leu Gln Arg Leu Asn Asp Tyr Gly Lys Val Arg Gly Gln Val Val
                165                 170                 175

Ile Gly Asp Asp Pro Asp Asn Gln Lys Val Leu Leu Asn Val Phe Pro
            180                 185                 190

Thr Ser Ala Tyr Glu Lys Glu Ala Lys Gln Ile Ile Ala Thr Gln Gln
        195                 200                 205

Gln Phe Tyr Pro Glu Ser Leu Thr Asp Lys Phe Thr Glu Glu Tyr Cys
    210                 215                 220

Gln Ile Leu Thr Arg Lys Arg Asp Tyr Phe Val Gly Pro Gly Asn Glu
225                 230                 235                 240

Lys Ser Arg Thr Asp Tyr Gly Ile Tyr Lys Thr Asp Gly Arg Thr Leu
                245                 250                 255

Asp Asn Leu Phe Glu Glu Leu Ile Gly His Asp Lys Ile Tyr Pro Glu
            260                 265                 270

Glu Leu Arg Ala Ser Ala Ala Ser Tyr Thr Ala Gln Leu Phe Asn Val
        275                 280                 285

Leu Asn Asp Leu Asn Asn Leu Arg Ile Leu Asn Tyr Glu Asp Gly Lys
    290                 295                 300

Leu Thr Lys Glu Asp Lys Glu Lys Ile Ile Ala Glu Ile Lys Asn Asn
305                 310                 315                 320

Thr Thr Thr Ile Asn Met Leu Asn Val Ile Lys Lys Val Ala Gly Cys
                325                 330                 335

Ser Lys Asp Asp Ile Lys Gly Phe Arg Val Asn Glu Lys Asp Lys Pro
            340                 345                 350

Glu Ile Ser Ser Met Pro Val Tyr Arg Lys Ile His Lys Asp Leu Leu
        355                 360                 365
```

```
Lys Ala Gly Val Asp Ile Ser Asp Trp Pro Val Glu Phe Ile Asp Glu
    370                 375                 380

Leu Ser Phe Ile Leu Thr Leu Asn Thr Glu Asn Gly Glu Ile Arg Lys
385                 390                 395                 400

Gln Leu Asn Asn Arg Leu Ala Pro Lys Phe Asp Phe Leu Asn Ala Asp
                405                 410                 415

Leu Ile Gln Leu Ile Ile Asp Asn Lys Asp Ser Phe Glu Ile Lys Thr
            420                 425                 430

Asn Asn Lys Trp His Arg Phe Ser Val Lys Thr Met Asn Lys Leu Ile
        435                 440                 445

Pro Glu Met Met Glu Arg Pro Val Glu Gln Met Thr Leu Leu Asn Glu
    450                 455                 460

Met Gly Leu Val Lys Lys Asp Lys Lys Arg Phe Glu Asn Asn Lys Tyr
465                 470                 475                 480

Leu Pro Tyr Lys Glu Ile Ala Lys Asp Ile Phe Asn Pro Val Ala Ser
                485                 490                 495

Lys Ser Val Arg Glu Ala Leu Lys Ile Val Asn Ala Val Leu Lys Lys
            500                 505                 510

Tyr Gly His Ile Asp Tyr Leu Val Val Glu Met Pro Arg Asp Lys Asn
        515                 520                 525

Leu Lys Glu Glu Gln Asp Asn Ile Lys Glu Phe Gln Asn Lys Asn Lys
    530                 535                 540

Lys Ala Lys Asp Ala Ala Phe Glu Ala Phe Val Lys Ser Val Gly Ser
545                 550                 555                 560
```

```
Glu Gln Arg Val Lys Glu Ala Leu Ser Lys Asn Arg Lys Leu Gln Met
                565                 570                 575

Lys Met Arg Leu Trp Tyr Gln Gln Gln Glu Ile Asp Pro Tyr Asn Gly
            580                 585                 590

Lys Thr Ile Asp Ala Thr Asp Leu Ile Asn Asn Pro Asp Lys Phe Glu
        595                 600                 605

Ile Asp His Ile Ile Pro Gln Ser Ile Ser Phe Tyr Asp Ser Ile Asn
    610                 615                 620

Asn Lys Thr Leu Cys Phe Ala Ser Met Asn Gln Val Lys Gly Gln Lys
625                 630                 635                 640

Thr Pro Tyr Glu Phe Met Leu Glu Gly His Gly Gln Ser Tyr Asp Lys
                645                 650                 655

Phe Lys Ala Thr Val Met Ala Asn Lys Asn Phe Gly Lys Ala Lys Arg
            660                 665                 670

Ala Asn Tyr Leu Phe Glu Glu Asn Val Ser Asp Ile Glu Thr Arg Lys
        675                 680                 685

Arg Phe Leu Ser Arg Asn Leu Val Asp Thr Arg Tyr Ser Ser Arg Val
    690                 695                 700

Val Leu Asn Ser Leu Gln Asp Phe Phe Arg Glu Lys Ser Ala Asp Thr
705                 710                 715                 720

Lys Val Thr Val Ile Arg Gly Lys Phe Thr Ser Asn Met Arg Lys His
                725                 730                 735

Trp His Ile Asp Lys Thr Arg Glu Thr Phe His His His Ala Ile Asp
            740                 745                 750

Ala Ser Ile Ile Ala Ala Thr Pro Phe Leu Arg Met Trp Lys Lys Gly
        755                 760                 765
```

```
Gly Thr Ile Phe Pro Val Lys Val Gly Glu Glu Ser Ile Asp Ile Glu
    770                 775                 780

Thr Gly Glu Ile Leu Asp Asp Lys Asn Phe Asp Lys Ala Met Tyr Glu
785                 790                 795                 800

Glu Pro Tyr Ser Gly Phe Val Ser Glu Ile Met Asn Ala Asp Asp Arg
                805                 810                 815

Ile Lys Phe Ser His Gln Val Asp Lys Lys Met Asn Arg Lys Val Ser
            820                 825                 830

Asp Ala Thr Ile Tyr Ser Thr Arg Thr Gly Lys Leu Ala Lys Asp Lys
        835                 840                 845

Lys Asp Ala Glu Tyr Ile Val Ala Lys Val Lys Asp Ile Tyr Ser Val
    850                 855                 860

Asp Gly Phe Lys Lys Phe Lys Lys Val Tyr Asp Lys Asp Lys Thr Lys
865                 870                 875                 880

Phe Leu Leu Tyr Lys Tyr Asp Pro Arg Thr Phe Ser Lys Leu Glu Arg
                885                 890                 895

Ile Ile Ser Asp Cys Pro Asp Lys Val Glu Lys Val Gln Thr Asn Gly
            900                 905                 910

Lys Val Lys Ala Val Asp Ile Ser Pro Phe Glu Met Tyr Arg Arg Asp
        915                 920                 925

His Gly Met Ile Lys Lys Tyr Ser Lys Lys Gly Asn Gly Pro Ala Ile
    930                 935                 940

Lys Gln Leu Lys Tyr Leu Asp Lys Lys Leu Gly Ser His Ile Asp Ile
945                 950                 955                 960
```

```
Thr Pro Ala Asn Ala Asn Gly Lys His Val Ile Leu Gln Ser Leu Lys
                965                 970                 975

Pro Trp Arg Thr Asp Val Tyr Leu Asn His Glu Thr Gly Glu Tyr Glu
            980                 985                 990

Ile Met Gly Ile Lys Tyr Ser Asp  Leu Lys Phe Asn Lys  Asn Glu Gly
        995                 1000                1005

Tyr Gly  Ile Lys Lys Asp Lys  Tyr Leu Glu Ile Lys  Lys Val Glu
    1010                1015                1020

Glu Val  Ser Glu Lys Ser Glu  Phe Met Phe Ser Leu  Tyr Arg Lys
    1025                1030                1035

Asp Arg  Val Lys Val Gln Asp  Met Lys Thr Gly Glu  Ser Val Glu
    1040                1045                1050

Leu Leu  Phe Trp Ser Arg Asn  Phe Ser Asn Lys Lys  Tyr Ala Glu
    1055                1060                1065

Leu Lys  Pro Ile Ser Gln Ala  Glu Asn Asp Lys Lys  Leu Pro Val
    1070                1075                1080

Tyr Gly  Lys Gly Arg Leu Ile  Lys Arg Leu Ile Pro  Lys Asn Cys
    1085                1090                1095

Lys Ile  Trp Lys Val Asn Thr  Thr Ile Leu Gly Asp  Pro Tyr Tyr
    1100                1105                1110

Leu Glu  Lys Glu Ser Asp Ser  Pro Lys Asp Ile Leu  Asp
    1115                1120                1125
```

<210> 225
<211> 1380
<212> PRT
<213> Eggerthella sp.

<400> 225

```
Met Asn Leu Arg His Val Gly Asn Tyr Asn Ile Gly Leu Asp Met Gly
1               5                  10                  15

Thr Ala Ser Val Gly Trp Ala Ala Ile Asp Glu Gln Gly Glu Leu Leu
            20                  25                  30

His Phe Lys Gly Lys Pro Thr Trp Gly Ser Arg Leu Phe Asp Ser Ala
        35                  40                  45

Asn Thr Ala Ala Thr Ala Arg Met Pro Arg Gly Gln Arg Arg Arg Tyr
    50                  55                  60

Ile Arg Arg Arg Trp Arg Leu Asp Leu Leu Gln Lys Phe Phe Ser Glu
65                  70                  75                  80

Glu Met Ala Glu Lys Asp Pro Glu Phe Phe Ile Arg Leu Arg Gln Ser
                85                  90                  95

Ser Leu Trp Pro Glu Asp Arg Glu Gly Gly His Thr Ala Tyr His Trp
            100                 105                 110

Pro Leu Phe Asn Asp Ser Asp Phe Asn Glu Lys Glu Tyr Tyr Glu Lys
        115                 120                 125

Phe Pro Thr Ile Phe His Leu Arg Gln Trp Leu Met Glu Thr Asp Glu
    130                 135                 140

Lys Ala Asp Ile Arg Leu Ile Tyr Leu Ala Phe His Asn Ile Val Lys
145                 150                 155                 160

His Arg Gly Asn Phe Leu Gln Glu Asn Asn Asp Ser Leu Ser Ala Gln
                165                 170                 175

Asn Ala Asn Met Arg Glu Ser Leu Glu Ser Phe Cys Ile Ala Leu Glu
            180                 185                 190

Glu Trp Cys Asp Glu Lys Glu Leu Thr Cys Ser Cys Asp Pro Gln Lys
```

```
        195                 200                 205

Leu Glu His Leu Phe Lys Glu Val Lys Tyr Arg Ser Asp Ile Arg Asp
    210                 215                 220

Gly Phe Ala Ala Leu Leu Gly Leu Ala Cys Ser Gly Glu Asn Glu Val
225                 230                 235                 240

Asp Val Lys Ala Met Ala Lys Glu Met Gly Lys Ala Ile Val Gly Tyr
                245                 250                 255

Lys Ala Asp Phe Ser Lys Ile Phe Thr Glu Cys Asp Lys Glu Gly Ser
            260                 265                 270

Ser Phe Arg Leu Ser Asp Asp Glu Gly Pro Glu Ala Phe Leu Asp Ile
        275                 280                 285

Cys Pro Asp Asp Gly Ile Ala Leu Phe Glu Ala Ile Gln Met Val Tyr
    290                 295                 300

Ser Ser Phe Ile Leu Thr Gly Met Leu Thr Glu Lys Gly Leu Ser Leu
305                 310                 315                 320

Ser Lys Ile Ser Ala Tyr Asn Gln Tyr Gly Gln Asp Leu Glu Ser Leu
                325                 330                 335

Lys Ala Leu Val Lys Glu Tyr Val Pro Asn Glu Tyr Ser Ser Phe Phe
            340                 345                 350

Arg Gly Pro Thr Tyr Ser Gly Ser Thr Glu Tyr Asp Pro Ser Lys Ala
        355                 360                 365

Gln Gly Tyr Thr Arg Tyr Asn Leu Gly Pro Ser Lys Lys Gly Ser Gly
    370                 375                 380

Ala Lys Pro Met Ala Tyr Glu Asp Phe Lys Lys Ser Val Glu Gln Leu
385                 390                 395                 400
```

```
Phe Ala Asn Thr Asn Ala Ile Asn Asp Glu Arg Tyr Lys Glu Met Met
                405                 410                 415

Gly Arg Phe Ala Glu Glu Lys Phe Leu Arg Arg Leu Arg Thr Ser Asp
            420                 425                 430

Asn Gly Arg Ile Pro Phe Gln Leu Asn Leu Glu Glu Met Thr Ala Ile
        435                 440                 445

Ile Ile Asn Gln Gly Lys Tyr Tyr Pro Phe Leu Leu Glu Gln Gln Glu
    450                 455                 460

Lys Leu Glu Ser Leu Val Arg Phe Arg Ile Pro Tyr Tyr Val Gly Pro
465                 470                 475                 480

Leu Thr Arg Ile Asn Ala Arg Leu Asp Ser Lys Gly Asn Ala Cys Phe
                485                 490                 495

Ala Trp Ser Lys Arg Lys Asp Gly Met Asp Ser Ala Ser Ile Lys Pro
            500                 505                 510

Trp Asn Trp Asp Glu Val Ile Asp Lys His Ala Ser Ala Gln Ala Phe
        515                 520                 525

Ile Glu Arg Met Thr Gly Thr Cys Thr Tyr Leu Arg Gly Glu Pro Val
    530                 535                 540

Leu Pro Arg Cys Ser Leu Leu Tyr Glu Glu Tyr Cys Val Leu Asn Glu
545                 550                 555                 560

Leu Asn Gly Ala Arg Trp Thr Gln Asp Gly Asp Lys Phe Ile Arg Phe
                565                 570                 575

Asp Tyr Lys Asp Arg Ser Asp Ile Ile Glu Glu Leu Phe Lys Lys Arg
            580                 585                 590

Arg Gly Arg Ile Gln Tyr Ala Ala Val Ala Asp Trp Met Lys Gln Glu
```

```
        595                 600                 605

Arg Ser His Ala Asn Val His Val Ser Gly Gly Gln Gly Glu Asn Ala
    610                 615                 620

Phe Glu Ser Arg Leu Ser Ser Tyr His Phe Phe Cys Asn Asp Val Phe
625                 630                 635                 640

Gly Val Asp Glu Leu Pro Gly Ser Tyr Val Asp Met Val Glu Glu Ile
                645                 650                 655

Ile Leu Trp Ser Thr Leu Phe Glu Asp Arg Ser Ile Leu Arg Glu Glu
            660                 665                 670

Ile Gln Arg Lys Tyr Gly Asp Val Leu Asn Glu Glu Gln Ile Lys Thr
        675                 680                 685

Ile Cys Lys Lys Arg Phe Ser Gly Trp Gly Arg Leu Ser Arg Lys Leu
    690                 695                 700

Leu Cys Ser Leu Lys Ala Gln Thr Asp Asn Gly Pro Lys Ser Ile Met
705                 710                 715                 720

Asp Ile Leu Gln Glu Gly Asp Gln Asn Asn Gly Arg Val Gly Arg Ala
                725                 730                 735

Met Val Phe Gln Glu Ile Leu His Asp Glu Gln Leu Gly Phe Glu Gln
            740                 745                 750

Lys Ile Glu Glu Glu Asn Thr Gln Ser Met Leu Glu Gly Glu Asn Leu
        755                 760                 765

Leu Ile Glu Asp Leu Pro Gly Ser Pro Ala Ile Arg Arg Ser Ile Asn
    770                 775                 780

Gln Ala Val Arg Ile Val Asp Glu Ile Val Gly Ile Ala Gly His Ala
785                 790                 795                 800
```

```
Pro Asp Asn Ile Phe Ile Glu Val Thr Arg Glu Asp Asp Thr Lys Lys
               805                 810                 815

Lys Gly Lys Arg Thr Thr Thr Arg Tyr Ser Asn Ile Gln Lys Ala Leu
            820                 825                 830

Glu Ala Leu Lys Glu Glu Gly Ala Glu Ala Leu Arg Glu Leu Lys Thr
        835                 840                 845

Tyr Lys His Asn Glu Leu Asp Lys Arg Leu Ser Leu Tyr Phe Met Gln
    850                 855                 860

Asn Gly Lys Ser Leu Tyr Ser Gly Ile Pro Leu Asp Ile Arg Arg Leu
865                 870                 875                 880

Ser Glu Tyr Gln Ile Asp His Ile Ile Pro Gln Ser Tyr Ile Lys Asp
               885                 890                 895

Asp Ser Tyr Glu Asn Met Ala Leu Val Leu Pro Gly Glu Asn Gln Ser
            900                 905                 910

Lys Ala Asp Asn Leu Leu Ile Ser Gln Asp Ile Arg Ile Lys Met Lys
        915                 920                 925

Ala Thr Trp Thr Ala Leu His Lys Ala Gly Leu Met Gly Asp Lys Lys
    930                 935                 940

Tyr Asn Asn Leu Met Asn Ser Ser Ile Ser Asp Ala Lys Met Lys Gly
945                 950                 955                 960

Phe Ile Asn Arg Gln Leu Val Glu Thr Ser Gln Ser Val Lys Leu Thr
               965                 970                 975

Gln Met Met Leu Ser Gln Lys Tyr Pro Gly Ala Lys Val Arg Pro Ile
            980                 985                 990

Lys Ala Ser Ile Ser Ser Gln Leu  Arg Asp Ala Cys Asp  Leu Val Lys
```

995 1000 1005

Cys Arg Glu Ala Asn Asp Tyr His His Ala His Asp Ala Tyr Leu
1010 1015 1020

Ala Cys Gln Val Gly Arg Phe Val Leu Lys Arg His Ser Ser Met
1025 1030 1035

Phe Asp Asn Pro Ile Gly Met Thr Lys Val Ile Arg Asp Phe Val
1040 1045 1050

Lys Arg Gln Gly Gln Glu Phe Lys Arg Asn Gly Lys Leu Pro Ala
1055 1060 1065

Tyr Ala Ser Arg Ser Gly Phe Ile Val Gln Ser Phe Met Arg Ser
1070 1075 1080

Gly Phe Asp Ala Glu Thr Gly Glu Leu Leu Arg Asp Asp Trp Asn
1085 1090 1095

Ala Pro Phe Glu Ile Ala Arg Ile Lys Arg Cys Leu Asn Tyr Arg
1100 1105 1110

Asp Cys Tyr Ile Ser Arg Met Pro Met Glu Asp Ser Gly Ala Phe
1115 1120 1125

Trp Asp Ala Thr Ile Tyr Ser Pro Lys Ala Gly Lys Lys Gly Ala
1130 1135 1140

Leu Pro Val Lys Gln Gly Leu Pro Val Glu Lys Tyr Gly Ser Tyr
1145 1150 1155

Ser Arg Glu Gln Phe Ala Tyr Phe Phe Val Tyr Lys Ala Tyr Asn
1160 1165 1170

Pro Lys Lys Lys Ala Tyr Arg Leu Glu Phe Glu Ala Val Pro Val
1175 1180 1185

```
Arg Val  Ala Ser Ala Val Glu  Thr Arg Glu Asn Ala  Leu Glu Glu
    1190                1195                1200

Tyr Ala  Lys Ser Val Ala Lys  Gln Ala Gly Leu Glu  Phe Val Glu
    1205                1210                1215

Val Ala  Arg Pro Lys Val Tyr  Lys Tyr Gln Leu Ile  Glu Leu Gly
    1220                1225                1230

Glu Asp  Arg Leu Tyr Ile Thr  Gly Lys Arg Glu Val  Arg Asn Ala
    1235                1240                1245

Ser Gln  Leu Ala Phe Ser Leu  Asp Glu Ile Asp Leu  Leu Lys Arg
    1250                1255                1260

Leu Ala  Glu Gly Glu Glu Thr  Ser Ser Glu Glu Arg  Glu Arg Leu
    1265                1270                1275

Phe Asp  Val Leu Ile Glu Lys  Tyr Ala Arg Tyr Ala  Pro Arg Leu
    1280                1285                1290

Ala Arg  Gln Leu Ser Val Asp  Ser Met Ser Ala Thr  Phe Glu Thr
    1295                1300                1305

Leu Asn  Ala Glu Glu Gln Leu  Gly Ile Leu Leu Ser  Leu Val Glu
    1310                1315                1320

Ile Ala  Asn Gly Lys Arg Asn  Met Ile Asp Leu Ser  Ser Ala Gly
    1325                1330                1335

Gly Ser  Lys Asn Ala Gly Cys  Met Asn Pro Thr Phe  Ser Ser Glu
    1340                1345                1350

Leu Ser  Ser Pro Gly Ser Asn  Phe Thr Phe Ile Asp  Gln Ser Val
    1355                1360                1365

Thr Gly  Met Phe Glu Arg Arg  Gln Arg Leu Glu Leu
```

1370 1375 1380

<210> 226
<211> 1430
<212> PRT
<213> Capnocytophaga canimorsus

<400> 226

Met Lys His Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1 5 10 15

Ala Val Val Lys Glu Ala Gln Asn Asp Asn Glu Gln Ser Glu Ile Val
20 25 30

Asp Val Gly Val Arg Val Asn Pro Leu Thr Thr Asp Glu Lys Thr Asn
35 40 45

Phe Glu Lys Gly Lys Pro Ile Ser Thr Asn Ala Asp Arg Thr Leu Lys
50 55 60

Arg Ser Ala Arg Arg Asn Leu Gln Arg Tyr Lys Leu Arg Arg Lys Glu
65 70 75 80

Leu Ile Glu Leu Leu Lys Glu His Gln Leu Ile Ser Thr Asp Thr Ile
85 90 95

Leu Thr Glu Asn Gly Lys Gly Thr Thr Phe Gln Thr Leu Glu Leu Arg
100 105 110

Ala Lys Ser Ala Lys Glu Lys Ile Ser Leu Glu Glu Leu Ala Arg Val
115 120 125

Phe Leu Thr Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Ala
130 135 140

Lys Asn Glu Asp Glu Gly Gln Leu Ile Asp Gly Met Glu Ile Ala Lys
145 150 155 160

```
Arg Leu Tyr Glu Glu Asn Leu Thr Thr Gly Gln Leu Ser Leu Gln Leu
                165                 170                 175

Leu Lys Glu Gly Lys Lys Ser Leu Pro Asp Tyr Tyr Arg Ser Asp Leu
            180                 185                 190

Gln Phe Glu Leu Asp Lys Val Trp Asn Phe Gln Lys Gln Phe His Ser
        195                 200                 205

His Ile Leu Thr Asp Glu Phe Tyr Ala Gln Leu Lys Gly Lys Gly Gln
    210                 215                 220

Arg Ala Thr Ser Ala Leu Phe Leu Ala Lys Tyr Gln Ile Tyr Thr Ala
225                 230                 235                 240

Glu Asn Lys Gly Ser Arg Glu Asp Lys Lys Leu Gln Ala Tyr Gln Trp
                245                 250                 255

Arg Val Asp Ala Leu Ser Lys Glu Leu Thr Arg Glu Gln Leu Ala Phe
            260                 265                 270

Val Ile Thr Glu Ile Asn Asn Asn Leu Asn Asn Ser Ser Gly Tyr Leu
        275                 280                 285

Gly Ala Ile Ser Asp Arg Ser Lys Glu Leu Tyr Phe Asn Asn Glu Thr
    290                 295                 300

Val Gly Glu Tyr Leu Trp Lys Gln Ile Ala Ala Asn Pro His Thr Ser
305                 310                 315                 320

Leu Lys Asn Gln Val Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe Glu
                325                 330                 335

Gln Ile Trp Lys Thr Gln Ser Ala Phe Tyr Pro Glu Ile Leu Thr Asp
            340                 345                 350

Glu Leu Lys Lys Glu Leu Arg Asp Val Val Ile Phe Tyr Gln Arg Lys
        355                 360                 365
```

```
Leu Lys Ser Gln Lys Ser Leu Val Ser Phe Cys Glu Phe Glu Asn Lys
    370                 375                 380

Glu Ile Glu Ile Lys Lys Glu Asp Gly Thr Ser Thr Lys Lys Val Ile
385                 390                 395                 400

Gly Leu Lys Val Ala Pro Lys Ser Ser Pro Leu Phe Gln Glu Phe Lys
                405                 410                 415

Ile Trp Gln Asn Leu Asn Asn Val Leu Ile Arg Lys Lys Gly Ser Lys
            420                 425                 430

Thr Lys Lys Val Asp Lys Asn Gln Gln Ala Val Leu Phe Glu Glu Glu
        435                 440                 445

Lys Thr Ile Phe Glu Leu Asp Leu Glu Ala Lys Gln Ala Leu Phe Asn
    450                 455                 460

Glu Leu Asn Leu Lys Gly Asn Leu Lys Ala Tyr Tyr Cys Leu Glu Ile
465                 470                 475                 480

Leu Gly Tyr Ser Pro Lys Glu Trp Glu Met Asn Tyr Ser Val Leu Glu
                485                 490                 495

Gly Asn Arg Thr Asn Lys Ala Leu Tyr Glu Ala Tyr Leu Lys Ile Thr
            500                 505                 510

Asp Leu Glu Gly Tyr Asp Ala Lys Asn His Leu Lys Val Lys Leu Asn
        515                 520                 525

Lys Asp Glu Val Glu Leu Asp Asp Leu Lys Val Pro Ala Ser Glu Ile
    530                 535                 540

Lys Asp Met Val Gln Ala Ile Phe Lys Glu Ala Gly Ile Asn Thr Asp
545                 550                 555                 560
```

```
Ile Leu His Phe Asn Ala Glu Leu Asp Gly Lys Asp Phe Glu Asn Gln
                565                 570                 575

Ala Ser Tyr Gln Leu Trp His Leu Leu Tyr Ser Tyr Glu Gly Asp Asp
            580                 585                 590

Ser Lys Ser Gly Asn Glu Leu Leu Tyr Lys Leu Leu Glu Thr Lys Phe
        595                 600                 605

Gly Phe Lys Lys Glu Tyr Ala Gln Ile Leu Ala Asn Val Ser Leu Ser
    610                 615                 620

Asp Asp Tyr Gly Ser Leu Ser Thr Lys Ala Met Arg Lys Ile His Pro
625                 630                 635                 640

Tyr Ile Lys Glu Asn Lys Phe Ser Thr Ala Cys Glu Leu Ala Gly Tyr
                645                 650                 655

Arg His Ser Lys His Ser Leu Thr Lys Glu Glu Asn Asp Asn Arg Val
            660                 665                 670

Leu Lys Asp Ser Leu Glu Val Leu Lys Lys Asn Ser Leu Arg Gln Pro
        675                 680                 685

Val Val Glu Lys Ile Leu Asn Gln Met Ile Asn Leu Val Asn Ala Leu
    690                 695                 700

Leu Lys Lys Tyr Arg Thr Glu Asn Pro Asn Phe Lys Phe Asp Glu Ile
705                 710                 715                 720

Arg Ile Glu Leu Ala Arg Glu Leu Lys Lys Asn Ala Glu Glu Arg Ala
                725                 730                 735

Asn Met Thr Val Asn Ile Asn Lys Ala Lys Thr Glu His Glu Lys Ile
            740                 745                 750

Ile Lys Ile Leu Lys Asn Glu Phe Gly Leu Pro Asn Pro Thr Arg Asn
        755                 760                 765
```

```
Asp Ile Ile Arg Tyr Arg Leu Tyr Glu Glu Leu Lys Ala Asn Gly Tyr
    770                 775                 780

Lys Asp Leu Tyr Thr Asn Glu Tyr Ile Glu Lys Gln Asp Leu Phe Thr
785                 790                 795                 800

Lys Asn Ile Asp Ile Glu His Ile Ile Pro Lys Ser Arg Val Phe Asp
                805                 810                 815

Asp Ser Phe Ser Asn Lys Thr Leu Ser Phe Arg Lys Thr Asn Leu Asp
            820                 825                 830

Lys Gly Glu Arg Thr Ala Phe Asp Tyr Ile Glu Ser Lys Phe Gly Ala
        835                 840                 845

Asp Lys Leu Glu Glu Tyr Val Ala Arg Val Glu Asp Leu Tyr Lys Asn
    850                 855                 860

Asn Ile Ile Ser Lys Ala Lys Tyr Gln Lys Leu Leu Lys Lys Glu Ser
865                 870                 875                 880

Glu Ile Gly Asp Gly Phe Val Glu Arg Asp Leu Arg Glu Thr Gln Tyr
                885                 890                 895

Ile Ala Lys Lys Ala Lys Glu Ile Leu Leu Gln Ile Thr Pro Asn Val
            900                 905                 910

Leu Ser Thr Ser Gly Gly Ile Thr Asp Arg Leu Arg Glu Asp Trp Asp
        915                 920                 925

Leu Ile Asn Val Met Lys Glu Leu Asn Leu Pro Lys Tyr Arg Ala Leu
    930                 935                 940

Gly Leu Thr Gln Met Glu Asp Arg Lys Tyr Gly Gln Gln Val Glu Val
945                 950                 955                 960
```

```
Ile Ile Asp Trp Thr Lys Arg Asn Asp His Arg His His Ala Met Asp
               965                 970                 975

Ala Leu Thr Val Ala Phe Thr Lys His Asn His Ile Gln Tyr Leu Asn
           980                 985                 990

Tyr Leu Asn Ala Arg Lys Asn Glu  Lys His Arg Glu His  Ser Asn Ile
        995                 1000                1005

Met Gly  Ile Gln Gln Leu Glu  Thr Ile Lys Val Thr  Asp Lys Asn
    1010                1015                1020

Gly Asn  Glu Lys Arg Val Phe  Lys Ala Pro Met Pro  Asn Phe Arg
    1025                1030                1035

Gln Val  Thr Lys Ala Phe Leu  Glu Asn Val Leu Ile  Ser His Lys
    1040                1045                1050

Ala Lys  Asn Lys Val Val Thr  Lys Asn Lys Asn Lys  Val Ala Gly
    1055                1060                1065

Ser Asn  Lys Val Gln Glu Val  Leu Thr Pro Arg Gly  Gln Leu His
    1070                1075                1080

Lys Glu  Thr Val Tyr Gly Lys  Tyr Gln Tyr Tyr Val  Gln Lys Glu
    1085                1090                1095

Glu Lys  Ile Gly Gly Lys Phe  Asp Leu Glu Thr Ile  Lys Lys Val
    1100                1105                1110

Ala Asn  Pro Leu Tyr Gln Ser  Leu Leu Lys Lys Arg  Leu Glu Glu
    1115                1120                1125

Asn Gly  Gly Asp Pro Lys Lys  Ala Phe Thr Gly Lys  Asn Ser Leu
    1130                1135                1140

Ala Lys  Asn Pro Ile Tyr Leu  Asp Asp Ala Gln Thr  Glu Gln Leu
    1145                1150                1155
```

```
Pro Glu  Lys Val Lys Leu Val  Trp Leu Glu Asn Ser  Phe Ser Ile
    1160                1165                1170

Arg Lys  Asp Ile Thr Pro Glu  Asn Phe Lys Asp Glu  Lys Leu Ile
    1175                1180                1185

Asp Lys  Ile Leu Asp Glu Gly  Val Lys Arg Ile Leu  Lys Glu Arg
    1190                1195                1200

Leu Gln  Ser Phe Gly Asn Asp  Ala Lys Lys Ala Phe  Ser Asp Leu
    1205                1210                1215

Asp Lys  Asn Pro Ile Trp Leu  Asn Lys Glu Lys Gly  Ile Ala Ile
    1220                1225                1230

Lys Arg  Val Ala Ile Ser Gly  Val Ala Asn Ala Glu  Pro Leu His
    1235                1240                1245

Thr Lys  Lys Asp His Leu Gly  Lys Glu Ile Leu Asp  Lys Glu Gly
    1250                1255                1260

Lys Ser  Ile Pro Val Asp Phe  Ile Ser Thr Gly Asn  Asn His His
    1265                1270                1275

Val Ala  Val Tyr Arg Asp Glu  Lys Gly Asn Leu Gln  Glu Lys Val
    1280                1285                1290

Val Ser  Val Phe Glu Ala Val  Val Arg Ala Asn Gln  Gly Leu Pro
    1295                1300                1305

Ile Ile  Asp Lys Thr Tyr Asn  Gln His Leu Gly Trp  Glu Phe Leu
    1310                1315                1320

Phe Thr  Met Lys Gln Asn Glu  Met Phe Val Phe Ser  Asn Glu Ser
    1325                1330                1335
```

```
Thr Gly  Phe Asn Pro Asn Asp  Ile Asp Leu Leu Asp  Pro Lys Asn
    1340                1345                1350


Lys Lys  Ile Ile Ser Pro Asn  Leu Phe Arg Val Gln  Lys Phe Ser
    1355                1360                1365


Lys Leu  Gln Tyr Gly Asn Ser  Phe Val Arg Glu Phe  Val Phe Arg
    1370                1375                1380


His His  Leu Glu Thr Thr Val  Glu Asp Arg Lys Glu  Leu Gln Gly
    1385                1390                1395


Ile Thr  Tyr Lys Gln Met Lys  Asn Ser Ala Phe Phe  Asn Asp Ile
    1400                1405                1410


Ile Lys  Val Arg Ile Asn His  Leu Gly Gly Ile Val  Ser Val Gly
    1415                1420                1425


Glu Tyr
    1430
```

<210> 227
<211> 1348
<212> PRT
<213> Finegoldia magna

<400> 227

```
Met Lys Ser Glu Lys Lys Tyr Tyr Ile Gly Leu Asp Val Gly Thr Asn
1               5                   10                  15


Ser Val Gly Trp Ala Val Thr Asp Glu Phe Tyr Asn Ile Leu Arg Ala
            20                  25                  30


Lys Gly Lys Asp Leu Trp Gly Val Arg Leu Phe Glu Lys Ala Lys Thr
        35                  40                  45


Ala Ala Asp Thr Arg Thr Phe Arg Ser Gly Arg Arg Arg Asn Asp Arg
    50                  55                  60
```

```
Lys Gly Val Arg Leu Gln Ile Leu Arg Glu Ile Phe Glu Asp Glu Ile
65                  70                  75                  80

Lys Lys Val Asp Lys Asp Phe Tyr Asp Arg Leu Asp Glu Ser Lys Phe
                85                  90                  95

Trp Ala Glu Asp Lys Lys Val Ser Gly Lys Tyr Ser Leu Phe Asn Asp
            100                 105                 110

Lys Asn Phe Ser Asp Lys Gln Tyr Phe Glu Lys Phe Pro Thr Ile Phe
        115                 120                 125

His Leu Arg Lys Tyr Leu Met Glu Glu His Gly Lys Val Asp Ile Arg
    130                 135                 140

Tyr Tyr Phe Leu Ala Ile Asn Gln Met Met Lys Arg Arg Gly His Phe
145                 150                 155                 160

Leu Ile Asp Gly Gln Ile Ser His Val Thr Asp Asp Lys Pro Leu Lys
                165                 170                 175

Gln Gln Leu Ile Leu Leu Ile Asn Asp Leu Leu Lys Ile Glu Leu Glu
            180                 185                 190

Glu Glu Phe Met Asp Ser Ile Phe Glu Ile Leu Ala Asp Val Asn Glu
        195                 200                 205

Lys Lys Thr Glu Lys Lys Asn Ile Leu Lys Glu Leu Ile Asn Ala Gln
    210                 215                 220

Asp Phe Asn Lys Gln Glu Gly Lys Ile Leu Tyr Ser Ile Phe Glu Ser
225                 230                 235                 240

Ile Val Thr Gly Lys Ala Lys Ile Lys Asn Ile Ile Ser Asp Glu Asp
                245                 250                 255

Ile Leu Glu Lys Ile Lys Glu Asp Asn Lys Glu Asp Phe Val Leu Thr
```

```
            260                 265                 270

Gly Asp Ser Tyr Glu Glu Asn Leu Gln Tyr Phe Glu Glu Val Leu Gln
        275                 280                 285

Glu Asn Ile Thr Leu Phe Asn Thr Leu Lys Ser Ala Tyr Asp Phe Val
    290                 295                 300

Ile Leu Gln Ser Ile Leu Lys Gly Lys Ser Thr Leu Ser Asp Ala Gln
305                 310                 315                 320

Val Glu Arg Tyr Asp Glu His Lys Lys Asp Leu Glu Ile Leu Lys Lys
                325                 330                 335

Val Ile Lys Lys Tyr Asp Glu Asp Gly Lys Leu Phe Lys Gln Val Phe
            340                 345                 350

Lys Glu Asp Asn Gly Asn Gly Tyr Val Ser Tyr Ile Gly Tyr Tyr Leu
        355                 360                 365

Asn Lys Asn Lys Lys Ile Thr Ala Lys Lys Lys Ile Ser Asn Ile Glu
    370                 375                 380

Phe Thr Lys Tyr Val Lys Gly Ile Leu Glu Lys Gln Cys Asp Cys Glu
385                 390                 395                 400

Asp Glu Asp Val Lys Tyr Leu Leu Gly Lys Ile Glu Gln Glu Asn Phe
                405                 410                 415

Leu Leu Lys Gln Ile Ser Ser Ile Asn Ser Val Ile Pro His Gln Ile
            420                 425                 430

His Leu Phe Glu Leu Asp Lys Ile Leu Glu Asn Leu Ala Lys Tyr Tyr
        435                 440                 445

Pro Ser Phe Asn Asn Lys Lys Glu Glu Phe Thr Lys Ile Glu Lys Ile
    450                 455                 460
```

```
Arg Lys Thr Phe Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Asn
465                 470                 475                 480

Asp Tyr His Lys Asn Asn Gly Gly Asn Ala Trp Ile Phe Arg Asn Lys
                485                 490                 495

Gly Glu Lys Ile Arg Pro Trp Asn Phe Glu Lys Ile Val Asp Leu His
            500                 505                 510

Lys Ser Glu Glu Glu Phe Ile Lys Arg Met Leu Asn Gln Cys Thr Tyr
        515                 520                 525

Leu Pro Glu Glu Thr Val Leu Pro Lys Ser Ser Ile Leu Tyr Ser Glu
    530                 535                 540

Tyr Met Val Leu Asn Glu Leu Asn Asn Leu Arg Ile Asn Gly Lys Pro
545                 550                 555                 560

Ile Asp Thr Asp Val Lys Leu Lys Leu Ile Glu Glu Leu Phe Lys Lys
                565                 570                 575

Lys Thr Lys Val Thr Leu Lys Ser Ile Arg Asp Tyr Met Ile Arg Asn
            580                 585                 590

Asn Phe Ala Asp Lys Glu Asp Phe Asp Asn Ser Glu Lys Asn Leu Glu
        595                 600                 605

Ile Val Ser Asn Met Lys Ser Tyr Ile Asp Phe Asn Asn Ile Leu Gly
    610                 615                 620

Asp Lys Phe Glu Leu Glu Met Val Glu Asp Leu Ile Glu Lys Ile Thr
625                 630                 635                 640

Ile His Thr Gly Asn Lys Lys Leu Leu Lys Lys Tyr Ile Glu Glu Thr
                645                 650                 655

Tyr Pro Asp Leu Ser Ser Ser Gln Ile Gln Lys Ile Ile Asn Leu Lys
```

```
            660                 665                 670

Tyr Lys Asp Trp Gly Arg Leu Ser Arg Lys Leu Leu Asp Gly Ile Thr
        675                 680                 685

Gly Thr Asn Ile Glu Thr Gly Glu Ile Asp Thr Val Ile Asn Phe Leu
    690                 695                 700

Arg Asn Ser Ser Asp Asn Leu Met Gln Ile Ile Gly Ser Gln Asn Tyr
705                 710                 715                 720

Ser Phe Asn Asn Asp Ile Asp Lys Leu Arg Lys Lys Tyr Ile Pro Gln
                725                 730                 735

Glu Ile Ser Tyr Glu Val Val Glu Asn Leu Tyr Val Ser Pro Ser Val
            740                 745                 750

Lys Lys Met Ile Trp Gln Val Ile Arg Ile Thr Glu Glu Ile Thr Lys
        755                 760                 765

Val Met Gly Tyr Asp Pro Asp Lys Ile Phe Ile Glu Met Ala Lys Ser
    770                 775                 780

Glu Glu Gly Lys Lys Thr Thr Ile Ser Arg Lys Asn Lys Leu Leu Ala
785                 790                 795                 800

Leu Tyr Lys Ala Ile Lys Lys Asp Glu Arg Asp Ser Gln Tyr Glu Lys
                805                 810                 815

Leu Leu Thr Gly Leu Asn Lys Leu Asp Asp Ser Asp Leu Arg Ser Arg
            820                 825                 830

Lys Leu Tyr Leu Tyr Tyr Thr Gln Met Gly Arg Asp Met Tyr Thr Gly
        835                 840                 845

Glu Lys Ile Asp Leu Asp Lys Leu Phe Asp Ser Thr His Tyr Asp Lys
    850                 855                 860
```

```
Asp His Ile Ile Pro Gln Ser Met Lys Lys Asp Asp Ser Ile Ile Asn
865                 870                 875                 880

Asn Leu Val Leu Val Asn Lys Asn Ala Asn Gln Thr Thr Lys Gly Asn
                885                 890                 895

Ile Tyr Pro Val Pro Ser Ser Ile Arg Asn Asn Pro Lys Ile Tyr Asn
            900                 905                 910

Tyr Trp Lys Tyr Leu Met Glu Lys Glu Phe Ile Ser Lys Glu Lys Tyr
        915                 920                 925

Asn Arg Leu Ile Arg Asn Thr Pro Leu Thr Asn Glu Glu Leu Gly Gly
    930                 935                 940

Phe Ile Asn Arg Gln Leu Val Glu Thr Arg Gln Ser Thr Lys Ala Ile
945                 950                 955                 960

Lys Glu Leu Phe Glu Lys Phe Tyr Lys Lys Ser Lys Ile Ile Pro Val
                965                 970                 975

Lys Ala Ile Leu Ala Ser Asp Leu Arg Lys Asp Met Asn Thr Leu Lys
            980                 985                 990

Ser Arg Glu Val Asn Asp Leu His  His Ala His Asp Ala  Phe Leu Asn
        995                 1000                1005

Ile Val  Ala Gly Asp Val Trp  Asn Arg Glu Phe Thr  Ser Asn Pro
    1010                1015                1020

Ile Asn  Tyr Val Lys Glu Asn  Arg Glu Gly Asp Lys  Val Lys Tyr
    1025                1030                1035

Ser Leu  Ser Lys Tyr Phe Thr  Arg Pro Arg Lys Ser  Lys Gly Lys
    1040                1045                1050

Val Ile  Trp Thr Pro Glu Lys  Gly Arg Lys Leu Ile  Val Asp Thr
```

```
    1055                1060                1065

Leu Asn  Lys Pro Ser Val Leu  Ile Ser Asn Glu Ser  His Val Lys
    1070                1075                1080

Lys Gly  Glu Leu Phe Asn Ala  Thr Ile Ala Gly Lys  Lys Asp Tyr
    1085                1090                1095

Lys Lys  Gly Lys Ile Tyr Leu  Pro Leu Lys Lys Asp  Asp Arg Leu
    1100                1105                1110

Gln Asp  Val Ser Lys Tyr Gly  Gly Tyr Lys Ala Ile  Asn Gly Ala
    1115                1120                1125

Phe Phe  Phe Leu Val Glu His  Thr Lys Ser Lys Lys  Arg Ile Arg
    1130                1135                1140

Ser Ile  Glu Leu Phe Pro Leu  His Leu Leu Ser Lys  Phe Tyr Glu
    1145                1150                1155

Asp Lys  Asn Thr Val Leu Asp  Tyr Ala Ile Asn Val  Leu Gln Leu
    1160                1165                1170

Gln Asp  Pro Lys Ile Ile Ile  Asp Lys Ile Asn Tyr  Arg Thr Glu
    1175                1180                1185

Ile Ile  Ile Asp Asn Phe Ser  Tyr Leu Ile Ser Thr  Lys Ser Asn
    1190                1195                1200

Asp Gly  Ser Ile Thr Val Lys  Pro Asn Glu Gln Met  Tyr Trp Arg
    1205                1210                1215

Val Asp  Glu Ile Ser Asn Leu  Lys Lys Ile Glu Asn  Lys Tyr Lys
    1220                1225                1230

Lys Asp  Ala Ile Leu Thr Glu  Glu Asp Arg Lys Ile  Met Glu Ser
    1235                1240                1245
```

```
Tyr Ile  Asp Lys Ile Tyr Gln  Gln Phe Lys Ala Gly  Lys Tyr Lys
    1250                1255                1260


Asn Arg  Arg Thr Thr Asp Thr  Ile Ile Glu Lys Tyr  Glu Ile Ile
    1265                1270                1275


Asp Leu  Asp Thr Leu Asp Asn  Lys Gln Leu Tyr Gln  Leu Leu Val
    1280                1285                1290


Ala Phe  Ile Ser Leu Ser Tyr  Lys Thr Ser Asn Asn  Ala Val Asp
    1295                1300                1305


Phe Thr  Val Ile Gly Leu Gly  Thr Glu Cys Gly Lys  Pro Arg Ile
    1310                1315                1320


Thr Asn  Leu Pro Asp Asn Thr  Tyr Leu Val Tyr Lys  Ser Ile Thr
    1325                1330                1335


Gly Ile  Tyr Glu Lys Arg Ile  Arg Ile Lys
    1340                1345
```

<210> 228
<211> 1352
<212> PRT
<213> Megasphaera sp.

<400> 228

```
Met Lys Lys Arg Asn Arg Glu Glu Tyr Tyr Val Gly Leu Asp Ile Gly
1               5                   10                  15


Thr Ser Ser Val Gly Trp Ala Val Ala Thr Pro Asp Tyr Arg Ile Pro
            20                  25                  30


Lys Phe Arg Gly His Lys Met Trp Gly Ser Arg Leu Phe Ala Glu Gly
        35                  40                  45


Lys Arg Ala Ala Glu Arg Arg Gln Phe Arg Thr Asn Arg Arg Arg Leu
    50                  55                  60
```

```
Ala Arg Arg Arg Asp Arg Leu Gln Ile Leu Glu Glu Leu Phe Ala Glu
65                  70                  75                  80

Glu Met Ala Lys Val Asp Asn Thr Phe Phe Met Arg Leu Lys Glu Ser
                85                  90                  95

Lys Phe Phe Leu Glu Asp Lys Thr Val Lys Glu Lys His Ile Leu Phe
            100                 105                 110

Ser Thr Asp Lys Phe Asp Ala Asp Arg Phe Tyr Lys Asp Asn Pro Thr
        115                 120                 125

Ile Tyr His Val Arg Lys Arg Leu Met Glu Glu Glu Pro Gln Asp Ile
    130                 135                 140

Arg Glu Leu Phe Leu Ala Val His His Ile Leu Lys Tyr Arg Gly His
145                 150                 155                 160

Phe Leu Phe Ala Gly Ser Leu Glu Gln Asn Gly Ala Ser Ile Glu Glu
                165                 170                 175

Leu Val Arg Thr Leu Leu Gly Lys Gln Gly Leu Ala Ile Leu Asp Asp
            180                 185                 190

Thr Ile Asp Ser Asn Glu Met Val Asn Ile Leu Lys Asn Thr Gly Glu
        195                 200                 205

Thr Lys Ser Asp Arg Lys Lys Asp Val Gln Glu Leu Trp Asn Pro Leu
    210                 215                 220

Lys Asp Lys Val Lys Lys Ala Gln Ala Ala Glu Met Ala Gly Leu Val
225                 230                 235                 240

Leu Gly Leu Lys Ser Asp Ile Ser Lys Leu Phe Ala Asn Ser Asp Tyr
                245                 250                 255
```

```
Lys Asp Leu Asp Ser Ser Ile Lys Asn Ile Asn Phe Ser Ser Gly Asp
            260                 265                 270

Tyr Glu Glu Lys Arg Asp Asp Tyr Ala Asn Ser Ile Gly Asp Asp Ile
        275                 280                 285

Val Leu Leu Asp Thr Met Lys Ala Leu Tyr Asp Thr Leu Ile Leu Ser
    290                 295                 300

Gln Ile Leu Gln Gly Lys Arg Ser Ile Ser Ala Ala Lys Val Glu Asp
305                 310                 315                 320

Tyr Asn Thr His Lys Glu Gln Leu Arg Ala Leu Lys Ala Ile Leu Lys
                325                 330                 335

Pro His Lys Arg Leu Tyr Asn Glu Met Phe Arg Glu Asn Asn Lys Lys
            340                 345                 350

Asp Leu Ser Asn Tyr Val Ala Tyr Ile Ser Ser Tyr Ser Glu Gly Lys
        355                 360                 365

Arg Val Asn Arg Glu Gly Phe Tyr Lys Tyr Val Gln Ala Val Leu Lys
    370                 375                 380

Gln Val Asp Asp Ser Asp Ser Lys Gln Ala Ile Leu Glu Ala Ile Arg
385                 390                 395                 400

Leu Glu Thr Phe Leu Pro Leu Leu Arg Val Lys Asp Asn Ala Val Ile
                405                 410                 415

Pro His Gln Ile His Gln Ala Glu Leu Glu Ala Ile Leu Glu Thr Ala
            420                 425                 430

Arg Lys Lys Tyr Asn Phe Leu Asn Asp Val Ser Asp Gly Val Ser Val
        435                 440                 445

Lys Asp Lys Ile Ile Gln Leu Phe Thr Phe Arg Ile Pro Tyr Tyr Val
    450                 455                 460
```

```
Gly Pro Leu Asn Pro His Ser Gly Glu Thr Val Ala Asp Arg Lys Gln
465                 470                 475                 480

Gly Thr Gly Trp Val Val Arg Lys Gln Arg Gly Lys Val Tyr Pro Trp
                485                 490                 495

Asn Phe Ala Asp Met Val Asp Val Lys Ala Ser Ala Glu Ala Phe Ile
            500                 505                 510

Thr Asn Leu Thr Asn Lys Cys Thr Tyr Leu Ile Gly Glu Asp Val Leu
        515                 520                 525

Pro Lys Arg Ser Leu Leu Tyr Ser Glu Phe Met Leu Leu Asn Glu Leu
    530                 535                 540

Asn Met Ile Lys Tyr Asp Gly His Glu Leu Pro Val Ala Ile Lys Gln
545                 550                 555                 560

Leu Tyr Ile Glu Gln Val Phe Lys Gln Glu His Lys Lys Gln Thr Lys
                565                 570                 575

Gly Arg Val Leu Asp Phe Leu Lys Arg Asn Gly Leu Ile Thr Gly Ser
            580                 585                 590

Ala Thr Ala Val Ile Thr Gly Met Asp Asp Ala Ile Lys Gly Asp Leu
        595                 600                 605

Gln Ser Tyr Arg Asp Met Val Arg Ile Phe Gly Ala Gly Phe Asp His
    610                 615                 620

Ser Met Ala Glu Arg Ile Ile Arg Trp Val Thr Leu Phe Gly Glu Ala
625                 630                 635                 640

Lys Asp Ile Leu Glu Asn Lys Ile Arg Glu Val Tyr Gly Asn Ser Ile
                645                 650                 655
```

```
Ser Asp Ser Gln Met Arg Ala Ile Lys Lys Leu Lys Tyr Ala Asp Trp
            660                 665                 670

Gly Arg Leu Ser Gln Ala Phe Leu Ile Ala Val Lys Gly Cys Asp Lys
        675                 680                 685

Ser Gly Val Glu Arg Asn Ile Ile Thr Cys Leu Arg Ala Ser Ser Gln
    690                 695                 700

Asn Leu Met Glu Ile Leu Ser Asp Gln Gly Thr Tyr Ile Lys Gln Ile
705                 710                 715                 720

Lys Ala Trp Asn His Gln His Thr Thr Asn Met Met Asp Thr Leu Asp
                725                 730                 735

Tyr Gln Leu Val Asp Asp Leu Tyr Val Ala Pro Ser Val Lys Arg Ser
            740                 745                 750

Ile Trp Gln Ser Leu Cys Ile Val Glu Glu Leu Val Lys Ile Met Gly
        755                 760                 765

Gln Ala Pro Lys Lys Ile Phe Val Glu Val Thr Arg Thr Lys Gln Ala
    770                 775                 780

Glu Lys Thr Lys Lys Asp Ser Arg Lys Lys Arg Leu Val Glu Leu Tyr
785                 790                 795                 800

Thr Ala Ile Gly Lys Glu Gly Ala Ala Trp Lys Lys Glu Ile Glu Ala
                805                 810                 815

His Gln Ala Gly Asp Phe Arg Arg Lys Lys Leu Tyr Leu Tyr Tyr Thr
            820                 825                 830

Gln Met Gly Arg Cys Met Tyr Ser Asn Glu Pro Ile Ala Met Asp Ala
        835                 840                 845

Leu Phe Thr Ser Ala Tyr Asp Ile Asp His Ile Tyr Pro Gln Ser Leu
    850                 855                 860
```

```
Thr Lys Asp Gly Ser Trp Asp Asn Leu Val Leu Val Lys Ser Gln Leu
865                 870                 875                 880


Asn Lys Glu Lys Ser Asp Gln Tyr Pro Leu Arg Pro Ala Ile Arg Glu
                885                 890                 895


Lys Asn Lys Ala His Trp Gln Tyr Leu Cys Arg Ala Gly Phe Ile Ser
            900                 905                 910


Glu Lys Lys Tyr Glu Arg Leu Met Arg Thr Thr Glu Leu Thr Ala Glu
        915                 920                 925


Glu Leu Ser Gly Phe Ile Ala Arg Gln Leu Val Glu Thr Ser Gln Ala
    930                 935                 940


Thr Lys Ala Val Thr Gly Leu Leu Glu Arg Ile Tyr Thr Asn Thr Glu
945                 950                 955                 960


Ile Cys Phe Val Lys Ala Glu Thr Val Ser Gln Phe Arg His Gln His
                965                 970                 975


Asn Phe Ile Lys Ile Arg Glu Leu Asn Asn Tyr His His Ala Lys Asp
            980                 985                 990


Ala Tyr Leu Asn Ile Val Val Gly  Asn Val Tyr His Glu  Lys Phe Thr
        995                 1000                1005


Lys Asn  Pro Trp Glu Phe Ile  Ala Arg Ser Thr Glu  Arg Arg Pro
    1010                1015                1020


Tyr Asn  Leu Asn Arg Met Tyr  Asp Phe Asp Leu Leu  Lys Gln Gly
    1025                1030                1035


Arg Val  Ile Trp Gln Val Pro  Lys Ser Leu Glu Thr  Val Gln Ala
    1040                1045                1050
```

```
Met Met  Lys Ser Asn Asp Val  Arg Ile Thr Lys Lys  Leu Leu Val
    1055                1060                1065

Gln Lys  Gly Glu Leu Tyr Asp  Ala Thr Ile Thr Lys  Ala His Lys
    1070                1075                1080

Ala Lys  Glu Gly Thr Tyr Phe  Pro Leu Lys Gly Ala  Asp Ala Arg
    1085                1090                1095

Leu Arg  Asp Val His Arg Tyr  Gly Gly Tyr Glu Lys  Ile Lys Ile
    1100                1105                1110

Ala Tyr  Tyr Ser Val Phe Ser  Cys Arg Glu Lys Ala  Ser Asn Thr
    1115                1120                1125

Ile His  Thr Leu Ile Ile Pro  Ile Pro Val Tyr Lys  Ala Gly Leu
    1130                1135                1140

Leu Gln  Thr Glu Ala Asp Leu  Thr Ala Tyr Ala Trp  Gln Thr Lys
    1145                1150                1155

Gln Lys  Thr Lys Pro Ile Lys  Asp Ile Tyr Ser Ala  Ile Thr Pro
    1160                1165                1170

Ile Tyr  Lys Lys Leu Cys Ile  Asn Thr Val Val Lys  Ile Asp Gly
    1175                1180                1185

Phe Lys  Tyr Phe Leu Gly Gly  Lys Thr Gly Asp Tyr  Met Trp Leu
    1190                1195                1200

Asp Pro  Ala Ile Pro Val Val  Leu Asp Glu Gln Ala  Ala Ala Tyr
    1205                1210                1215

Leu Lys  Ala Ile Ser Lys Val  Gly Arg Ala Asp Asp  Val Glu Asn
    1220                1225                1230

Thr Ala  Gln Ala Ile Asp Leu  Ile Thr Ala Glu Ala  Asn Glu Ala
    1235                1240                1245
```

```
Phe Tyr  Asp Val Leu Leu Lys  Lys Met Glu Ala Lys  Ile Phe Ala
    1250                1255                1260


Lys Ala  Tyr Gln Thr Ile Val  Glu Lys Leu Ala Ser  Glu Thr Ala
    1265                1270                1275


Arg Glu  Arg Phe Arg Glu Leu  Ser Ile Gly Ala Gln  Cys Ser Cys
    1280                1285                1290


Leu Leu  Glu Ile Leu Asn Leu  Leu Ala Asn Asn Lys  Thr Thr Phe
    1295                1300                1305


Thr Phe  Phe Lys Asp Lys Met  Gly Val Thr Met Ser  Arg Arg Lys
    1310                1315                1320


Gln Pro  Met Asp Leu Thr Lys  Leu Glu Glu Cys Ile  Val Tyr Glu
    1325                1330                1335


Thr Ser  Ile Thr Gly Leu Tyr  Glu Lys Ala Val Ser  Leu Leu
    1340                1345                1350


<210>  229
<211>  650
<212>  PRT
<213>  Haemophilus pittmaniae

<400>  229

Met Glu Asn Lys Asn Leu His Tyr Ile Leu Gly Leu Asp Leu Gly Ile
1               5                  10                  15


Ala Ser Val Gly Trp Ala Val Val Glu Ile Asp Lys Glu Glu Asn Pro
            20                  25                  30


Leu Cys Leu Ile Asp Val Gly Val Arg Thr Phe Glu Arg Ala Glu Val
        35                  40                  45


Pro Lys Thr Gly Glu Ser Leu Ala Leu Ser Arg Arg Leu Ala Arg Ser
```

```
    50                  55                  60

Ala Arg Arg Leu Thr Gln Arg Arg Val Ala Arg Leu Lys Lys Ala Lys
65                  70                  75                  80

Arg Leu Leu Lys Leu Glu Asn Ile Leu Leu Ser Thr Asp Glu Arg Leu
                85                  90                  95

Pro His Gln Val Trp Gln Leu Arg Val Glu Gly Leu Asp Arg Lys Leu
            100                 105                 110

Lys Arg Gln Glu Trp Ala Ala Val Leu Leu His Leu Ile Lys His Arg
        115                 120                 125

Gly Tyr Leu Ser Gln Arg Lys Asn Glu Ser Lys Ser Glu Asn Lys Glu
    130                 135                 140

Leu Gly Ala Leu Leu Ser Gly Val Ala Ser Asn His Glu Leu Leu Gln
145                 150                 155                 160

Gln Thr Thr Tyr Arg Thr Pro Ala Glu Leu Ala Val Lys Lys Phe Glu
                165                 170                 175

Val Glu Glu Gly His Ile Arg Asn Gln Gln Gly Ala Tyr Thr His Thr
            180                 185                 190

Phe Ser Arg Leu Asp Leu Leu Ala Glu Met Glu Leu Leu Phe Ser Arg
        195                 200                 205

Gln Gln His Phe Gly Asn Pro Phe Ala Ser Glu Lys Leu Leu Glu Asn
    210                 215                 220

Leu Thr Ala Leu Leu Met Trp Gln Lys Pro Ala Leu Ser Gly Glu Ala
225                 230                 235                 240

Ile Leu Lys Met Leu Gly Lys Cys Thr Phe Glu Asp Glu Tyr Lys Ala
                245                 250                 255
```

```
Ala Lys Asn Thr Tyr Thr Ala Glu Arg Phe Val Trp Ile Thr Lys Leu
            260                 265                 270

Asn Asn Leu Arg Ile Gln Glu Asn Gly Leu Glu Arg Ala Leu Asn Asp
        275                 280                 285

Asn Glu Arg Leu Ile Leu Ile Glu Gln Pro Tyr Glu Lys Ala Lys Leu
    290                 295                 300

Thr Tyr Ala Gln Val Arg Ser Ile Leu Asn Leu Ser Asp Glu Ala Ile
305                 310                 315                 320

Phe Lys Gly Leu Arg Tyr Ser Gly Glu Asp Lys Lys Ala Ile Glu Thr
                325                 330                 335

Lys Thr Thr Leu Met Glu Met Lys Ala Tyr His Gln Ile Arg Lys Val
            340                 345                 350

Leu Glu Gly Asn Asn Leu Lys Ala Glu Trp Thr Glu Leu Lys Glu Asn
        355                 360                 365

Ser Thr Leu Leu Asp Glu Ile Gly Thr Ala Phe Ser Leu Tyr Lys Thr
    370                 375                 380

Asp Glu Asp Ile Ser Thr Tyr Leu Ala Gly Lys Leu Ser Gln Pro Val
385                 390                 395                 400

Leu Asn Ala Leu Leu Glu Asn Leu Ser Phe Asp Lys Phe Ile Gln Leu
                405                 410                 415

Ser Leu Lys Ala Leu Tyr Lys Leu Leu Pro Leu Met Gln Gln Gly Leu
            420                 425                 430

Arg Tyr Asp Glu Ala Cys His Glu Met Tyr Gly Asp His Tyr Gly Lys
        435                 440                 445

Lys Thr Tyr Gly Lys Lys Thr Glu Glu Asn His Tyr Phe Leu Pro Gln
```

```
    450                 455                 460

Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Thr Leu Thr
465                 470                 475                 480

Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Leu Tyr Gly Ser Pro
                485                 490                 495

Ala Arg Ile His Ile Glu Thr Gly Arg Glu Val Gly Lys Ser Tyr Lys
            500                 505                 510

Asp Arg Arg Glu Leu Glu Lys Arg Gln Glu Glu Asn Arg Lys Gln Arg
        515                 520                 525

Glu Asn Ala Ile Lys Glu Phe Lys Glu Tyr Phe Pro His Phe Ala Gly
    530                 535                 540

Glu Pro Lys Ala Lys Asp Ile Leu Lys Met Arg Leu Tyr Lys Gln Gln
545                 550                 555                 560

Asn Ala Lys Cys Leu Tyr Ser Gly Lys Pro Ile Glu Leu His Arg Leu
                565                 570                 575

Leu Glu Lys Gly Tyr Val Glu Val Asp His Ala Leu Pro Phe Ser Arg
            580                 585                 590

Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Ala Asn Glu
        595                 600                 605

Asn Gln Asn Lys Gly Asn Leu Thr Pro Phe Glu Trp Leu Asp Gly Lys
    610                 615                 620

His Asn Ser Glu Arg Trp Arg Ala Phe Lys Ala Leu Val Glu Thr Ser
625                 630                 635                 640

Ala Phe Pro Tyr Ala Lys Asn Asn Ala Ser
                645                 650
```

<210> 230
<211> 1062
<212> PRT
<213> Ralstonia syzygii

<400> 230

```
Met Ala Glu Lys Gln His Arg Trp Gly Leu Asp Ile Gly Thr Asn Ser
1               5                   10                  15


Ile Gly Trp Ala Val Ile Ala Leu Ile Glu Gly Arg Pro Ala Gly Leu
            20                  25                  30


Val Ala Thr Gly Ser Arg Ile Phe Ser Asp Gly Arg Asn Pro Lys Asp
        35                  40                  45


Gly Ser Ser Leu Ala Val Glu Arg Arg Gly Pro Arg Gln Met Arg Arg
    50                  55                  60


Arg Arg Asp Arg Tyr Leu Arg Arg Arg Asp Arg Phe Met Gln Ala Leu
65                  70                  75                  80


Ile Asn Val Gly Leu Met Pro Gly Asp Ala Ala Ala Arg Lys Ala Leu
                85                  90                  95


Val Thr Glu Asn Pro Tyr Val Leu Arg Gln Arg Gly Leu Asp Gln Ala
            100                 105                 110


Leu Thr Leu Pro Glu Phe Gly Arg Ala Leu Phe His Leu Asn Gln Arg
        115                 120                 125


Arg Gly Phe Gln Ser Asn Arg Lys Thr Asp Arg Ala Thr Ala Lys Glu
    130                 135                 140


Ser Gly Lys Val Lys Asn Ala Ile Ala Ala Phe Arg Ala Gly Met Gly
145                 150                 155                 160


Asn Ala Arg Thr Val Gly Glu Ala Leu Ala Arg Arg Leu Glu Asp Gly
                165                 170                 175
```

```
Arg Pro Val Arg Ala Arg Met Val Gly Gln Gly Lys Asp Glu His Tyr
            180                 185                 190

Glu Leu Tyr Ile Ala Arg Glu Trp Ile Ala Gln Glu Phe Asp Ala Leu
        195                 200                 205

Trp Ala Ser Gln Gln Arg Phe His Ala Glu Val Leu Ala Asp Ala Ala
    210                 215                 220

Arg Asp Arg Leu Arg Ala Ile Leu Leu Phe Gln Arg Lys Leu Leu Pro
225                 230                 235                 240

Val Pro Val Gly Lys Cys Phe Leu Glu Pro Asn Gln Pro Arg Val Ala
                245                 250                 255

Ala Ala Leu Pro Ser Ala Gln Arg Phe Arg Leu Met Gln Glu Leu Asn
            260                 265                 270

His Leu Arg Val Met Thr Leu Ala Asp Lys Arg Glu Arg Pro Leu Ser
        275                 280                 285

Phe Gln Glu Arg Asn Asp Leu Leu Ala Gln Leu Val Ala Arg Pro Lys
    290                 295                 300

Cys Gly Phe Asp Met Leu Arg Lys Ile Val Phe Gly Ala Asn Lys Glu
305                 310                 315                 320

Ala Tyr Arg Phe Thr Ile Glu Ser Glu Arg Arg Lys Glu Leu Lys Gly
                325                 330                 335

Cys Asp Thr Ala Ala Lys Leu Ala Lys Val Asn Ala Leu Gly Thr Arg
            340                 345                 350

Trp Gln Ala Leu Ser Leu Asp Glu Gln Asp Arg Leu Val Cys Leu Leu
        355                 360                 365
```

```
Leu Asp Gly Glu Asn Asp Ala Val Leu Ala Asp Ala Leu Arg Glu His
    370                 375                 380

Tyr Gly Leu Thr Asp Ala Gln Ile Asp Thr Leu Leu Gly Leu Ser Phe
385                 390                 395                 400

Glu Asp Gly His Met Arg Leu Gly Arg Ser Ala Leu Leu Arg Val Leu
                405                 410                 415

Asp Ala Leu Glu Ser Gly Arg Asp Glu Gln Gly Leu Pro Leu Ser Tyr
            420                 425                 430

Asp Lys Ala Val Val Ala Ala Gly Tyr Pro Ala His Thr Ala Asp Leu
        435                 440                 445

Glu Asn Gly Glu Arg Asp Ala Leu Pro Tyr Tyr Gly Glu Leu Leu Trp
    450                 455                 460

Arg Tyr Thr Gln Asp Ala Pro Thr Ala Lys Asn Asp Ala Glu Arg Lys
465                 470                 475                 480

Phe Gly Lys Ile Ala Asn Pro Thr Val His Ile Gly Leu Asn Gln Leu
                485                 490                 495

Arg Lys Leu Val Asn Ala Leu Ile Gln Arg Tyr Gly Lys Pro Ala Gln
            500                 505                 510

Ile Val Val Glu Leu Ala Arg Asn Leu Lys Ala Gly Leu Glu Glu Lys
        515                 520                 525

Glu Arg Ile Lys Lys Gln Gln Thr Ala Asn Leu Glu Arg Asn Glu Arg
    530                 535                 540

Ile Arg Gln Lys Leu Gln Asp Ala Gly Val Pro Asp Asn Arg Glu Asn
545                 550                 555                 560

Arg Leu Arg Met Arg Leu Phe Glu Glu Leu Gly Gln Gly Asn Gly Leu
                565                 570                 575
```

```
Gly Thr Pro Cys Ile Tyr Ser Gly Arg Gln Ile Ser Leu Gln Arg Leu
            580                 585                 590

Phe Ser Asn Asp Val Gln Val Asp His Ile Leu Pro Phe Ser Lys Thr
        595                 600                 605

Leu Asp Asp Ser Phe Ala Asn Lys Val Leu Ala Gln His Asp Ala Asn
    610                 615                 620

Arg Tyr Lys Gly Asn Arg Gly Pro Phe Glu Ala Phe Gly Ala Asn Arg
625                 630                 635                 640

Asp Gly Tyr Ala Trp Asp Asp Ile Arg Ala Arg Ala Ala Val Leu Pro
                645                 650                 655

Arg Asn Lys Arg Asn Arg Phe Ala Glu Thr Ala Met Gln Asp Trp Leu
            660                 665                 670

His Asn Glu Thr Asp Phe Leu Ala Arg Gln Leu Thr Asp Thr Ala Tyr
        675                 680                 685

Leu Ser Arg Val Ala Arg Gln Tyr Leu Thr Ala Ile Cys Ser Lys Asp
    690                 695                 700

Asp Val Tyr Val Ser Pro Gly Arg Leu Thr Ala Met Leu Arg Ala Lys
705                 710                 715                 720

Trp Gly Leu Asn Arg Val Leu Asp Gly Val Met Glu Glu Gln Gly Arg
                725                 730                 735

Pro Ala Val Lys Asn Arg Asp Asp His Arg His His Ala Ile Asp Ala
            740                 745                 750

Val Val Ile Gly Ala Thr Asp Arg Ala Met Leu Gln Gln Val Ala Thr
        755                 760                 765
```

```
Leu Ala Ala Arg Ala Arg Glu Gln Asp Ala Glu Arg Leu Ile Gly Asp
    770                 775                 780

Met Pro Thr Pro Trp Pro Asn Phe Leu Glu Asp Val Arg Ala Ala Val
785                 790                 795                 800

Ala Arg Cys Val Val Ser His Lys Pro Asp His Gly Pro Glu Gly Gly
                805                 810                 815

Leu His Asn Asp Thr Ala Tyr Gly Ile Val Ala Gly Pro Phe Glu Asp
            820                 825                 830

Gly Arg Tyr Arg Val Arg His Arg Val Ser Leu Phe Asp Leu Lys Pro
        835                 840                 845

Gly Asp Leu Ser Asn Val Arg Cys Asp Ala Pro Leu Gln Ala Glu Leu
    850                 855                 860

Glu Pro Ile Phe Glu Gln Asp Asp Ala Arg Ala Arg Glu Val Ala Leu
865                 870                 875                 880

Thr Ala Leu Ala Glu Arg Tyr Arg Gln Arg Lys Val Trp Leu Glu Glu
                885                 890                 895

Leu Met Ser Val Leu Pro Ile Arg Pro Arg Gly Glu Asp Gly Lys Thr
            900                 905                 910

Leu Pro Asp Ser Ala Pro Tyr Lys Ala Tyr Lys Gly Asp Ser Asn Tyr
        915                 920                 925

Cys Tyr Glu Leu Phe Ile Asn Glu Arg Gly Arg Trp Asp Gly Glu Leu
    930                 935                 940

Ile Ser Thr Phe Arg Ala Asn Gln Ala Ala Tyr Arg Arg Phe Arg Asn
945                 950                 955                 960

Asp Pro Ala Arg Phe Arg Arg Tyr Thr Ala Gly Gly Arg Pro Leu Leu
                965                 970                 975
```

```
Met Arg Leu Cys Ile Asn Asp Tyr Ile Ala Val Gly Thr Ala Ala Glu
            980                 985                 990


Arg Thr Ile Phe Arg Val Val Lys  Met Ser Glu Asn Lys  Ile Thr Leu
        995                 1000                1005


Ala Glu  His Phe Glu Gly Gly  Thr Leu Lys Gln Arg  Asp Ala Asp
    1010                1015                1020


Lys Asp  Asp Pro Phe Lys Tyr  Leu Thr Lys Ser Pro  Gly Ala Leu
    1025                1030                1035


Arg Asp  Leu Gly Ala Arg Arg  Ile Phe Val Asp Leu  Ile Gly Arg
    1040                1045                1050


Val Leu  Asp Pro Gly Ile Lys  Gly Asp
    1055                1060
```

<210> 231
<211> 1052
<212> PRT
<213> Haemophilus parainfluenzae

<400> 231

```
Met Glu Asn Lys Asn Leu His Tyr Ile Leu Gly Leu Asp Leu Gly Ile
1               5                   10                  15


Ala Ser Val Gly Trp Ala Val Val Glu Ile Asp Glu Lys Glu Asn Pro
            20                  25                  30


Leu Arg Leu Ile Asp Val Gly Val Arg Thr Phe Glu Arg Ala Glu Thr
        35                  40                  45


Gln Lys Gly Glu Ser Leu Ala Leu Ser Arg Arg Ser Ala Arg Ser Ala
    50                  55                  60


Arg Arg Leu Thr Gln Arg Arg Val Ala Arg Leu Lys Lys Ala Lys Arg
```

```
65                  70                  75                  80

Leu Leu Lys Ser Glu Asn Ile Leu Leu Ser Thr Asp Glu Arg Leu Pro
                85                  90                  95

His Gln Val Trp Gln Leu Arg Val Glu Gly Leu Asp Arg Lys Leu Glu
            100                 105                 110

Arg Gln Glu Trp Ala Ala Val Leu Leu His Leu Ile Lys His Arg Gly
        115                 120                 125

Tyr Leu Ser Gln Arg Lys Asn Glu Ser Lys Ser Glu Asn Lys Glu Leu
    130                 135                 140

Gly Ala Leu Leu Ser Gly Val Ala Ser Asn His Glu Leu Leu Gln Gln
145                 150                 155                 160

Ala Thr Tyr Arg Thr Pro Ala Glu Leu Ala Val Lys Lys Phe Glu Val
                165                 170                 175

Glu Glu Gly His Ile Arg Asn Gln Gln Gly Ala Tyr Thr His Thr Phe
            180                 185                 190

Ser Arg Leu Asp Leu Leu Ala Glu Met Glu Leu Leu Phe Ser Arg Gln
        195                 200                 205

Gln His Phe Gly Asn Pro Phe Ala Ser Glu Lys Leu Leu Glu Asn Leu
    210                 215                 220

Thr Ala Leu Leu Met Trp Gln Lys Pro Ala Leu Ser Gly Glu Asp Ile
225                 230                 235                 240

Leu Lys Met Leu Gly Lys Cys Thr Phe Glu Asp Glu Tyr Lys Ala Ala
                245                 250                 255

Lys Asn Thr Tyr Thr Ala Glu Arg Phe Val Trp Ile Thr Lys Leu Asn
            260                 265                 270
```

```
Asn Leu Arg Ile Gln Glu Asn Gly Leu Glu Arg Ala Leu Ser Asp Asn
        275                 280                 285

Glu Arg Leu Met Leu Ile Glu Gln Pro Tyr Glu Lys Ala Lys Leu Thr
    290                 295                 300

Tyr Ala Gln Val Arg Ser Ile Leu Asn Leu Ser Asp Asp Ala Ile Phe
305                 310                 315                 320

Lys Gly Val Arg Tyr Ser Gly Glu Asp Lys Lys Ala Ile Glu Thr Lys
                325                 330                 335

Thr Thr Leu Met Glu Met Lys Ala Tyr His Gln Ile Arg Lys Val Leu
            340                 345                 350

Glu Gly Asn Asn Leu Lys Ala Glu Trp Val Ala Leu Lys Ala Asn Pro
        355                 360                 365

Thr Leu Leu Asp Glu Ile Gly Thr Ala Phe Ser Leu Tyr Lys Thr Asp
    370                 375                 380

Glu Asp Ile Ser Ala Tyr Leu Ala Gly Lys Leu Ser Gln Pro Val Leu
385                 390                 395                 400

Asn Ala Leu Leu Glu Asn Leu Ser Phe Asp Lys Phe Ile Gln Leu Ser
                405                 410                 415

Leu Lys Ala Leu Tyr Lys Leu Leu Pro Leu Met Gln Gln Gly Leu Arg
            420                 425                 430

Tyr Asp Glu Ala Cys Arg Glu Ile Tyr Gly Asp His Tyr Gly Lys Lys
        435                 440                 445

Thr Glu Glu Thr His His Phe Leu Pro Gln Ile Pro Ala Asp Glu Ile
    450                 455                 460

Arg Asn Pro Val Val Leu Arg Thr Leu Thr Gln Ala Arg Lys Val Ile
```

```
465                 470                 475                 480

Asn Gly Val Val Arg Leu Tyr Gly Ser Pro Ala Arg Ile His Ile Glu
                485                 490                 495

Thr Gly Arg Glu Val Gly Lys Ser Tyr Lys Asp Arg His Glu Leu Lys
            500                 505                 510

Lys Arg Gln Glu Glu Asn Arg Lys Gln Arg Glu Lys Thr Ile Ser Glu
        515                 520                 525

Ile Lys Thr Leu Phe Pro Asn Phe Ser Gly Glu Pro Lys Gly Lys Asp
    530                 535                 540

Ile Leu Lys Met Arg Leu Tyr Tyr Gln Gln Asn Ala Lys Cys Leu Tyr
545                 550                 555                 560

Ser Gly Lys Pro Leu Glu Leu His Arg Leu Phe Glu Gln Lys Tyr Val
                565                 570                 575

Glu Val Asp His Ala Leu Pro Leu Ser Arg Thr Trp Asp Asp Ser Phe
            580                 585                 590

Asn Asn Lys Val Leu Val Leu Ala Asn Glu Asn Gln Asn Lys Gly Asn
        595                 600                 605

Leu Thr Pro Phe Glu Trp Leu Asp Gly Lys Asn Asn Ser Glu Arg Trp
    610                 615                 620

Arg Thr Phe Lys Ala Leu Val Glu Thr Ser Ala Phe Pro Tyr Ala Lys
625                 630                 635                 640

Lys Gln Arg Ile Leu Ser Gln Lys Leu Asp Glu Lys Gly Phe Ile Glu
                645                 650                 655

Arg Asn Leu Asn Asp Thr Arg Tyr Val Ala Arg Phe Leu Cys Asn Phe
            660                 665                 670
```

```
Ile Ala Asp Asn Met His Leu Thr Gly Glu Gly Lys Arg Lys Val Phe
        675                 680                 685

Ala Ser Asn Gly Gln Ile Thr Ala Leu Leu Arg Arg Arg Trp Gly Leu
    690                 695                 700

Ala Lys Ser Arg Glu Asp Asn Asp Arg His His Ala Leu Asp Ala Val
705                 710                 715                 720

Leu Val Ala Cys Ser Thr Val Ala Met Gln Gln Lys Ile Thr Arg Phe
                725                 730                 735

Val Arg Phe Lys Ala Gly Asp Val Phe Thr Gly Glu Arg Ile Asp Arg
            740                 745                 750

Glu Thr Gly Glu Ile Ile Pro Leu His Phe Pro Thr Pro Trp Gln Phe
        755                 760                 765

Phe Lys Gln Glu Val Glu Ile Arg Ile Phe Ser Asp Asn Pro Lys Leu
    770                 775                 780

Glu Leu Glu Asn Arg Leu Pro Asp Arg Pro Gln Ala Asn His Glu Phe
785                 790                 795                 800

Val Gln Pro Leu Phe Val Ser Arg Met Pro Thr Arg Lys Met Thr Gly
                805                 810                 815

Gln Gly His Met Glu Thr Val Lys Ser Ala Lys Arg Leu Asn Glu Gly
            820                 825                 830

Ile Ser Met Ile Lys Met Pro Leu Thr Lys Leu Lys Leu Lys Asp Leu
        835                 840                 845

Glu Leu Met Val Asn Arg Glu Arg Glu Lys Asp Leu Tyr Asp Ala Leu
    850                 855                 860

Lys Thr Arg Leu Glu Ala Phe Asn Asp Asp Pro Ala Lys Ala Phe Ala
```

865 870 875 880

Glu Pro Phe Met Lys Lys Gly Gly Ala Ile Val Lys Ser Val Arg Val
885 890 895

Glu Gln Val Gln Lys Ser Gly Val Leu Val Arg Gln Gly Asn Gly Val
900 905 910

Ala Asp Asn Ala Ser Met Val Arg Val Asp Val Phe Thr Lys Asp Gly
915 920 925

Lys Tyr Phe Leu Val Pro Ile Tyr Thr Trp Gln Val Ala Lys Gly Ile
930 935 940

Leu Pro Asn Lys Ala Val Ile Gln Gly Lys Asp Glu Glu Asp Trp Glu
945 950 955 960

Asp Ile Asp Asp Ala Thr Phe Gln Phe Ser Leu His Pro Asn Asp Leu
965 970 975

Ile Ser Val Lys Thr Lys Lys Asp Glu Phe Leu Gly Tyr Phe Asn Gly
980 985 990

Leu Asn Arg His Thr Gly Gly Ile Asn Ile Arg Thr His Asp Leu Glu
995 1000 1005

Lys Ser Lys Gly Lys Gln Gly Ile Phe Glu Gly Ile Gly Val Lys
1010 1015 1020

Ile Ala Leu Ser Phe Glu Lys Tyr Gln Ile Asp Glu Leu Gly Lys
1025 1030 1035

Asn Ile Arg Leu Cys Lys Pro Ser Lys Arg Gln Pro Val Arg
1040 1045 1050

<210> 232
<211> 1331
<212> PRT

<213> Lactobacillus sanfranciscensis

<400> 232

```
Met Asn Lys Gln Pro Tyr Asn Ile Gly Leu Asp Ile Gly Thr Ser Ser
1               5                  10                  15


Val Gly Trp Ser Ala Thr Glu Leu Asp Asn Arg Leu Leu His Ile Lys
            20                  25                  30


Gly His Asn Gly Ile Gly Val Arg Leu Phe Lys Glu Gly Glu Ser Ala
        35                  40                  45


Ala Asp Arg Arg Gly Phe Arg Thr Thr Arg Arg Arg Leu Ala Arg Arg
    50                  55                  60


Lys Trp Arg Leu Arg Leu Leu Asn Glu Ile Phe Ala Thr Glu Ile Ala
65                  70                  75                  80


Lys Val Asp Pro Ser Phe Phe Ala Arg Leu Lys Gln Ser Asn Val Ser
                85                  90                  95


Pro Lys Asp Pro Asn Lys Thr Met Phe Glu Asn Ile Leu Phe Asp Asp
            100                 105                 110


Glu Asn Leu Asp Asp Gln Lys Phe His His Asp Tyr Lys Thr Ile Tyr
        115                 120                 125


His Leu Arg Gln Ala Ile Ile Asn His Pro Glu Gln Lys Phe Asp Ile
    130                 135                 140


Arg Leu Ile Tyr Leu Ala Met His His Ile Ile Lys Tyr Arg Gly His
145                 150                 155                 160


Phe Leu Asn Gln Ala Asn Val Gln Asp Phe Lys Gly Gly Lys Ile Asp
                165                 170                 175


Leu Glu Lys Ser Phe Lys Ala Leu Asn Asp Ile Phe Glu Asn Gln Gly
            180                 185                 190
```

```
Arg Asp Leu Arg Leu Val Thr Asp Lys Ala Asn Gln Tyr Val Lys Val
        195                 200                 205

Leu Ser Asp Asn Ala Lys Thr Arg Ser Asp Arg Lys Lys Glu Leu Ser
    210                 215                 220

Lys Leu Leu Tyr Val Pro Ile Asp Lys Asp Thr Asp Lys Asn Ser Lys
225                 230                 235                 240

Lys Val Thr Gly Glu Ile Leu Lys Ala Ile Leu Gly Asn Lys Ala Lys
                245                 250                 255

Phe Asp Val Ile Phe Gly Ile Glu Val Glu Asn Pro Lys Glu Trp Val
            260                 265                 270

Leu Thr Phe Asn Ser Asp Asp Phe Asp Asp Lys Ile Glu Gly Leu Ser
        275                 280                 285

Ser Gln Met Thr Asp Glu Asp Ser Glu Ile Leu Leu Ile Leu Lys Glu
    290                 295                 300

Leu Tyr Phe Ala Leu Asn Leu Ser Asp Ile Leu Asn Asn Ser Val Thr
305                 310                 315                 320

Asp Lys Asn Ala Lys Thr Leu Ser Glu Ala Met Ile Asn Arg Tyr Asp
                325                 330                 335

Asp His Lys Asn Gln Leu Ala Met Leu Lys Lys Val Ile Asp Ser Ser
            340                 345                 350

Asp Lys Lys His Ala Lys Glu Leu Lys Glu Ala Tyr Ser Ala Tyr Ile
        355                 360                 365

Asp Gly Glu Asn Asn Lys Lys Ile Ser Phe Glu Asp Leu Lys Lys Arg
    370                 375                 380
```

```
Ile Gln Lys Asn Leu Val Asp Ser Glu Leu Ser Gln Lys Ile Asn Asp
385                 390                 395                 400

Leu Leu Asp His Asp Tyr Phe Leu Pro Lys Gln Arg Ser Lys Glu Asn
                405                 410                 415

Gly Ala Ile Pro His Gln Leu Gln Gln Gln Glu Leu Asp Gln Ile Ile
            420                 425                 430

Glu Ser Gln Lys Gln Tyr Tyr Pro Phe Leu Ala Glu Leu Asn Pro Asn
        435                 440                 445

Glu Lys Arg Ser Arg Gln Ala Lys Tyr Lys Leu Asp Glu Leu Val Ala
    450                 455                 460

Phe Arg Val Pro Tyr Tyr Val Gly Pro Met Val Glu Val Thr Asp Ser
465                 470                 475                 480

Asn Gln Glu Asn Asn Gly Lys Phe Ala Trp Met Ile Arg Lys Glu Gln
                485                 490                 495

Gly Glu Ile Thr Pro Trp Asn Phe Asp Glu Lys Val Asp Arg Thr Glu
            500                 505                 510

Thr Ala Thr Lys Phe Ile Thr Arg Met Thr Thr Thr Asp Thr Tyr Leu
        515                 520                 525

Ile Gly Glu Pro Val Leu Pro Lys Asn Ser Leu Leu Tyr Gln Lys Phe
    530                 535                 540

Val Val Leu Asn Glu Leu Asn Asn Leu Lys Ile Asn Gln Glu Ile Ile
545                 550                 555                 560

Thr Pro Gly Gln Lys Gln Tyr Leu Tyr Glu His Val Met Lys Lys Asn
                565                 570                 575

Lys Arg Val Thr Leu Lys Lys Ile Ala Asp Ala Leu Val Ile Lys Gly
            580                 585                 590
```

```
Asp Tyr Pro Tyr Ala Pro Glu Val Lys Gly Thr Thr Asp Gln Lys Asn
        595                 600                 605

Leu Asn Asn Gly Leu Thr Thr Tyr Ile Asp Leu Ala Lys Ile Phe Gly
    610                 615                 620

Asn Glu Leu Asp Asp Val Asp Arg Glu Ala Asp Phe Glu Lys Ile Ile
625                 630                 635                 640

Glu Trp Ser Thr Ile Phe Glu Asp Gln His Ile Phe Ala Leu Lys Leu
                645                 650                 655

Gln Glu Leu Lys Trp Leu Thr Glu Lys Gln Arg Asn Gln Val Val Lys
            660                 665                 670

Leu Arg Tyr Gln Gly Trp Gly Lys Leu Ser Lys Glu Leu Leu Ala Gly
        675                 680                 685

Leu Val Asp Asp Asn Gly Gln Arg Ile Ile Asp Leu Leu Trp Ser Asp
    690                 695                 700

Asn Gln Asn Phe Met Gln Ile Val Asn Gln Lys Ser Phe Lys Glu Ser
705                 710                 715                 720

Ile Ala Asp His Asn Gly Ala His Leu Glu Glu Lys Asn Leu Lys Asp
                725                 730                 735

Val Ile Asn Asp Leu Tyr Thr Ser Pro Gln Asn Lys Lys Ala Ile Arg
            740                 745                 750

Gln Val Ile Leu Val Val Asp Asp Ile Ile Asn Ala Val Gly Tyr Glu
        755                 760                 765

Pro Ala Asn Ile Met Met Glu Phe Ala Arg Glu Asp Ser Asn Asp His
    770                 775                 780
```

```
Arg Leu Thr Asn Ser Arg Ser Arg Gln Leu Glu Asn Val Tyr Lys Asp
785                 790                 795                 800

Ile Thr Asn Ser Trp Phe Asp Asn Asp Ser Val Lys Asp Glu Leu Glu
                805                 810                 815

Asp Lys Ile Lys Asn Lys Asp Lys Phe Thr Asp Arg Leu Tyr Leu Tyr
            820                 825                 830

Phe Thr Gln Gly Gly Lys Asp Leu Tyr Thr Gly Glu Pro Leu Asn Ile
        835                 840                 845

Asp Asp Leu Ser Ser Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Phe
    850                 855                 860

Ile Leu Asp Asn Ser Leu Asp Asn Arg Val Leu Thr Ser Gln Arg Asn
865                 870                 875                 880

Asn Arg Val Ser Lys Glu Asp Gln Leu Pro Gly Glu Leu Phe Gly Thr
                885                 890                 895

Lys Met His Ala Phe Trp Lys Arg Leu Lys Ala Ala His Leu Ile Ser
            900                 905                 910

Asn Lys Lys Tyr Tyr Asn Leu Thr Leu Thr Pro Asn Ser Ile Ser Lys
        915                 920                 925

Phe Asn Asn Gln Gly Arg Phe Ile Asn Arg Gln Leu Val Glu Thr Arg
    930                 935                 940

Gln Val Ile Lys Leu Ala Ala Glu Ile Leu His Asn Arg Tyr Ser Glu
945                 950                 955                 960

Glu Lys Gly Thr Asn Ile Val Thr Ile Lys Ala Asn Leu Thr His His
                965                 970                 975

Met Arg Glu Lys Phe Asn Phe Tyr Lys Asn Arg Asn Val Asn Asp Tyr
            980                 985                 990
```

```
His His Ala Phe Asp Ala Tyr Leu  Thr Ala Phe Val Gly  Asn Trp Leu
        995                 1000                1005


Leu Gln  Gln Tyr Pro Lys Leu  Lys Pro Tyr Phe Val  Tyr Gly Asp
    1010                1015                1020


Phe Ala  Lys Thr Glu Ile Asn  Asn Leu Lys Ser Phe  Asn Met Leu
    1025                1030                1035


Tyr Lys  Phe Glu Gln Ala His  Gln Leu Asn Glu Lys  Asp Gly Lys
    1040                1045                1050


Ile Ala  Lys Asp Ala Asp Ala  Leu Leu Gly Tyr Met  Lys Asn Val
    1055                1060                1065


Tyr His  Phe Lys Lys Met Leu  Val Thr Lys Lys Leu  Glu Thr Asn
    1070                1075                1080


His Gly  Ala Leu Phe Lys Gln  Thr Leu Tyr Pro Ser  Pro Ala His
    1085                1090                1095


Asp Ile  Lys Lys Arg Gln Leu  Ile Lys Pro Lys Asp  Asn Arg Pro
    1100                1105                1110


Thr Asp  Ile Tyr Gly Gly Tyr  Thr His Glu Glu Arg  Lys Tyr Met
    1115                1120                1125


Ser Leu  Val Lys Val Ile Gly  Lys Lys Asp Asn Glu  Tyr Arg Met
    1130                1135                1140


Ala Asn  Val Pro Leu Leu Lys  Ile Asn Lys Asn Asn  Asp Ile Lys
    1145                1150                1155


Glu Ile  Leu Lys Ser Gln Phe  Ser Asn Lys Lys Phe  Glu Ile Val
    1160                1165                1170
```

```
Leu Pro  Lys Val Leu Lys Asn  Gln Leu Phe Ser Glu  Asn Gly Ala
    1175                1180                1185


Leu Phe  Val Ile Gly Ser Lys  Gly Tyr Lys Tyr Asn  Ala Asn Gln
    1190                1195                1200


Leu Val  Leu Ser Asp Leu Asp  Met Lys Leu Leu Asn  Asp Leu Ser
    1205                1210                1215


Asn Asn  Lys Ser Ile Asp Glu  Val Thr Ile Asn Gln  Leu Phe Lys
    1220                1225                1230


Asn Ile  Val Asp Ser Thr Asn  Lys Tyr Met Pro Leu  Tyr Glu Ile
    1235                1240                1245


Lys Asn  Leu Asn Glu Val Val  Glu Lys Phe Asn Asn  Leu Glu Phe
    1250                1255                1260


Asn Asp  Lys Lys Lys Thr Ile  Thr Asp Phe Leu Leu  Ala Thr His
    1265                1270                1275


Ala Asn  Pro Thr Met Ser Asn  Leu Lys Asn Ile Gly  Leu Pro Ser
    1280                1285                1290


Tyr Phe  Gly Arg Phe Thr Ser  Gly Asn Ala Gly Ile  Lys Leu Ser
    1295                1300                1305


Glu Asn  Ala Asn Val Ile Tyr  Gln Ser Pro Thr Gly  Leu Phe Ser
    1310                1315                1320


Arg Lys  Val Lys Ile Ser Asp  Phe
    1325                1330


<210>  233
<211>  1473
<212>  PRT
<213>  Flavobacterium branchiophilum

<400>  233
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```
Met Ala Lys Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                  10                  15

Ala Val Val Glu Arg Glu Asn Ile Asp Phe Ser Leu Ile Asp Lys Gly
            20                  25                  30

Val Arg Ile Phe Ser Glu Gly Val Lys Ser Glu Lys Gly Ile Glu Ser
        35                  40                  45

Ser Arg Ala Ala Glu Arg Thr Gly Tyr Arg Ser Ala Arg Lys Ile Lys
    50                  55                  60

Tyr Arg Arg Lys Leu Arg Lys Tyr Glu Thr Leu Lys Val Leu Ser Leu
65                  70                  75                  80

Asn Arg Met Cys Pro Leu Ser Ile Glu Glu Val Glu Glu Trp Lys Lys
                85                  90                  95

Ser Gly Phe Lys Asp Tyr Pro Leu Asn Pro Glu Phe Leu Lys Trp Leu
            100                 105                 110

Ser Thr Asp Glu Glu Ser Asn Val Asn Pro Tyr Phe Phe Arg Asp Arg
        115                 120                 125

Ala Ser Lys His Lys Val Ser Leu Phe Glu Leu Gly Arg Ala Phe Tyr
    130                 135                 140

His Ile Ala Gln Arg Arg Gly Phe Leu Ser Asn Arg Leu Asp Gln Ser
145                 150                 155                 160

Ala Glu Gly Ile Leu Glu Glu His Cys Pro Lys Ile Glu Ala Ile Val
                165                 170                 175

Glu Asp Leu Ile Ser Ile Asp Glu Ile Ser Thr Asn Ile Thr Asp Tyr
            180                 185                 190

Phe Phe Glu Thr Gly Ile Leu Asp Ser Asn Glu Lys Asn Gly Tyr Ala
```

```
        195                 200                 205

Lys Asp Leu Asp Glu Gly Asp Lys Lys Leu Val Ser Leu Tyr Lys Ser
    210                 215                 220

Leu Leu Ala Ile Leu Lys Lys Asn Glu Ser Asp Phe Glu Asn Cys Lys
225                 230                 235                 240

Ser Glu Ile Ile Glu Arg Leu Asn Lys Lys Asp Val Leu Gly Lys Val
                245                 250                 255

Lys Gly Lys Ile Lys Asp Ile Ser Gln Ala Met Leu Asp Gly Asn Tyr
            260                 265                 270

Lys Thr Leu Gly Gln Tyr Phe Tyr Ser Leu Tyr Ser Lys Glu Lys Ile
        275                 280                 285

Arg Asn Gln Tyr Thr Ser Arg Glu Glu His Tyr Leu Ser Glu Phe Ile
    290                 295                 300

Thr Ile Cys Lys Val Gln Gly Ile Asp Gln Ile Asn Glu Glu Glu Lys
305                 310                 315                 320

Ile Asn Glu Lys Lys Phe Asp Gly Leu Ala Lys Asp Leu Tyr Lys Ala
                325                 330                 335

Ile Phe Phe Gln Arg Pro Leu Lys Ser Gln Lys Gly Leu Ile Gly Lys
            340                 345                 350

Cys Ser Phe Glu Lys Ser Lys Ser Arg Cys Ala Ile Ser His Pro Asp
        355                 360                 365

Phe Glu Glu Tyr Arg Met Trp Thr Tyr Leu Asn Thr Ile Lys Ile Gly
    370                 375                 380

Thr Gln Ser Asp Lys Lys Leu Arg Phe Leu Thr Gln Asp Glu Lys Leu
385                 390                 395                 400
```

```
Lys Leu Val Pro Lys Phe Tyr Arg Lys Asn Asp Phe Asn Phe Asp Val
                405                 410                 415

Leu Ala Lys Glu Leu Ile Glu Lys Gly Ser Ser Phe Gly Phe Tyr Lys
            420                 425                 430

Ser Ser Lys Lys Asn Asp Phe Phe Tyr Trp Phe Asn Tyr Lys Pro Thr
        435                 440                 445

Asp Thr Val Ala Ala Cys Gln Val Ala Ala Ser Leu Lys Asn Ala Ile
    450                 455                 460

Gly Glu Asp Trp Lys Thr Lys Ser Phe Lys Tyr Gln Thr Ile Asn Ser
465                 470                 475                 480

Asn Lys Glu Gln Val Ser Arg Thr Val Asp Tyr Lys Asp Leu Trp His
                485                 490                 495

Leu Leu Thr Val Ala Thr Ser Asp Val Tyr Leu Tyr Glu Phe Ala Ile
            500                 505                 510

Asp Lys Leu Gly Leu Asp Glu Lys Asn Ala Lys Ala Phe Ser Lys Thr
        515                 520                 525

Lys Leu Lys Lys Asp Phe Ala Ser Leu Ser Leu Ser Ala Ile Asn Lys
    530                 535                 540

Ile Leu Pro Tyr Leu Lys Glu Gly Leu Leu Tyr Ser His Ala Val Phe
545                 550                 555                 560

Val Ala Asn Ile Glu Asn Ile Val Asp Glu Asn Ile Trp Lys Asp Glu
                565                 570                 575

Lys Gln Arg Asp Tyr Ile Lys Thr Gln Ile Ser Glu Ile Ile Glu Asn
            580                 585                 590

Tyr Thr Leu Glu Lys Ser Arg Phe Glu Ile Ile Asn Gly Leu Leu Lys
```

```
        595                 600                 605

Glu Tyr Lys Ser Glu Asn Glu Asp Gly Lys Arg Val Tyr Tyr Ser Lys
    610                 615                 620

Glu Ala Glu Gln Ser Phe Glu Asn Asp Leu Lys Lys Lys Leu Val Leu
625                 630                 635                 640

Phe Tyr Lys Ser Asn Glu Ile Glu Asn Lys Glu Gln Gln Glu Thr Ile
                645                 650                 655

Phe Asn Glu Leu Leu Pro Ile Phe Ile Gln Gln Leu Lys Asp Tyr Glu
            660                 665                 670

Phe Ile Lys Ile Gln Arg Leu Asp Gln Lys Val Leu Ile Phe Leu Lys
        675                 680                 685

Gly Lys Asn Glu Thr Gly Gln Ile Phe Cys Thr Glu Glu Lys Gly Thr
    690                 695                 700

Ala Glu Glu Lys Glu Lys Lys Ile Lys Asn Arg Leu Lys Lys Leu Tyr
705                 710                 715                 720

His Pro Ser Asp Ile Glu Lys Phe Lys Lys Lys Ile Ile Lys Asp Glu
                725                 730                 735

Phe Gly Asn Glu Lys Ile Val Leu Gly Ser Pro Leu Thr Pro Ser Ile
            740                 745                 750

Lys Asn Pro Met Ala Met Arg Ala Leu His Gln Leu Arg Lys Val Leu
        755                 760                 765

Asn Ala Leu Ile Leu Glu Gly Gln Ile Asp Glu Lys Thr Ile Ile His
    770                 775                 780

Ile Glu Met Ala Arg Glu Leu Asn Asp Ala Asn Lys Arg Lys Gly Ile
785                 790                 795                 800
```

```
Gln Asp Tyr Gln Asn Asp Asn Lys Lys Phe Arg Glu Asp Ala Ile Lys
                805                 810                 815

Glu Ile Lys Lys Leu Tyr Phe Glu Asp Cys Lys Lys Glu Val Glu Pro
            820                 825                 830

Thr Glu Asp Asp Ile Leu Arg Tyr Gln Leu Trp Met Glu Gln Asn Arg
        835                 840                 845

Ser Glu Ile Tyr Glu Glu Gly Lys Asn Ile Ser Ile Cys Asp Ile Ile
    850                 855                 860

Gly Ser Asn Pro Ala Tyr Asp Ile Glu His Thr Ile Pro Arg Ser Arg
865                 870                 875                 880

Ser Gln Asp Asn Ser Gln Met Asn Lys Thr Leu Cys Ser Gln Arg Phe
                885                 890                 895

Asn Arg Glu Val Lys Lys Gln Ser Met Pro Ile Glu Leu Asn Asn His
            900                 905                 910

Leu Glu Ile Leu Pro Arg Ile Ala His Trp Lys Glu Glu Ala Asp Asn
        915                 920                 925

Leu Thr Arg Glu Ile Glu Ile Ile Ser Arg Ser Ile Lys Ala Ala Ala
    930                 935                 940

Thr Lys Glu Ile Lys Asp Lys Lys Ile Arg Arg Arg His Tyr Leu Thr
945                 950                 955                 960

Leu Lys Arg Asp Tyr Leu Gln Gly Lys Tyr Asp Arg Phe Ile Trp Glu
                965                 970                 975

Glu Pro Lys Val Gly Phe Lys Asn Ser Gln Ile Pro Asp Thr Gly Ile
            980                 985                 990

Ile Thr Lys Tyr Ala Gln Ala Tyr  Leu Lys Ser Tyr Phe  Lys Lys Val
```

995 1000 1005

Glu Ser Val Lys Gly Gly Met Val Ala Glu Phe Arg Lys Ile Trp
1010 1015 1020

Gly Ile Gln Glu Ser Phe Ile Asp Glu Asn Gly Met Lys His Tyr
1025 1030 1035

Lys Val Lys Asp Arg Ser Lys His Thr His His Thr Ile Asp Ala
1040 1045 1050

Ile Thr Ile Ala Cys Met Thr Lys Glu Lys Tyr Asp Val Leu Ala
1055 1060 1065

His Ala Trp Thr Leu Glu Asp Gln Gln Asn Lys Lys Glu Ala Arg
1070 1075 1080

Ser Ile Ile Glu Ala Ser Lys Pro Trp Lys Thr Phe Lys Glu Asp
1085 1090 1095

Leu Leu Lys Ile Glu Glu Glu Ile Leu Val Ser His Tyr Thr Pro
1100 1105 1110

Asp Asn Val Lys Lys Gln Ala Lys Lys Ile Val Arg Val Arg Gly
1115 1120 1125

Lys Lys Gln Phe Val Ala Glu Val Glu Arg Asp Val Asn Gly Lys
1130 1135 1140

Ala Val Pro Lys Lys Ala Ala Ser Gly Lys Thr Ile Tyr Lys Leu
1145 1150 1155

Asp Gly Glu Gly Lys Lys Leu Pro Arg Leu Gln Gln Gly Asp Thr
1160 1165 1170

Ile Arg Gly Ser Leu His Gln Asp Ser Ile Tyr Gly Ala Ile Lys
1175 1180 1185

```
Asn Pro  Leu Asn Thr Asp Glu  Ile Lys Tyr Val Ile  Arg Lys Asp
    1190                1195                1200

Leu Glu  Ser Ile Lys Gly Ser  Asp Val Glu Ser Ile  Val Asp Glu
    1205                1210                1215

Val Val  Lys Glu Lys Ile Lys  Glu Ala Ile Ala Asn  Lys Val Leu
    1220                1225                1230

Leu Leu  Ser Ser Asn Ala Gln  Gln Lys Asn Lys Leu  Val Gly Thr
    1235                1240                1245

Val Trp  Met Asn Glu Glu Lys  Arg Ile Ala Ile Asn  Lys Val Arg
    1250                1255                1260

Ile Tyr  Ala Asn Ser Val Lys  Asn Pro Leu His Ile  Lys Glu His
    1265                1270                1275

Ser Leu  Leu Ser Lys Ser Lys  His Val His Lys Gln  Lys Val Tyr
    1280                1285                1290

Gly Gln  Asn Asp Glu Asn Tyr  Ala Met Ala Ile Tyr  Glu Leu Asp
    1295                1300                1305

Gly Lys  Arg Asp Phe Glu Leu  Ile Asn Ile Phe Asn  Leu Ala Lys
    1310                1315                1320

Leu Ile  Lys Gln Gly Gln Gly  Phe Tyr Pro Leu His  Lys Lys Lys
    1325                1330                1335

Glu Ile  Lys Gly Lys Ile Val  Phe Val Pro Ile Glu  Lys Arg Asn
    1340                1345                1350

Lys Arg  Asp Val Val Leu Lys  Arg Gly Gln Gln Val  Val Phe Tyr
    1355                1360                1365

Asp Lys  Glu Val Glu Asn Pro  Lys Asp Ile Ser Glu  Ile Val Asp
```

```
    1370                1375                1380

Phe Lys  Gly Arg Ile Tyr Ile  Ile Glu Gly Leu Ser  Ile Gln Arg
    1385                1390                1395

Ile Val  Arg Pro Ser Gly Lys  Val Asp Glu Tyr Gly  Val Ile Met
    1400                1405                1410

Leu Arg  Tyr Phe Lys Glu Ala  Arg Lys Ala Asp Asp  Ile Lys Gln
    1415                1420                1425

Asp Asn  Phe Lys Pro Asp Gly  Val Phe Lys Leu Gly  Glu Asn Lys
    1430                1435                1440

Pro Thr  Arg Lys Met Asn His  Asn Gln Phe Thr Ala  Phe Val Glu
    1445                1450                1455

Gly Ile  Asp Phe Lys Val Leu  Pro Ser Gly Lys Phe  Glu Lys Ile
    1460                1465                1470
```

<210> 234
<211> 933
<212> PRT
<213> Mycoplasma iowae

<400> 234

```
Ser Val Arg Asp Tyr Ser Asp Gly Pro Gly Ser Glu Lys Ser Pro Thr
1               5                   10                  15

Pro Tyr Gly Leu Trp Arg Leu Asn Lys Glu Gly Lys Val Glu Lys Ile
            20                  25                  30

Gly Glu Asn Leu Trp Asp Val Leu Val Gly Lys Cys Thr Ile Tyr Gly
        35                  40                  45

Asn Asp Asp Ser Ile Lys Asp Glu Lys Thr Lys Leu Arg Gly Gly Lys
    50                  55                  60
```

```
Asn Ser Pro Ile Ala Glu Val Phe Asn Phe Ile Asn Asp Leu Thr Asn
65                  70                  75                  80

Ile Tyr Leu Phe Ser Ser Ser Lys Leu Lys Leu Asn Ser Lys Thr Lys
                85                  90                  95

Leu Ser Ile Leu Asp Glu Phe Asn Ile Ser Leu Lys Thr Ser Lys Pro
            100                 105                 110

Ile Lys Ser Phe Ser Glu Lys Lys Leu Val Lys His Ile Ile Ser Thr
        115                 120                 125

Thr Glu Phe Lys Asp Ile Asn Phe Asp Asp Val Tyr Gly Tyr Arg Ile
    130                 135                 140

Asp Thr Ser Lys Lys Pro Leu Phe Thr Lys Leu Glu Asn Thr Ile Thr
145                 150                 155                 160

Ile Ala Lys Trp Leu Leu Asp Asn Asn Val Tyr Asn Glu Leu Asn Ile
                165                 170                 175

Tyr Asp Gln Glu Asp Leu Ile Lys Ile Asn Asn Ile Phe Val Ile Leu
            180                 185                 190

Gln Lys Ser Met Asp Ile Asn Lys Arg Ala Gln Leu Val Ser Asp Glu
        195                 200                 205

Tyr Lys Ile Asp Leu Pro Ile Cys Leu Glu Leu Val Lys Lys Ile Lys
    210                 215                 220

Gly Val Met Gln Thr His Ser Phe Ser Tyr Lys Ala Met Leu Glu Tyr
225                 230                 235                 240

Ile Pro Val Gly Ile Lys Tyr Asn Asp Leu Glu Thr Gly Glu Asp Thr
                245                 250                 255

Ser Ile Asn Ala Ser Thr Tyr Phe Val Asp Lys Ile Asn Asn Leu Asn
            260                 265                 270
```

```
Thr Lys Leu Leu Phe Asn Gly Arg Pro Arg Lys Tyr Ile Pro Lys Asn
        275                 280                 285

Ile Phe Glu Asp Gly Ile Ile Ser Pro Thr Ser Lys Arg Ala Phe Ile
    290                 295                 300

Gln Thr Ile Asn Val Leu Asn Lys Ile Ile Lys Val Tyr Ser Lys Asp
305                 310                 315                 320

Tyr Asp Ile Asp Asn Ile Ala Ile Glu Leu Pro Arg Asp Lys Asn Thr
                325                 330                 335

Ala Glu Glu Arg Lys Lys Ile Ser Ser Asn Gln Lys Lys Ala Gly Glu
            340                 345                 350

Glu Ile Ala Glu Val Leu Lys Phe Ala Gly Leu Asn Val Glu Glu Tyr
        355                 360                 365

Thr Ser Lys Leu Asn Ser Lys Thr Lys Leu Lys Leu Lys Leu Leu Lys
    370                 375                 380

Glu Gln Asn Tyr Lys Asp Ile Tyr Asp Gly Gln Glu Ile Asp Val Ile
385                 390                 395                 400

Asp Val Ile Lys Asn Ser Asn Lys Tyr His Glu Glu His Ile Ile Pro
                405                 410                 415

Tyr Ser Leu Cys Phe Ile Asp Ser Arg Arg Asn Lys Val Leu Thr Lys
            420                 425                 430

Phe Glu Asn Asn Lys Gln Lys Gly Asn Lys Thr Pro Phe Gln Trp Leu
        435                 440                 445

Ser Ser Ile Gly Lys Tyr Ala Glu Phe Lys Asp Arg Val Glu Lys Leu
    450                 455                 460
```

```
Phe Val Glu Gln Lys Ile Ser Lys Ala Lys Lys Glu Leu Leu Leu Phe
465                 470                 475                 480

Glu Gln Asp Pro Arg Thr Glu Met Leu Gly Phe Ile Glu Lys Asn Leu
                485                 490                 495

Ser Asp Thr Arg Tyr Ala Ser Lys Leu Val Phe Asp Thr Phe Arg Asp
            500                 505                 510

Phe Phe Lys Val Asn Asn Pro Asn Val Lys Ile Lys Val Ile Asn Gly
        515                 520                 525

Ala Leu Thr Asn Tyr Ala Arg Tyr Asn Leu Phe Ala Thr Tyr Lys Asp
    530                 535                 540

Gly Leu Leu Glu Arg Lys Gly Ile Met Lys Gln Arg Glu Phe Tyr Glu
545                 550                 555                 560

His His Gly Ile Asp Ala Thr Ile Leu Ala Phe Leu Gly Ser Asn His
                565                 570                 575

Lys Ile Asn Gln Leu Leu Lys Leu Ser His Lys Phe Lys Lys Gln Asp
            580                 585                 590

Asp Asn Lys Ile Tyr Asp Glu Asn Thr Gly Glu Leu Ile Glu Phe Thr
        595                 600                 605

Lys Asp Phe Leu Ser Asp Glu Ala Arg Lys Lys Ala Met Glu Leu Ser
    610                 615                 620

Lys Gln Ile Phe Glu Ile Pro Cys Lys Phe Ser Arg Pro Ile Tyr Arg
625                 630                 635                 640

Lys Ser Asn Val Ser Phe Ser Asn Glu Thr Leu Ile Ser Met Lys Trp
                645                 650                 655

Ile Asp Asp Lys Tyr Thr Lys Gly Val Lys Ile Asn Lys Leu Ser Leu
            660                 665                 670
```

```
Val Asn Lys Asp Leu Asp Leu Asn Glu Tyr Phe Ala Asp Tyr Glu Thr
        675                 680                 685

Asn Glu Met Lys Asn Leu Ile Cys Tyr Gln Glu Asp Lys Thr Leu Tyr
    690                 695                 700

Asn Lys Leu Lys Asn Ile Tyr Asp Lys Tyr Asn Asn Phe Val Glu Asn
705                 710                 715                 720

Ser Asn Ile Lys Pro Val Lys Asn Pro Phe Ile Asn Tyr Met Ile Ser
                725                 730                 735

Asn Phe Ser Ser Asp Asp Ser Lys Ile Gln Asn Phe Lys His Ile Ile
            740                 745                 750

Phe Tyr Asp His Lys Gly Asn Lys Lys Phe Val Lys Ser Leu Lys Val
        755                 760                 765

Cys Gly Asp Glu Lys Asn Leu Ser Asn Ile Val Leu Arg Lys Asp Gln
    770                 775                 780

Lys Asp Ile Met Asn Ser Lys Lys Ile Lys Lys Ser Gly Ile Leu Glu
785                 790                 795                 800

Ser Leu Asn Pro Ile Ser Ala Arg Ile Tyr Lys Asp Asn Lys Gly Lys
                805                 810                 815

Tyr Ile Thr Ile Pro Ile Asn Ser Leu Val Leu Asn Trp Thr Lys Lys
            820                 825                 830

Gly Leu Glu Ile Asp Asn Glu Lys Leu Cys Asn Ile Leu Lys Ser Lys
        835                 840                 845

Asn Ile Phe Asn Asn Gln Phe Ile Glu Ile Asn Ala Gly Gln Ser Ile
    850                 855                 860
```

```
Ile Asn Asn Glu Asn Lys Leu Phe Tyr Phe Val Gly Gly Gly Asp Phe
865                 870                 875                 880


Lys Val Asn Lys Leu Glu Ile Lys Ser Gln Phe Cys Asp Asn Glu Ile
                885                 890                 895


Phe Phe Pro Arg Lys Gln Met Asn Ile Ser Ile Ala Thr Ile Ile Asp
            900                 905                 910


Asn Tyr Lys Leu Cys Glu Val Asp Glu Leu Gly Lys Ile Tyr Asn Ile
        915                 920                 925


Arg Lys Ile Val Leu
    930
```

<210> 235
<211> 1358
<212> PRT
<213> Acidaminococcus intestini

<400> 235

```
Met Gly Lys Met Tyr Tyr Leu Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Tyr Ala Val Thr Asp Pro Ser Tyr His Leu Leu Lys Phe Lys Gly
            20                  25                  30


Glu Pro Met Trp Gly Ala His Val Phe Ala Ala Gly Asn Gln Ser Ala
        35                  40                  45


Glu Arg Arg Ser Phe Arg Thr Ser Arg Arg Arg Leu Asp Arg Arg Gln
    50                  55                  60


Gln Arg Val Lys Leu Val Gln Glu Ile Phe Ala Pro Val Ile Ser Pro
65                  70                  75                  80


Ile Asp Pro Arg Phe Phe Ile Arg Leu His Glu Ser Ala Leu Trp Arg
                85                  90                  95
```

```
Asp Asp Val Ala Glu Thr Asp Lys His Ile Phe Phe Asn Asp Pro Thr
            100                 105                 110

Tyr Thr Asp Lys Glu Tyr Tyr Ser Asp Tyr Pro Thr Ile His His Leu
        115                 120                 125

Ile Val Asp Leu Met Glu Ser Ser Glu Lys His Asp Pro Arg Leu Val
    130                 135                 140

Tyr Leu Ala Val Ala Trp Leu Val Ala His Arg Gly His Phe Leu Asn
145                 150                 155                 160

Glu Val Asp Lys Asp Asn Ile Gly Asp Val Leu Ser Phe Asp Ala Phe
                165                 170                 175

Tyr Pro Glu Phe Leu Ala Phe Leu Ser Asp Asn Gly Val Ser Pro Trp
            180                 185                 190

Val Cys Glu Ser Lys Ala Leu Gln Ala Thr Leu Leu Ser Arg Asn Ser
        195                 200                 205

Val Asn Asp Lys Tyr Lys Ala Leu Lys Ser Leu Ile Phe Gly Ser Gln
    210                 215                 220

Lys Pro Glu Asp Asn Phe Asp Ala Asn Ile Ser Glu Asp Gly Leu Ile
225                 230                 235                 240

Gln Leu Leu Ala Gly Lys Lys Val Lys Val Asn Lys Leu Phe Pro Gln
                245                 250                 255

Glu Ser Asn Asp Ala Ser Phe Thr Leu Asn Asp Lys Glu Asp Ala Ile
            260                 265                 270

Glu Glu Ile Leu Gly Thr Leu Thr Pro Asp Glu Cys Glu Trp Ile Ala
        275                 280                 285

His Ile Arg Arg Leu Phe Asp Trp Ala Ile Met Lys His Ala Leu Lys
```

```
    290                 295                 300

Asp Gly Arg Thr Ile Ser Glu Ser Lys Val Lys Leu Tyr Glu Gln His
305                 310                 315                 320

His His Asp Leu Thr Gln Leu Lys Tyr Phe Val Lys Thr Tyr Leu Ala
                325                 330                 335

Lys Glu Tyr Asp Asp Ile Phe Arg Asn Val Asp Ser Glu Thr Thr Lys
            340                 345                 350

Asn Tyr Val Ala Tyr Ser Tyr His Val Lys Glu Val Lys Gly Thr Leu
        355                 360                 365

Pro Lys Asn Lys Ala Thr Gln Glu Glu Phe Cys Lys Tyr Val Leu Gly
    370                 375                 380

Lys Val Lys Asn Ile Glu Cys Ser Glu Ala Asp Lys Val Asp Phe Asp
385                 390                 395                 400

Glu Met Ile Gln Arg Leu Thr Asp Asn Ser Phe Met Pro Lys Gln Val
                405                 410                 415

Ser Gly Glu Asn Arg Val Ile Pro Tyr Gln Leu Tyr Tyr Tyr Glu Leu
            420                 425                 430

Lys Thr Ile Leu Asn Lys Ala Ala Ser Tyr Leu Pro Phe Leu Thr Gln
        435                 440                 445

Cys Gly Lys Asp Ala Ile Ser Asn Gln Asp Lys Leu Leu Ser Ile Met
    450                 455                 460

Thr Phe Arg Ile Pro Tyr Phe Val Gly Pro Leu Arg Lys Asp Asn Ser
465                 470                 475                 480

Glu His Ala Trp Leu Glu Arg Lys Ala Gly Lys Ile Tyr Pro Trp Asn
                485                 490                 495
```

```
Phe Asn Asp Lys Val Asp Leu Asp Lys Ser Glu Glu Ala Phe Ile Arg
            500                 505                 510

Arg Met Thr Asn Thr Cys Thr Tyr Tyr Pro Gly Glu Asp Val Leu Pro
        515                 520                 525

Leu Asp Ser Leu Ile Tyr Glu Lys Phe Met Ile Leu Asn Glu Ile Asn
    530                 535                 540

Asn Ile Arg Ile Asp Gly Tyr Pro Ile Ser Val Asp Val Lys Gln Gln
545                 550                 555                 560

Val Phe Gly Leu Phe Glu Lys Lys Arg Arg Val Thr Val Lys Asp Ile
                565                 570                 575

Gln Asn Leu Leu Leu Ser Leu Gly Ala Leu Asp Lys His Gly Lys Leu
            580                 585                 590

Thr Gly Ile Asp Thr Thr Ile His Ser Asn Tyr Asn Thr Tyr His His
        595                 600                 605

Phe Lys Ser Leu Met Glu Arg Gly Val Leu Thr Arg Asp Asp Val Glu
    610                 615                 620

Arg Ile Val Glu Arg Met Thr Tyr Ser Asp Asp Thr Lys Arg Val Arg
625                 630                 635                 640

Leu Trp Leu Asn Asn Asn Tyr Gly Thr Leu Thr Ala Asp Asp Val Lys
                645                 650                 655

His Ile Ser Arg Leu Arg Lys His Asp Phe Gly Arg Leu Ser Lys Met
            660                 665                 670

Phe Leu Thr Gly Leu Lys Gly Val His Lys Glu Thr Gly Glu Arg Ala
        675                 680                 685

Ser Ile Leu Asp Phe Met Trp Asn Thr Asn Asp Asn Leu Met Gln Leu
```

```
    690                 695                 700

Leu Ser Glu Cys Tyr Thr Phe Ser Asp Glu Ile Thr Lys Leu Gln Glu
705                 710                 715                 720

Ala Tyr Tyr Ala Lys Ala Gln Leu Ser Leu Asn Asp Phe Leu Asp Ser
                725                 730                 735

Met Tyr Ile Ser Asn Ala Val Lys Arg Pro Ile Tyr Arg Thr Leu Ala
            740                 745                 750

Val Val Asn Asp Ile Arg Lys Ala Cys Gly Thr Ala Pro Lys Arg Ile
        755                 760                 765

Phe Ile Glu Met Ala Arg Asp Gly Glu Ser Lys Lys Lys Arg Ser Val
    770                 775                 780

Thr Arg Arg Glu Gln Ile Lys Asn Leu Tyr Arg Ser Ile Arg Lys Asp
785                 790                 795                 800

Phe Gln Gln Glu Val Asp Phe Leu Glu Lys Ile Leu Glu Asn Lys Ser
                805                 810                 815

Asp Gly Gln Leu Gln Ser Asp Ala Leu Tyr Leu Tyr Phe Ala Gln Leu
            820                 825                 830

Gly Arg Asp Met Tyr Thr Gly Asp Pro Ile Lys Leu Glu His Ile Lys
        835                 840                 845

Asp Gln Ser Phe Tyr Asn Ile Asp His Ile Tyr Pro Gln Ser Met Val
    850                 855                 860

Lys Asp Asp Ser Leu Asp Asn Lys Val Leu Val Gln Ser Glu Ile Asn
865                 870                 875                 880

Gly Glu Lys Ser Ser Arg Tyr Pro Leu Asp Ala Ala Ile Arg Asn Lys
                885                 890                 895
```

```
Met Lys Pro Leu Trp Asp Ala Tyr Tyr Asn His Gly Leu Ile Ser Leu
            900                 905                 910

Lys Lys Tyr Gln Arg Leu Thr Arg Ser Thr Pro Phe Thr Asp Asp Glu
        915                 920                 925

Lys Trp Asp Phe Ile Asn Arg Gln Leu Val Glu Thr Arg Gln Ser Thr
    930                 935                 940

Lys Ala Leu Ala Ile Leu Leu Lys Arg Lys Phe Pro Asp Thr Glu Ile
945                 950                 955                 960

Val Tyr Ser Lys Ala Gly Leu Ser Ser Asp Phe Arg His Glu Phe Gly
                965                 970                 975

Leu Val Lys Ser Arg Asn Ile Asn Asp Leu His His Ala Lys Asp Ala
            980                 985                 990

Phe Leu Ala Ile Val Thr Gly Asn  Val Tyr His Glu Arg  Phe Asn Arg
        995                 1000                1005

Arg Trp  Phe Met Val Asn Gln  Pro Tyr Ser Val Lys  Thr Lys Thr
    1010                1015                1020

Leu Phe  Thr His Ser Ile Lys  Asn Gly Asn Phe Val  Ala Trp Asn
    1025                1030                1035

Gly Glu  Glu Asp Leu Gly Arg  Ile Val Lys Met Leu  Lys Gln Asn
    1040                1045                1050

Lys Asn  Thr Ile His Phe Thr  Arg Phe Ser Phe Asp  Arg Lys Glu
    1055                1060                1065

Gly Leu  Phe Asp Ile Gln Pro  Leu Lys Ala Ser Thr  Gly Leu Val
    1070                1075                1080

Pro Arg  Lys Ala Gly Leu Asp  Val Val Lys Tyr Gly  Gly Tyr Asp
```

```
    1085                1090                1095

Lys Ser  Thr Ala Ala Tyr Tyr  Leu Leu Val Arg Phe  Thr Leu Glu
    1100                1105                1110

Asp Lys  Lys Thr Gln His Lys  Leu Met Met Ile Pro  Val Glu Gly
    1115                1120                1125

Leu Tyr  Lys Ala Arg Ile Asp  His Asp Lys Glu Phe  Leu Thr Asp
    1130                1135                1140

Tyr Ala  Gln Thr Thr Ile Ser  Glu Ile Leu Gln Lys  Asp Lys Gln
    1145                1150                1155

Lys Val  Ile Asn Ile Met Phe  Pro Met Gly Thr Arg  His Ile Lys
    1160                1165                1170

Leu Asn  Ser Met Ile Ser Ile  Asp Gly Phe Tyr Leu  Ser Ile Gly
    1175                1180                1185

Gly Lys  Ser Ser Lys Gly Lys  Ser Val Leu Cys His  Ala Met Val
    1190                1195                1200

Pro Leu  Ile Val Pro His Lys  Ile Glu Cys Tyr Ile  Lys Ala Met
    1205                1210                1215

Glu Ser  Phe Ala Arg Lys Phe  Lys Glu Asn Asn Lys  Leu Arg Ile
    1220                1225                1230

Val Glu  Lys Phe Asp Lys Ile  Thr Val Glu Asp Asn  Leu Asn Leu
    1235                1240                1245

Tyr Glu  Leu Phe Leu Gln Lys  Leu Gln His Asn Pro  Tyr Asn Lys
    1250                1255                1260

Phe Phe  Ser Thr Gln Phe Asp  Val Leu Thr Asn Gly  Arg Ser Thr
    1265                1270                1275
```

```
Phe Thr  Lys Leu Ser Pro Glu  Glu Gln Val Gln Thr  Leu Leu Asn
    1280                1285                1290


Ile Leu  Ser Ile Phe Lys Thr  Cys Arg Ser Ser Gly  Cys Asp Leu
    1295                1300                1305


Lys Ser  Ile Asn Gly Ser Ala  Gln Ala Ala Arg Ile  Met Ile Ser
    1310                1315                1320


Ala Asp  Leu Thr Gly Leu Ser  Lys Lys Tyr Ser Asp  Ile Arg Leu
    1325                1330                1335


Val Glu  Gln Ser Ala Ser Gly  Leu Phe Val Ser Lys  Ser Gln Asn
    1340                1345                1350


Leu Leu  Glu Tyr Leu
    1355
```

<210> 236
<211> 983
<212> PRT
<213> Campylobacter jejuni

<400> 236

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15


Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30


Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45


Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60


Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80
```

```
Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270
```

```
Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Val Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480
```

```
Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asn Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670
```

```
Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Phe Tyr Gln Ser
785                 790                 795                 800

Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys Ile
                805                 810                 815

Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg Val
            820                 825                 830

Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro Ile
        835                 840                 845

Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val Ala
    850                 855                 860

Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu Asn
865                 870                 875                 880
```

Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile Gln
885 890 895

Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe Thr
900 905 910

Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe Glu
915 920 925

Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu Lys
930 935 940

Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe Glu
945 950 955 960

Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe Arg
965 970 975

Gln Arg Glu Asp Phe Lys Lys
980

<210> 237
<211> 1338
<212> PRT
<213> Streptococcus macacae

<400> 237

Met Thr Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Val Thr Asp Gly Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
35 40 45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Lys Asp Arg Arg Leu

```
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ala Lys Ala Asp Glu Ser
                85                  90                  95

Phe Phe Gln Arg Leu Asn Glu Ser Phe Leu Thr Asn Asp Asp Lys Glu
            100                 105                 110

Phe Asp Ser His Pro Ile Phe Gly Asn Lys Ala Glu Glu Glu Ala His
        115                 120                 125

His His Lys Phe Pro Thr Ile Phe His Leu Arg Lys His Leu Ala Asp
    130                 135                 140

Ser Thr Glu Lys Ser Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Gln Leu Lys Ala
                165                 170                 175

Glu Asn Thr Asn Val Gln Thr Leu Phe Asp Asp Phe Val Glu Val Tyr
            180                 185                 190

Asp Lys Thr Val Glu Glu Ser His Leu Ser Glu Ile Ser Val Ser Ser
        195                 200                 205

Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu Asn Leu Ile
    210                 215                 220

Lys Tyr Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly Asn Leu Ile
225                 230                 235                 240

Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe Lys Leu
                245                 250                 255
```

```
Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu Glu Asp
            260                 265                 270

Leu Gly Glu Leu Leu Gly Lys Ile Gly Asp Asn Tyr Ala Asp Leu Phe
        275                 280                 285

Ile Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly Ile Leu
    290                 295                 300

Thr Ile Asp Asp Asn Thr Thr Lys Ala Pro Leu Ser Ala Ser Met Ile
305                 310                 315                 320

Lys Arg Tyr Glu Glu His Gln Glu Asp Leu Ala Gln Leu Lys Lys Phe
                325                 330                 335

Ile Arg Gln Asn Leu Pro Asp Gln Tyr Ser Glu Val Phe Ser Asp Lys
            340                 345                 350

Thr Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn Gln Glu
        355                 360                 365

Ala Phe Tyr Lys Tyr Ile Lys Asn Met Leu Ser Lys Thr Glu Gly Ala
    370                 375                 380

Asp Tyr Phe Leu Asp Lys Ile Asp Arg Glu Asp Phe Leu Arg Lys Gln
385                 390                 395                 400

Arg Thr Phe Asp Asn Gly Ser Val Pro His Gln Ile His Leu Gln Glu
                405                 410                 415

Met His Ala Ile Leu Arg Arg Gln Gly Glu Tyr Tyr Pro Phe Leu Lys
            420                 425                 430

Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr
        435                 440                 445

Tyr Val Gly Pro Leu Ala Arg Lys Gly Ser Arg Phe Ala Trp Ala Glu
```

```
    450                 455                 460

Tyr Lys Ala Asp Lys Lys Val Thr Pro Trp Asn Phe Asp Asp Ile Leu
465                 470                 475                 480

Asp Lys Glu Lys Ser Ala Glu Glu Phe Ile Thr Arg Met Thr Leu Asn
                485                 490                 495

Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser Leu Val
            500                 505                 510

Tyr Glu Thr Phe Asn Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val
        515                 520                 525

Asn Glu Gln Gly Lys Ala Ile Phe Phe Asp Ala Asn Met Lys Gln Glu
    530                 535                 540

Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys Val Thr Lys Asp Lys
545                 550                 555                 560

Leu Leu Asn Tyr Leu Asn Lys Glu Phe Glu Glu Phe Arg Ile Val Asn
                565                 570                 575

Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ser Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Ser Phe Leu Asp Asp
        595                 600                 605

Lys Val Asn Glu Lys Ile Ile Glu Asp Ile Ile Gln Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Arg Gln Arg Leu Gln Lys Tyr Ser Asp
625                 630                 635                 640

Ile Phe Thr Thr Gln Gln Leu Lys Lys Leu Glu Arg Arg His Tyr Thr
                645                 650                 655
```

```
Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Asn Lys Thr Ile Leu Gly Tyr Leu Ile Asp Asp Gly Tyr Ser
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu Pro Phe Lys
    690                 695                 700

Glu Glu Ile Ala Arg Ala Gln Val Ile Gly Glu Thr Asp Asp Leu Asn
705                 710                 715                 720

Gln Leu Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val Met Gly His
            740                 745                 750

Asn Pro Ala Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Ala Lys Gly Arg Arg Ser Ser Gln Gln Arg Tyr Lys Arg Leu Glu Glu
    770                 775                 780

Ala Ile Lys Asn Leu Asp His Asp Leu Asn His Lys Ile Leu Lys Glu
785                 790                 795                 800

His Pro Thr Asp Asn Gln Ala Leu Gln Asn Asp Arg Leu Phe Leu Tyr
                805                 810                 815

Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Glu Asp Pro Leu Asp Ile
            820                 825                 830

Asn Arg Leu Ser Asp Tyr Asp Ile Asp His Ile Ile Pro Gln Ser Phe
        835                 840                 845

Ile Lys Asp Asp Ser Ile Asp Asn Lys Val Leu Val Ser Ser Ala Lys
```

```
    850                 855                 860

Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Glu Asp Val Val Asn Arg
865                 870                 875                 880

Met Arg Pro Phe Trp Asn Lys Leu Leu Ser Cys Gly Leu Ile Ser Gln
                885                 890                 895

Arg Lys Tyr Ser Asn Leu Thr Lys Lys Glu Leu Lys Pro Asp Asp Lys
            900                 905                 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925

His Val Ala Gln Ile Leu Asp Ala Arg Phe Asn Thr Lys Arg Asp Glu
    930                 935                 940

Asn Lys Lys Val Ile Arg Asp Val Lys Ile Ile Thr Leu Lys Ser Asn
945                 950                 955                 960

Leu Val Ser Gln Phe Arg Lys Asp Phe Lys Phe Tyr Lys Val Arg Glu
                965                 970                 975

Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Ile
            980                 985                 990

Gly Lys Ala Leu Leu Asp Val Tyr  Pro Gln Leu Glu Pro  Glu Phe Val
        995                 1000                1005

Tyr Gly  Glu Tyr Pro His Phe  His Gly Tyr Lys Glu  Asn Lys Ala
    1010                1015                1020

Thr Ala  Lys Lys Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1025                1030                1035

Lys Asp  Asp Ile Arg Thr Asp  Glu Asn Gly Glu Ile  Val Trp Lys
    1040                1045                1050
```

```
Lys Asp  Glu His Ile Ser Asn  Ile Lys Arg Val Leu  Ser Tyr Pro
    1055                1060                1065

Gln Val  Asn Ile Val Lys Lys  Val Glu Ile Gln Thr  Val Gly Gln
    1070                1075                1080

Asn Gly  Gly Leu Phe Asp Asp  Asn Pro Lys Ser Pro  Leu Glu Val
    1085                1090                1095

Thr Pro  Ser Lys Leu Val Pro  Leu Lys Lys Glu Leu  Asn Pro Lys
    1100                1105                1110

Lys Tyr  Gly Gly Tyr Gln Lys  Pro Thr Thr Ala Tyr  Pro Val Leu
    1115                1120                1125

Leu Ile  Thr Asp Thr Lys Gln  Leu Ile Pro Ile Ser  Val Met Asn
    1130                1135                1140

Lys Lys  Gln Phe Glu Gln Asn  Pro Val Lys Phe Leu  Arg Asp Arg
    1145                1150                1155

Gly Tyr  Gln Gln Val Gly Lys  Asn Asp Phe Ile Lys  Leu Pro Lys
    1160                1165                1170

Tyr Thr  Leu Val Asp Ile Gly  Asp Gly Ile Lys Arg  Leu Trp Ala
    1175                1180                1185

Ser Ser  Lys Glu Ile His Lys  Gly Asn Gln Leu Val  Val Ser Lys
    1190                1195                1200

Lys Ser  Gln Ile Leu Leu Tyr  His Ala His His Leu  Asp Ser Asp
    1205                1210                1215

Leu Ser  Asn Asp Tyr Leu Gln  Asn His Asn Gln Gln  Phe Asp Val
    1220                1225                1230

Leu Phe  Asn Glu Ile Ile Ser  Phe Ser Lys Lys Cys  Lys Leu Gly
```

```
    1235                1240                1245

Lys Glu  His Ile Gln Lys Ile  Glu Asn Val Tyr Ser  Asn Lys Lys
    1250                1255                1260

Asn Ser  Ala Ser Ile Glu Glu  Leu Ala Glu Ser Phe  Ile Lys Leu
    1265                1270                1275

Leu Gly  Phe Thr Gln Leu Gly  Ala Thr Ser Pro Phe  Asn Phe Leu
    1280                1285                1290

Gly Val  Lys Leu Asn Gln Lys  Gln Tyr Lys Gly Lys  Lys Asp Tyr
    1295                1300                1305

Ile Leu  Pro Cys Thr Glu Gly  Thr Leu Ile Arg Gln  Ser Ile Thr
    1310                1315                1320

Gly Leu  Tyr Glu Thr Arg Val  Asp Leu Ser Lys Ile  Gly Glu Asp
    1325                1330                1335


<210>  238
<211>  1265
<212>  PRT
<213>  Mycoplasma ovipneumoniae

<400>  238

Met His Asn Lys Lys Asn Ile Thr Ile Gly Phe Asp Leu Gly Ile Ala
1               5                   10                  15

Ser Ile Gly Trp Ala Ile Ile Asp Ser Thr Thr Ser Lys Ile Leu Asp
            20                  25                  30

Trp Gly Thr Arg Thr Phe Glu Glu Arg Lys Thr Ala Asn Glu Arg Arg
        35                  40                  45

Ala Phe Arg Ser Thr Arg Arg Asn Ile Arg Arg Lys Ala Tyr Arg Asn
    50                  55                  60
```

```
Gln Arg Phe Ile Asn Leu Ile Leu Lys Tyr Lys Asp Leu Phe Glu Leu
65                  70                  75                  80

Lys Asn Ile Ser Asp Ile Gln Arg Ala Asn Lys Lys Asp Thr Glu Asn
                85                  90                  95

Tyr Glu Lys Ile Ile Ser Phe Phe Thr Glu Ile Tyr Lys Lys Cys Ala
            100                 105                 110

Ala Lys His Ser Asn Ile Leu Glu Val Lys Val Lys Ala Leu Asp Ser
        115                 120                 125

Lys Ile Glu Lys Leu Asp Leu Ile Trp Ile Leu His Asp Tyr Leu Glu
    130                 135                 140

Asn Arg Gly Phe Phe Tyr Asp Leu Glu Glu Glu Asn Val Ala Asp Lys
145                 150                 155                 160

Tyr Glu Gly Ile Glu His Pro Ser Ile Leu Leu Tyr Asp Phe Phe Lys
                165                 170                 175

Lys Asn Gly Phe Phe Lys Ser Asn Ser Ser Ile Pro Lys Asp Leu Gly
            180                 185                 190

Gly Tyr Ser Phe Ser Asn Leu Gln Trp Val Asn Glu Ile Lys Lys Leu
        195                 200                 205

Phe Glu Val Gln Glu Ile Asn Pro Glu Phe Ser Glu Lys Phe Leu Asn
    210                 215                 220

Leu Phe Thr Ser Val Arg Asp Tyr Ala Lys Gly Pro Gly Ser Glu His
225                 230                 235                 240

Ser Ala Ser Glu Tyr Gly Ile Phe Gln Lys Asp Glu Lys Gly Lys Val
                245                 250                 255

Phe Lys Lys Tyr Asp Asn Ile Trp Asp Lys Thr Ile Gly Lys Cys Ser
            260                 265                 270
```

```
Phe Phe Val Glu Glu Asn Arg Ser Pro Val Asn Tyr Pro Ser Tyr Glu
        275                 280                 285

Ile Phe Asn Leu Leu Asn Gln Leu Ile Asn Leu Ser Thr Asp Leu Lys
    290                 295                 300

Thr Thr Asn Lys Lys Ile Trp Gln Leu Ser Ser Asn Asp Arg Asn Glu
305                 310                 315                 320

Leu Leu Asp Glu Leu Leu Lys Val Lys Glu Lys Ala Lys Ile Ile Ser
                325                 330                 335

Ile Ser Leu Lys Lys Asn Glu Ile Lys Lys Ile Ile Leu Lys Asp Phe
            340                 345                 350

Gly Phe Glu Lys Ser Asp Ile Asp Asp Gln Asp Thr Ile Glu Gly Arg
        355                 360                 365

Lys Ile Ile Lys Glu Glu Pro Thr Thr Lys Leu Glu Val Thr Lys His
    370                 375                 380

Leu Leu Ala Thr Ile Tyr Ser His Ser Ser Asp Ser Asn Trp Ile Asn
385                 390                 395                 400

Ile Asn Asn Ile Leu Glu Phe Leu Pro Tyr Leu Asp Ala Ile Cys Ile
                405                 410                 415

Ile Leu Asp Arg Glu Lys Ser Arg Gly Gln Asp Glu Val Leu Lys Lys
            420                 425                 430

Leu Thr Glu Lys Asn Ile Phe Glu Val Leu Lys Ile Asp Arg Glu Lys
        435                 440                 445

Gln Leu Asp Phe Val Lys Ser Ile Phe Ser Asn Thr Lys Phe Asn Phe
    450                 455                 460
```

```
Lys Lys Ile Gly Asn Phe Ser Leu Lys Ala Ile Arg Glu Phe Leu Pro
465                 470                 475                 480

Lys Met Phe Glu Gln Asn Lys Asn Ser Glu Tyr Leu Lys Trp Lys Asp
                485                 490                 495

Glu Glu Ile Arg Arg Lys Trp Glu Glu Gln Lys Ser Lys Leu Gly Lys
            500                 505                 510

Thr Asp Lys Lys Thr Lys Tyr Leu Asn Pro Arg Ile Phe Gln Asp Glu
        515                 520                 525

Ile Ile Ser Pro Gly Thr Lys Asn Thr Phe Glu Gln Ala Val Leu Val
    530                 535                 540

Leu Asn Gln Ile Ile Lys Lys Tyr Ser Lys Glu Asn Ile Ile Asp Ala
545                 550                 555                 560

Ile Ile Ile Glu Ser Pro Arg Glu Lys Asn Asp Lys Lys Thr Ile Glu
                565                 570                 575

Glu Ile Lys Lys Arg Asn Lys Lys Gly Lys Gly Lys Thr Leu Glu Lys
            580                 585                 590

Leu Phe Gln Ile Leu Asn Leu Glu Asn Lys Gly Tyr Lys Leu Ser Asp
        595                 600                 605

Leu Glu Thr Lys Pro Ala Lys Leu Leu Asp Arg Leu Arg Phe Tyr His
    610                 615                 620

Gln Gln Asp Gly Ile Asp Leu Tyr Thr Leu Asp Lys Ile Asn Ile Asp
625                 630                 635                 640

Gln Leu Ile Asn Gly Ser Gln Lys Tyr Glu Ile Glu His Ile Ile Pro
                645                 650                 655

Tyr Ser Met Ser Tyr Asp Asn Ser Gln Ala Asn Lys Ile Leu Thr Glu
            660                 665                 670
```

```
Lys Ala Glu Asn Leu Lys Lys Gly Lys Leu Ile Ala Ser Glu Tyr Ile
        675                 680                 685

Lys Arg Asn Gly Asp Glu Phe Tyr Asn Lys Tyr Tyr Glu Lys Ala Lys
    690                 695                 700

Glu Leu Phe Ile Asn Lys Tyr Lys Lys Asn Lys Lys Leu Asp Ser Tyr
705                 710                 715                 720

Val Asp Leu Asp Glu Asp Ser Ala Lys Asn Arg Phe Arg Phe Leu Thr
                725                 730                 735

Leu Gln Asp Tyr Asp Glu Phe Gln Val Glu Phe Leu Ala Arg Asn Leu
            740                 745                 750

Asn Asp Thr Arg Tyr Ser Thr Lys Leu Phe Tyr His Ala Leu Val Glu
        755                 760                 765

His Phe Glu Asn Asn Glu Phe Phe Thr Tyr Ile Asp Glu Asn Ser Ser
    770                 775                 780

Lys His Lys Val Lys Ile Ser Thr Ile Lys Gly His Val Thr Lys Tyr
785                 790                 795                 800

Phe Arg Ala Lys Pro Val Gln Lys Asn Asn Gly Pro Asn Glu Asn Leu
                805                 810                 815

Asn Asn Asn Lys Pro Glu Lys Ile Glu Lys Asn Arg Glu Asn Asn Glu
            820                 825                 830

His His Ala Val Asp Ala Ala Ile Val Ala Ile Ile Gly Asn Lys Asn
        835                 840                 845

Pro Gln Ile Ala Asn Leu Leu Thr Leu Ala Asp Asn Lys Thr Asp Lys
    850                 855                 860
```

```
Lys Phe Leu Leu His Asp Glu Asn Tyr Lys Glu Asn Ile Glu Thr Gly
865                 870                 875                 880


Glu Leu Val Lys Ile Pro Lys Phe Glu Val Asp Lys Leu Ala Lys Val
                885                 890                 895


Glu Asp Leu Lys Lys Ile Ile Gln Glu Lys Tyr Glu Glu Ala Lys Lys
            900                 905                 910


His Thr Ala Ile Lys Phe Ser Arg Lys Thr Arg Thr Ile Leu Asn Gly
        915                 920                 925


Gly Leu Ser Asp Glu Thr Leu Tyr Gly Phe Lys Tyr Asp Glu Lys Glu
    930                 935                 940


Asp Lys Tyr Phe Lys Ile Ile Lys Lys Lys Leu Val Thr Ser Lys Asn
945                 950                 955                 960


Glu Glu Leu Lys Lys Tyr Phe Glu Asn Pro Phe Gly Lys Lys Ala Asp
                965                 970                 975


Gly Lys Ser Glu Tyr Thr Val Leu Met Ala Gln Ser His Leu Ser Glu
            980                 985                 990


Phe Asn Lys Leu Lys Glu Ile Phe  Glu Lys Tyr Asn Gly  Phe Ser Asn
        995                 1000                1005


Lys Thr  Gly Asn Ala Phe Val  Glu Tyr Met Asn Asp  Leu Ala Leu
    1010                1015                1020


Lys Glu  Pro Thr Leu Lys Ala  Glu Ile Glu Ser Ala  Lys Ser Val
    1025                1030                1035


Glu Lys  Leu Leu Tyr Tyr Asn  Phe Lys Pro Ser Asp  Gln Phe Thr
    1040                1045                1050


Tyr His  Asp Asn Ile Asn Asn  Lys Ser Phe Lys Arg  Phe Tyr Lys
    1055                1060                1065
```

```
Asn Ile  Arg Ile Ile Glu Tyr  Lys Ser Ile Pro Ile  Lys Phe Lys
    1070                1075                1080

Ile Leu  Ser Lys His Asp Gly  Gly Lys Ser Phe Lys  Asp Thr Leu
    1085                1090                1095

Phe Ser  Leu Tyr Ser Leu Val  Tyr Lys Val Tyr Glu  Asn Gly Lys
    1100                1105                1110

Glu Ser  Tyr Lys Ser Ile Pro  Val Thr Ser Gln Met  Arg Asn Phe
    1115                1120                1125

Gly Ile  Asp Glu Phe Asp Phe  Leu Asp Glu Asn Leu  Tyr Asn Lys
    1130                1135                1140

Glu Lys  Leu Asp Ile Tyr Lys  Ser Asp Phe Ala Lys  Pro Ile Pro
    1145                1150                1155

Val Asn  Cys Lys Pro Val Phe  Val Leu Lys Lys Gly  Ser Ile Leu
    1160                1165                1170

Lys Lys  Lys Ser Leu Asp Ile  Asp Asp Phe Lys Glu  Thr Lys Glu
    1175                1180                1185

Thr Glu  Glu Gly Asn Tyr Tyr  Phe Ile Ser Thr Ile  Ser Lys Arg
    1190                1195                1200

Phe Asn  Arg Asp Thr Ala Tyr  Gly Leu Lys Pro Leu  Lys Leu Ser
    1205                1210                1215

Val Val  Lys Pro Val Ala Glu  Pro Ser Thr Asn Pro  Ile Phe Lys
    1220                1225                1230

Glu Tyr  Ile Pro Ile His Leu  Asp Glu Leu Gly Asn  Glu Tyr Pro
    1235                1240                1245
```

```
Val Lys  Ile Lys Glu His Thr  Asp Asp Glu Lys Leu  Met Cys Thr
    1250                1255                1260


Ile Lys
    1265
```

<210> 239
<211> 1535
<212> PRT
<213> Flavobacterium columnare

<400> 239

```
Met Thr Lys Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Ile Arg Asp Thr Glu Asn Glu Gly Ile Asn Gln Ile Leu Asp Lys
            20                  25                  30


Gly Ala Arg Ile Phe Ser Glu Gly Val Lys Ser Glu Asn Gly Lys Glu
        35                  40                  45


Ile Ser Arg Ala Ala Glu Arg Thr Ala Tyr Arg Ser Ala Arg Lys Ile
    50                  55                  60


Lys Tyr Arg Arg Lys Leu Arg Lys Tyr Glu Thr Leu Lys Val Leu Ser
65                  70                  75                  80


Ile Asn Gly Met Cys Pro Leu Ser Val Glu Glu Val Glu Gln Trp Lys
                85                  90                  95


Lys Ser Gly Phe Lys Glu Tyr Pro Leu Asn Pro Glu Phe Leu Asp Trp
            100                 105                 110


Leu Arg Thr Asn Glu Asp Lys Asn Ile Asn Pro Tyr Leu Phe Arg Asp
        115                 120                 125


Lys Ala Ser Lys Gln Lys Val Thr Leu Phe Glu Leu Gly Arg Ala Leu
    130                 135                 140
```

```
Tyr His Ile Ala Gln Arg Arg Gly Phe Leu Ser Asn Arg Leu Asp Gln
145                 150                 155                 160

Ser Ala Glu Gly Val Phe Glu Glu His Asn Pro Gln Ile Gln Asn Leu
                165                 170                 175

Ile Glu Asp Leu Asp Ser Ser Asn Thr Ile Leu Asn Glu Leu Lys Glu
            180                 185                 190

Tyr Tyr Ile Asn Leu Gly Ile Ile Asp Glu Thr Glu Lys Ser Gly Phe
        195                 200                 205

Lys Lys Asp Leu Asp Glu Gly Glu Lys Lys Leu Lys Ser Leu Tyr Asn
    210                 215                 220

Ser Leu Val Ala Ile Thr Lys Lys Asn Ala Asn Asp Ile Glu Thr Cys
225                 230                 235                 240

Lys Gln Glu Leu Ile Ala Arg Leu Asn Lys Lys Glu Asp Leu Gly Lys
                245                 250                 255

Val Lys Gly Lys Ile Lys Asp Ile Ser Gln Ala Met Leu Asp Arg Asn
            260                 265                 270

Phe Lys Thr Leu Gly Gln Tyr Phe Phe Ser Leu Tyr Asn Lys Glu Arg
        275                 280                 285

Ile Arg Asn Gln Tyr Thr Ser Arg Glu Glu His Tyr Leu Glu Glu Phe
    290                 295                 300

Ile Ile Ile Cys Gln Thr Gln Gly Ile Glu Gly Ile Asn Thr Asn Glu
305                 310                 315                 320

Lys Leu Pro Glu Lys Lys Phe Thr Gly Leu Ala Lys Asp Leu Tyr Arg
                325                 330                 335

Ala Ile Phe Phe Gln Arg Pro Leu Lys Ser Gln Lys Gly Leu Ile Gly
```

```
            340                 345                 350

Lys Cys Ser Phe Glu Lys Asn Lys Ser Arg Cys Ala Val Ser His Pro
        355                 360                 365

Asp Tyr Glu Glu Phe Arg Met Trp Ser Tyr Leu Asn Thr Ile Lys Ile
    370                 375                 380

Gly Thr Gln Ser Glu Lys Thr Leu Arg Phe Leu Thr Leu Glu Glu Lys
385                 390                 395                 400

Leu Lys Leu Val Pro Lys Phe Tyr Arg Lys Ser Asp Phe Asn Phe Glu
                405                 410                 415

Val Leu Ala Lys Glu Leu Val Glu Lys Gly Ala Ser Phe Gly Tyr Tyr
            420                 425                 430

Lys Ser Ser Lys Lys Asn Glu Phe Phe Tyr Trp Phe Asn Tyr Lys Pro
        435                 440                 445

Thr Asp Ser Val Ser Ala Cys Val Val Ser Ala Ser Leu Glu Asn Ala
    450                 455                 460

Ile Gly Lys Asp Trp Lys Ile Lys Thr Phe Glu Tyr Gln Thr Arg Asn
465                 470                 475                 480

Thr Glu Lys Asn Glu Val Thr Lys Ser Val Asp Tyr Lys Asp Leu Trp
                485                 490                 495

His Leu Leu Ser Val Ala Thr Ser Asp Thr Tyr Leu Tyr Asp Phe Ala
            500                 505                 510

Ile Glu Lys Leu Lys Leu Glu Pro Lys Asn Ala Lys Ala Phe Ser Lys
        515                 520                 525

Thr Lys Leu Lys Lys Asp Phe Ala Ser Leu Ser Leu Ala Ala Ile Ala
    530                 535                 540
```

```
Lys Ile Leu Pro Tyr Leu Lys Gln Gly Leu Leu Tyr Ser His Ala Val
545                 550                 555                 560

Phe Met Ala Asn Ile Glu Asn Ile Val Asp Ala Asp Ile Trp Lys Asp
                565                 570                 575

Glu Glu Gln Gln Lys Phe Ile Gln Ser Lys Ile Val Glu Leu Val Asp
            580                 585                 590

Asn Tyr Ile Val Glu Lys Ser Lys Leu Glu Leu Ile Asn Gly Leu Leu
        595                 600                 605

Lys Ile Tyr Asn Thr Glu Asp Lys Glu Gly Arg Lys Val Tyr Tyr Ser
    610                 615                 620

Lys Glu Ala Glu Ser Leu Phe Glu Ala Asp Leu Arg Lys Lys Leu Val
625                 630                 635                 640

Pro Phe Tyr Lys Ala Asn Ile Ile Ile Glu Glu His Glu Gln Glu Ile
                645                 650                 655

Ile Phe Gln Asp Leu Phe Pro Ile Leu Met Asp Gln Leu Lys Lys Gln
            660                 665                 670

Glu Phe Ile Lys Ile Gly Arg Leu Asp Lys Gln Ile Glu Ala Phe Leu
        675                 680                 685

Glu Gly Glu Asn Glu Glu Gly Gln Ile Phe Cys Asn His Thr Asp Lys
    690                 695                 700

Leu Lys Lys Leu Tyr His Pro Ser Asp Ile Glu Val Phe Lys Lys Lys
705                 710                 715                 720

Thr Ile Lys Asp Glu Trp Gly Asn Glu Lys Val Val Leu Gly Ser Pro
                725                 730                 735

Leu Thr Thr Ser Ile Lys Asn Pro Met Ala Met Arg Ala Leu His Gln
```

```
            740                 745                 750

Leu Arg Lys Val Leu Asn Thr Leu Ile Ala Asn Asp Gln Ile Asp Glu
        755                 760                 765

Asp Thr Arg Ile His Ile Glu Met Ala Arg Glu Leu Asn Asp Ala Asn
    770                 775                 780

Lys Arg Lys Gly Ile Gln Asp Phe Gln Asn Glu Asn Lys Lys Phe Arg
785                 790                 795                 800

Glu Glu Ala Ile Lys Glu Ile Lys Lys Leu Tyr Leu Glu Glu Cys His
                805                 810                 815

Lys Asp Val Asn Pro Thr Glu Asp Asp Ile Leu Arg Tyr Gln Leu Trp
            820                 825                 830

Leu Glu Gln Gly Lys Cys Glu Ile Tyr Glu Glu Gly Asn Asn Ile Ser
        835                 840                 845

Ile Cys Asp Ile Ile Gly Ser Asn Pro Ser Tyr Asp Ile Glu His Thr
    850                 855                 860

Ile Pro Arg Ser Ile Ser Gln Asp Asn Ser Gln Met Asn Lys Thr Leu
865                 870                 875                 880

Cys Ser Leu Lys Phe Asn Arg Ser Ile Lys Lys Gln Lys Met Pro Val
                885                 890                 895

Glu Leu Ser Asn Tyr Asn Asp Ile Leu Pro Arg Ile Ala His Trp Lys
            900                 905                 910

Lys Glu Ala Glu Glu Leu Thr Arg Gln Ile Glu Thr Ile Ser Arg Ser
        915                 920                 925

Ile Lys Ser Ala Ala Thr Lys Val Ala Lys Asp Lys Asn Ile Arg Lys
    930                 935                 940
```

```
Arg His Tyr Leu Thr Leu Lys Arg Asp Tyr Ile Leu Gly Lys Tyr Glu
945                 950                 955                 960


Arg Phe Thr Trp Glu Glu Pro Lys Val Gly Phe Lys Asn Ser Gln Ile
                965                 970                 975


Pro Asp Thr Gly Ile Ile Thr Lys Tyr Ala Gln Ala Tyr Leu Lys Ser
            980                 985                 990


Tyr Phe Lys Arg Val Glu Ser Val  Lys Gly Gly Ala Val  Ala Glu Phe
        995                 1000                1005


Arg Lys  Leu Trp Gly Ile Gln  Glu Ser Phe Ile Asp  Glu Asn Trp
    1010                1015                1020


Trp Lys  His Tyr Lys Asp Lys  Asp Arg Asp Lys His  Thr His His
    1025                1030                1035


Thr Ile  Asp Ala Ile Thr Ile  Ala Cys Met Pro Lys  Asp Lys Tyr
    1040                1045                1050


Asp Leu  Leu Ala His Ala Trp  Arg Leu Glu Asp Glu  Gln Asp Lys
    1055                1060                1065


Lys Ala  Ala Lys Val Leu Ile  Glu Gln Ala Lys Pro  Trp Lys Thr
    1070                1075                1080


Phe Lys  Glu Asp Ile Glu Lys  Ile Glu Thr Glu Ile  Leu Val Ser
    1085                1090                1095


His Phe  Thr Pro Asp Asn Val  Lys Lys Gln Ser Lys  Ser Ile Ile
    1100                1105                1110


Lys Asn  Arg Gly Lys Lys Val  Tyr Val Leu Lys Asn  Glu Leu Pro
    1115                1120                1125


Val Asn  Phe Lys Asn Lys Ile  Glu Gly Lys Asp Tyr  Phe Lys Leu
```

```
    1130                1135                1140

Lys Phe  Asp Ser Lys Ile Leu  Tyr Lys Ile Pro Lys  Lys Lys Glu
    1145                1150                1155

Lys Gln  Thr Asp Thr Phe Tyr  Glu Glu Leu Pro Lys  Asn Tyr Leu
    1160                1165                1170

Asn Gly  Val Glu Gly Lys Asp  Tyr Phe Lys Ile Asn  Thr Thr Gly
    1175                1180                1185

Lys Thr  Phe Tyr Lys Ile Pro  Ile Phe Asn Gln Gly  Asp Thr Ile
    1190                1195                1200

Arg Gly  Ser Leu His Gln Glu  Thr Thr Tyr Gly Ala  Ile Lys Leu
    1205                1210                1215

Pro Asp  Ile Asp Ile Glu Thr  Lys Lys Pro Leu His  Thr Asp Lys
    1220                1225                1230

Gly Gly  Phe Ile Leu Lys Lys  Asp Ile Lys Gly Asn  Glu Ile Val
    1235                1240                1245

Phe Phe  Val Val Arg Lys Glu  Ile Ser Lys Ile Ser  Glu Asn Asp
    1250                1255                1260

Val Gln  Asn Ile Val Asp Asn  Val Val Arg Lys Lys  Ile Glu Asn
    1265                1270                1275

Ala Ile  Ala Asn Ser Leu Ile  Thr Phe Lys Ile Val  Lys Lys Lys
    1280                1285                1290

Lys Val  Ala Val Ile Lys Glu  Gly Val Thr Ile Trp  Met Arg Glu
    1295                1300                1305

Pro Asn  Ile Glu Lys Gly Ile  Glu Gly Ile Pro Ile  Lys Lys Val
    1310                1315                1320
```

```
Arg Ile  Ile Thr Asn Ser Val  Lys Asn Pro Ile Glu  Ile Lys Val
    1325                1330                1335

His Ser  Pro Leu Ser Lys Ser  Arg His Lys His Lys  Gln Lys Val
    1340                1345                1350

Tyr Gly  Gln Asn Asp Glu Asn  Tyr Ala Met Ala Leu  Tyr Glu Leu
    1355                1360                1365

Asp Gly  Lys Arg Glu Phe Glu  Leu Ile Asn Asn Phe  Asn Leu Ala
    1370                1375                1380

Lys Leu  Leu Lys Gln Ser Gln  Ser Tyr Tyr Pro Leu  His Lys Glu
    1385                1390                1395

Lys Glu  Ile Lys Gly Lys Lys  Ile Leu Val Pro Ile  Glu Lys Arg
    1400                1405                1410

Asn Asn  Lys Asp Val Ile Leu  Lys Arg Gly Gln Gln  Val Val Phe
    1415                1420                1425

Tyr Asp  Lys Thr Val Glu Asn  Pro Lys Asp Ile Ser  Glu Ile Ile
    1430                1435                1440

Asp Phe  Arg Glu Arg Ile Tyr  Ile Ile Glu Gly Leu  Thr Ile Gln
    1445                1450                1455

Arg Gln  Lys Asp Lys Lys Thr  Ser Lys Val Asn Glu  Tyr Gly Ile
    1460                1465                1470

Ile Gln  Leu Arg His Phe Lys  Glu Ala Arg Lys Ser  Glu Glu Ile
    1475                1480                1485

Ser Lys  Asp Asn Phe Lys Pro  Asp Gly Glu Phe Lys  Ile Asn Glu
    1490                1495                1500

Asn Lys  Pro Thr Arg Lys Met  Asn His Asn Gln Phe  Thr Ala Phe
```

1505 1510 1515

Val Glu Gly Ile Asp Phe Lys Val Leu Pro Ser Gly Lys Phe Gln
1520 1525 1530

Lys Ile
1535

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<212> PRT
<213> Flavobacterium columnare

<400> 240

Met Lys Phe Asn Leu Gly Leu Asp Ile Gly Thr Asn Ser Ile Gly Trp
1 5 10 15

Ala Leu Val Asn Glu Asp Tyr Glu Asn Lys Lys Gly Lys Ile Ile Ala
20 25 30

Ala Gly Ser Arg Ile Ile Pro Met Thr Gln Asp Ile Leu Asp Lys Phe
35 40 45

Gly Ser Gly Ala Ile Thr Glu Thr Gln Thr Ala Leu Arg Thr Asp Tyr
50 55 60

Arg Ser Lys Arg Lys Leu Ile Gln Arg Phe Leu Leu Arg Arg Glu Arg
65 70 75 80

Leu His Arg Val Leu Asn Val Leu Asp Phe Leu Pro Lys His Tyr Ala
85 90 95

Glu Ser Ile Asp Phe Glu Lys Tyr Phe Gly Lys Phe Leu Pro Asn Thr
100 105 110

Glu Pro Lys Leu Ala Tyr Asn Gln Asn Gln Phe Ile Phe Gln Asn Ser
115 120 125

```
Phe Leu Glu Met Leu Lys Glu Phe Gln Glu Lys His Pro Glu Leu Leu
    130                 135                 140

Thr Asn Asn Lys Lys Ile Pro Tyr Asp Trp Thr Ile Tyr Tyr Leu Arg
145                 150                 155                 160

Lys Lys Ala Leu Asn Gln Arg Ile Glu Lys Glu Glu Leu Ala Trp Leu
                165                 170                 175

Leu Leu Gln Phe Asn Gln Lys Arg Gly Tyr Asn Gln Leu Arg Asp Glu
            180                 185                 190

Glu Glu Glu Ser Val Pro Asn Lys Gln Val Glu Phe Tyr Ser Leu Lys
        195                 200                 205

Ile Ile Asp Val Val Ala Asp Gln Pro Lys Glu Gly Arg Asp Lys Arg
    210                 215                 220

Trp Tyr Ser Ile Asn Leu Glu Asn Gly Trp Thr Tyr Arg Arg Glu Ser
225                 230                 235                 240

Lys Thr Pro Leu Phe Asn Trp Glu Gly Lys Thr Lys Asp Phe Ile Val
                245                 250                 255

Thr Thr Asp Leu Asn Gln Asp Gly Ser Ile Lys Lys Asp Lys Glu Gly
            260                 265                 270

Lys Glu Lys Arg Ser Phe Arg Ala Pro Ser Glu Gly Asp Trp Thr Leu
        275                 280                 285

Leu Lys Lys Lys Thr Glu Lys Glu Ile Tyr Glu Ser Gly Lys Thr Leu
    290                 295                 300

Gly Thr Tyr Ile Tyr Asp Ala Leu Leu Asn Thr Pro Asp Leu Lys Ile
305                 310                 315                 320

Lys Gly Asp Phe Ile Arg Thr Ile Asp Arg Ser Ile Tyr Lys Glu Glu
                325                 330                 335
```

```
Leu Gln Gln Ile Ile Asn Lys Gln Lys Glu Tyr His Leu Glu Leu Asn
            340                 345                 350

Ser Ser Lys Leu Tyr Lys Ala Cys Leu Glu Glu Leu Tyr Pro Lys Asn
        355                 360                 365

Glu Ile Tyr Lys Ser Ala Leu Lys Asn Lys Asp Ile Ala Tyr Leu Phe
    370                 375                 380

Ile Asn Asp Ile Leu Tyr Tyr Gln Arg Pro Leu Lys Ala Pro Lys Tyr
385                 390                 395                 400

Asn Ile Gly Lys Cys Thr Tyr Glu Ser Arg Thr Phe Lys Lys Glu Asp
                405                 410                 415

Lys Lys Ile Arg Glu Tyr Ile Pro Ala Val Ala Lys Ser His Pro Leu
            420                 425                 430

Phe Gln Glu Phe Arg Leu Trp Gln Trp Ile Lys Asn Leu Lys Ile Tyr
        435                 440                 445

Glu Lys Leu Ser Ser Asp Asn Cys Thr Asp Phe Phe Leu Thr Asn Glu
    450                 455                 460

Gln Asp Phe Glu Asn Leu Phe Glu Phe Leu Trp Asn Lys Lys Glu Ile
465                 470                 475                 480

Asp His Lys Gly Ile Leu Glu Tyr Leu Val Lys Thr Lys Phe Pro Asp
                485                 490                 495

Leu Lys Pro Lys Gln Val Lys Thr Lys Val Lys Glu Tyr Arg Trp Asn
            500                 505                 510

Tyr Val Tyr Asp His Glu Lys Asp Glu Ser Lys Thr Tyr Pro Cys Gly
        515                 520                 525
```

```
Glu Thr Tyr Phe Leu Leu Lys Asn Lys Leu Asp Lys Ile Tyr Asn Ala
    530                 535                 540

Gln Asp Asp Phe Leu Asp Lys Glu Arg Leu Tyr Asn Leu Trp His Ile
545                 550                 555                 560

Ile Tyr Ser Val Thr Asp Lys Lys Gln Tyr Glu Lys Ala Leu Ala Lys
                565                 570                 575

Phe Ala Leu Lys Asn His Leu Asp Thr Lys Ser Phe Val Asn Thr Phe
            580                 585                 590

Lys Arg Ile Pro Pro Phe Lys Asn Asp Tyr Ala Ile Tyr Ser Leu Lys
        595                 600                 605

Ala Ile Lys Lys Leu Leu Pro Leu Met Arg Val Gly Lys Tyr Trp Asn
    610                 615                 620

Tyr Asp Asp Ile Asp Pro Ile Thr Lys Gln Lys Ile Gln Cys Ile Ile
625                 630                 635                 640

Thr Gly Glu Glu Asn Asp Thr Ile Ser Thr Leu Val Arg Glu Lys Thr
                645                 650                 655

Asn His Phe Ser Asn Glu Asn Asp Phe Lys Asn Leu Pro Leu Trp Leu
            660                 665                 670

Ala Gly Tyr Ile Val Tyr Asn Ser His Asn Glu Ser Ser Glu Ile Glu
        675                 680                 685

Lys Trp Lys Ser Pro Gln Asp Ile Asp Thr Phe Leu Lys Lys Phe Lys
    690                 695                 700

Gln His Ala Leu Arg Asn Pro Ile Val Glu Gln Val Val Thr Glu Thr
705                 710                 715                 720

Leu Arg Val Val Arg Asp Ile Trp Ser Lys Lys Gly Gln Gly Lys Lys
                725                 730                 735
```

```
Asp Phe Phe Asn Glu Ile His Ile Glu Leu Gly Lys Asp Leu Lys Asn
            740                 745                 750

Pro Val Asp Lys Arg Arg Lys Leu Ser Ser Thr Asn Thr Lys Asn Glu
        755                 760                 765

Ser Thr Asn Thr Arg Ile Lys Ala Leu Leu Ile Glu Leu Phe Thr Gln
    770                 775                 780

Gly Val Glu Asn Val Lys Pro Asn Ser Pro Lys His Gln Glu Ile Leu
785                 790                 795                 800

Lys Ile Phe Glu Glu Gly Ala Leu Asn Ser Gly Ile Glu Ile Glu Glu
                805                 810                 815

Asp Ile Ile Lys Ile Ser Asn Thr Asp Gln Pro Thr Lys Lys Gln Leu
            820                 825                 830

Glu Leu Tyr Ile Leu Trp Leu Glu His Lys Tyr Lys Ser Pro Tyr Thr
        835                 840                 845

Gly Gln Ser Ile Pro Leu Ser Lys Leu Phe Thr Pro Asn Tyr Glu Ile
    850                 855                 860

Glu His Ile Ile Pro Arg Ser Lys Tyr Tyr Asp Asp Asn Leu Ser Asn
865                 870                 875                 880

Lys Val Ile Cys Glu Thr Glu Ile Asn Arg Leu Lys Asn Asn Gln Leu
                885                 890                 895

Gly Tyr Glu Phe Ile Asn Asn His Glu Ile Arg Glu Val Thr Leu Glu
            900                 905                 910

Glu Gly Lys Thr Ile Arg Leu Leu Ser Pro Glu Gln Tyr Trp Asn Phe
        915                 920                 925
```

```
Val Thr Thr Tyr Tyr Ala Lys Asn Lys Ala Lys Arg Glu Asn Leu Leu
    930                 935                 940

Leu Lys Glu Leu Pro Val Gln Met Val Glu Lys Gln Leu Asn Asp Thr
945                 950                 955                 960

Arg Tyr Val Ser Lys Tyr Val Met Gln Leu Leu Ser Lys Ile Val Arg
                965                 970                 975

Lys Glu Asp Gly Thr Asp Asn Gly Ile Asn Ser Thr Asn Ile Leu Ser
            980                 985                 990

Ile Ser Gly Lys Met Thr Arg Ala  Leu Lys Asn Asp Trp  Asp Leu Asn
        995                 1000                1005

Asp Val  Trp Asn Asp Leu Leu  Leu Tyr Arg Phe Glu  Arg Leu Asn
    1010                1015                1020

Thr Ile  Thr Lys Thr Asn Leu  Phe Thr Thr Tyr Ser  Glu Gln Lys
    1025                1030                1035

Gln Lys  Arg Met Pro Ile Val  Pro Asp Gln Tyr Ala  Lys Gly Phe
    1040                1045                1050

His Lys  Lys Arg Leu Asp His  Arg His His Ala Leu  Asp Ala Ile
    1055                1060                1065

Val Ile  Ala Cys Ile Thr Arg  Asn His Ile Asn Tyr  Met Asn Asn
    1070                1075                1080

Gln Asn  Ile Gln Gly Glu Lys  Leu Lys Lys Asn Ala  Ile Glu Lys
    1085                1090                1095

Glu Asn  Tyr Arg Glu Ile Leu  Gln Lys Ser Arg Leu  Asp Ile Arg
    1100                1105                1110

Ala Gln  Leu Cys Glu Lys Lys  Tyr Asn Asp Asn Asp  Pro Thr Lys
    1115                1120                1125
```

```
Tyr Asn  Trp Val Phe Ile Lys  Pro Trp Ala Asp Phe  Thr Glu Asn
    1130                1135                1140

Thr Lys  Asp Ile Leu Glu Ser  Ile Ile Pro Ser Phe  Lys Gln Asn
    1145                1150                1155

Leu Arg  Ile Ile Asn Lys Thr  Val Asn Tyr Tyr Glu  Lys Tyr Asn
    1160                1165                1170

Glu Asn  Gly Lys Lys Val Lys  Val Arg Gln Ile Lys  Gly Asp Asn
    1175                1180                1185

Trp Ala  Ile Arg Lys Pro Leu  His Lys Glu Thr Ile  Ser Gly Lys
    1190                1195                1200

Val His  Leu Ser Tyr Lys Thr  Pro Ala Lys Gly Lys  Ile Leu Thr
    1205                1210                1215

Ala Thr  Arg Lys Val Leu Asp  Ser Ser Met Asp Phe  Lys Ser Ile
    1220                1225                1230

Glu Lys  Ile Thr Asp Thr Gly  Ile Gln Lys Ile Leu  Lys Asn Tyr
    1235                1240                1245

Leu Glu  Tyr Lys Lys Ser Pro  Glu Leu Ala Phe Ser  Pro Glu Gly
    1250                1255                1260

Ile Glu  Glu Leu Asn Ala Thr  Ile Thr Lys Tyr Asn  Asn Gly Phe
    1265                1270                1275

His His  Lys Pro Ile Tyr Lys  Val Arg Ile Tyr Glu  Glu Gly Val
    1280                1285                1290

Lys Phe  Pro Leu Gly Asn Lys  Gly Asn Lys Lys Ser  Lys Tyr Val
    1295                1300                1305
```

```
Glu Ala  Glu Lys Gly Thr Asn  Leu Phe Phe Ala Ile  Tyr Lys Asp
    1310                1315                1320

Gln Glu  Asn Asn Arg Tyr Phe  Glu Thr Ile Pro Phe  Asn Asp Val
    1325                1330                1335

Leu Glu  Thr Leu Lys Lys Gly  Met Ser Ala Val Pro  Glu Lys Asn
    1340                1345                1350

Gln Glu  Glu Asn Thr Leu Val  Phe Ala Leu Ser Pro  Gln Asp Leu
    1355                1360                1365

Val Phe  Val Pro Thr Leu Asp  Glu Ile Glu Asn Pro  Asp Ile Val
    1370                1375                1380

Asp Phe  Lys Asn Leu Thr Lys  Asp Gln Thr Asn Arg  Ile Tyr Lys
    1385                1390                1395

Met Val  Ser Ser Ser Gly Lys  Gln Cys Phe Phe Ile  Lys Ala Glu
    1400                1405                1410

Val Ala  Thr Ser Ile Val Asn  Lys Met Glu Phe Ser  Thr Ser Asn
    1415                1420                1425

Lys Met  Glu Asn Ser Ile Glu  Gly Ile Gln Ile Lys  Ser Asn Cys
    1430                1435                1440

Trp Lys  Leu Lys Leu Asp Arg  Leu Gly Thr Ile Thr  Arg Val Ile
    1445                1450                1455

Lys
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<213> Oenococcus kitaharae

<400> 241

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Met Ala Arg Asp Tyr Ser Val Gly Leu Asp Ile Gly Thr Ser Ser Val
1               5                  10                  15

Gly Trp Ala Ala Ile Asp Asn Lys Tyr His Leu Ile Arg Ala Lys Ser
            20                  25                  30

Lys Asn Leu Ile Gly Val Arg Leu Phe Asp Ser Ala Val Thr Ala Glu
        35                  40                  45

Lys Arg Arg Gly Tyr Arg Thr Thr Arg Arg Arg Leu Ser Arg Arg His
    50                  55                  60

Trp Arg Leu Arg Leu Leu Asn Asp Ile Phe Ala Gly Pro Leu Thr Asp
65                  70                  75                  80

Phe Gly Asp Glu Asn Phe Leu Ala Arg Leu Lys Tyr Ser Trp Val His
                85                  90                  95

Pro Gln Asp Gln Ser Asn Gln Ala His Phe Ala Ala Gly Leu Leu Phe
            100                 105                 110

Asp Ser Lys Glu Gln Asp Lys Asp Phe Tyr Arg Lys Tyr Pro Thr Ile
        115                 120                 125

Tyr His Leu Arg Leu Ala Leu Met Asn Asp Asp Gln Lys His Asp Leu
    130                 135                 140

Arg Glu Val Tyr Leu Ala Ile His His Leu Val Lys Tyr Arg Gly His
145                 150                 155                 160

Phe Leu Ile Glu Gly Asp Val Lys Ala Asp Ser Ala Phe Asp Val His
                165                 170                 175

Thr Phe Ala Asp Ala Ile Gln Arg Tyr Ala Glu Ser Asn Asn Ser Asp
            180                 185                 190

Glu Asn Leu Leu Gly Lys Ile Asp Glu Lys Lys Leu Ser Ala Ala Leu
```

```
        195                 200                 205

Thr Asp Lys His Gly Ser Lys Ser Gln Arg Ala Glu Thr Ala Glu Thr
    210                 215                 220

Ala Phe Asp Ile Leu Asp Leu Gln Ser Lys Lys Gln Ile Gln Ala Ile
225                 230                 235                 240

Leu Lys Ser Val Val Gly Asn Gln Ala Asn Leu Met Ala Ile Phe Gly
                245                 250                 255

Leu Asp Ser Ser Ala Ile Ser Lys Asp Glu Gln Lys Asn Tyr Lys Phe
            260                 265                 270

Ser Phe Asp Asp Ala Asp Ile Asp Glu Lys Ile Ala Asp Ser Glu Ala
        275                 280                 285

Leu Leu Ser Asp Thr Glu Phe Glu Phe Leu Cys Asp Leu Lys Ala Ala
    290                 295                 300

Phe Asp Gly Leu Thr Leu Lys Met Leu Leu Gly Asp Asp Lys Thr Val
305                 310                 315                 320

Ser Ala Ala Met Val Arg Arg Phe Asn Glu His Gln Lys Asp Trp Glu
                325                 330                 335

Tyr Ile Lys Ser His Ile Arg Asn Ala Lys Asn Ala Gly Asn Gly Leu
            340                 345                 350

Tyr Glu Lys Ser Lys Lys Phe Asp Gly Ile Asn Ala Ala Tyr Leu Ala
        355                 360                 365

Leu Gln Ser Asp Asn Glu Asp Asp Arg Lys Lys Ala Lys Lys Ile Phe
    370                 375                 380

Gln Asp Glu Ile Ser Ser Ala Asp Ile Pro Asp Asp Val Lys Ala Asp
385                 390                 395                 400
```

```
Phe Leu Lys Lys Ile Asp Asp Asp Gln Phe Leu Pro Ile Gln Arg Thr
               405                 410                 415

Lys Asn Asn Gly Thr Ile Pro His Gln Leu His Arg Asn Glu Leu Glu
            420                 425                 430

Gln Ile Ile Glu Lys Gln Gly Ile Tyr Tyr Pro Phe Leu Lys Asp Thr
        435                 440                 445

Tyr Gln Glu Asn Ser His Glu Leu Asn Lys Ile Thr Ala Leu Ile Asn
    450                 455                 460

Phe Arg Val Pro Tyr Tyr Val Gly Pro Leu Val Glu Glu Glu Gln Lys
465                 470                 475                 480

Ile Ala Asp Asp Gly Lys Asn Ile Pro Asp Pro Thr Asn His Trp Met
               485                 490                 495

Val Arg Lys Ser Asn Asp Thr Ile Thr Pro Trp Asn Leu Ser Gln Val
            500                 505                 510

Val Asp Leu Asp Lys Ser Gly Arg Arg Phe Ile Glu Arg Leu Thr Gly
        515                 520                 525

Thr Asp Thr Tyr Leu Ile Gly Glu Pro Thr Leu Pro Lys Asn Ser Leu
    530                 535                 540

Leu Tyr Gln Lys Phe Asp Val Leu Gln Glu Leu Asn Asn Ile Arg Val
545                 550                 555                 560

Ser Gly Arg Arg Leu Asp Ile Arg Ala Lys Gln Asp Ala Phe Glu His
               565                 570                 575

Leu Phe Lys Val Gln Lys Thr Val Ser Ala Thr Asn Leu Lys Asp Phe
            580                 585                 590

Leu Val Gln Ala Gly Tyr Ile Ser Glu Asp Thr Gln Ile Glu Gly Leu
```

```
        595                 600                 605

Ala Asp Val Asn Gly Lys Asn Phe Asn Asn Ala Leu Thr Thr Tyr Asn
    610                 615                 620

Tyr Leu Val Ser Val Leu Gly Arg Glu Phe Val Glu Asn Pro Ser Asn
625                 630                 635                 640

Glu Glu Leu Leu Glu Glu Ile Thr Glu Leu Gln Thr Val Phe Glu Asp
                645                 650                 655

Lys Lys Val Leu Arg Arg Gln Leu Asp Gln Leu Asp Gly Leu Ser Asp
            660                 665                 670

His Asn Arg Glu Lys Leu Ser Arg Lys His Tyr Thr Gly Trp Gly Arg
        675                 680                 685

Ile Ser Lys Lys Leu Leu Thr Thr Lys Ile Val Gln Asn Ala Asp Lys
    690                 695                 700

Ile Asp Asn Gln Thr Phe Asp Val Pro Arg Met Asn Gln Ser Ile Ile
705                 710                 715                 720

Asp Thr Leu Tyr Asn Thr Lys Met Asn Leu Met Glu Ile Ile Asn Asn
                725                 730                 735

Ala Glu Asp Asp Phe Gly Val Arg Ala Trp Ile Asp Lys Gln Asn Thr
            740                 745                 750

Thr Asp Gly Asp Glu Gln Asp Val Tyr Ser Leu Ile Asp Glu Leu Ala
        755                 760                 765

Gly Pro Lys Glu Ile Lys Arg Gly Ile Val Gln Ser Phe Arg Ile Leu
    770                 775                 780

Asp Asp Ile Thr Lys Ala Val Gly Tyr Ala Pro Lys Arg Val Tyr Leu
785                 790                 795                 800
```

```
Glu Phe Ala Arg Lys Thr Gln Glu Ser His Leu Thr Asn Ser Arg Lys
                805                 810                 815

Asn Gln Leu Ser Thr Leu Leu Lys Asn Ala Gly Leu Ser Glu Leu Val
            820                 825                 830

Thr Gln Val Ser Gln Tyr Asp Ala Ala Ala Leu Gln Asn Asp Arg Leu
        835                 840                 845

Tyr Leu Tyr Phe Leu Gln Gln Gly Lys Asp Met Tyr Ser Gly Glu Lys
    850                 855                 860

Leu Asn Leu Asp Asn Leu Ser Asn Tyr Asp Ile Asp His Ile Ile Pro
865                 870                 875                 880

Gln Ala Tyr Thr Lys Asp Asn Ser Leu Asp Asn Arg Val Leu Val Ser
                885                 890                 895

Asn Ile Thr Asn Arg Arg Lys Ser Asp Ser Ser Asn Tyr Leu Pro Ala
            900                 905                 910

Leu Ile Asp Lys Met Arg Pro Phe Trp Ser Val Leu Ser Lys Gln Gly
        915                 920                 925

Leu Leu Ser Lys His Lys Phe Ala Asn Leu Thr Arg Thr Arg Asp Phe
    930                 935                 940

Asp Asp Met Glu Lys Glu Arg Phe Ile Ala Arg Ser Leu Val Glu Thr
945                 950                 955                 960

Arg Gln Ile Ile Lys Asn Val Ala Ser Leu Ile Asp Ser His Phe Gly
                965                 970                 975

Gly Glu Thr Lys Ala Val Ala Ile Arg Ser Ser Leu Thr Ala Asp Met
            980                 985                 990

Arg Arg Tyr Val Asp Ile Pro Lys  Asn Arg Asp Ile Asn  Asp Tyr His
```

```
        995                 1000                1005

His Ala  Phe Asp Ala Leu Leu  Phe Ser Thr Val Gly  Gln Tyr Thr
    1010                1015                1020

Glu Asn  Ser Gly Leu Met Lys  Lys Gly Gln Leu Ser  Asp Ser Ala
    1025                1030                1035

Gly Asn  Gln Tyr Asn Arg Tyr  Ile Lys Glu Trp Ile  His Ala Ala
    1040                1045                1050

Arg Leu  Asn Ala Gln Ser Gln  Arg Val Asn Pro Phe  Gly Phe Val
    1055                1060                1065

Val Gly  Ser Met Arg Asn Ala  Ala Pro Gly Lys Leu  Asn Pro Glu
    1070                1075                1080

Thr Gly  Glu Ile Thr Pro Glu  Glu Asn Ala Asp Trp  Ser Ile Ala
    1085                1090                1095

Asp Leu  Asp Tyr Leu His Lys  Val Met Asn Phe Arg  Lys Ile Thr
    1100                1105                1110

Val Thr  Arg Arg Leu Lys Asp  Gln Lys Gly Gln Leu  Tyr Asp Glu
    1115                1120                1125

Ser Arg  Tyr Pro Ser Val Leu  His Asp Ala Lys Ser  Lys Ala Ser
    1130                1135                1140

Ile Asn  Phe Asp Lys His Lys  Pro Val Asp Leu Tyr  Gly Gly Phe
    1145                1150                1155

Ser Ser  Ala Lys Pro Ala Tyr  Ala Ala Leu Ile Lys  Phe Lys Asn
    1160                1165                1170

Lys Phe  Arg Leu Val Asn Val  Leu Arg Gln Trp Thr  Tyr Ser Asp
    1175                1180                1185
```

```
Lys Asn  Ser Glu Asp Tyr Ile  Leu Glu Gln Ile Arg  Gly Lys Tyr
    1190                1195                1200

Pro Lys  Ala Glu Met Val Leu  Ser His Ile Pro Tyr  Gly Gln Leu
    1205                1210                1215

Val Lys  Lys Asp Gly Ala Leu  Val Thr Ile Ser Ser  Ala Thr Glu
    1220                1225                1230

Leu His  Asn Phe Glu Gln Leu  Trp Leu Pro Leu Ala  Asp Tyr Lys
    1235                1240                1245

Leu Ile  Asn Thr Leu Leu Lys  Thr Lys Glu Asp Asn  Leu Val Asp
    1250                1255                1260

Ile Leu  His Asn Arg Leu Asp  Leu Pro Glu Met Thr  Ile Glu Ser
    1265                1270                1275

Ala Phe  Tyr Lys Ala Phe Asp  Ser Ile Leu Ser Phe  Ala Phe Asn
    1280                1285                1290

Arg Tyr  Ala Leu His Gln Asn  Ala Leu Val Lys Leu  Gln Ala His
    1295                1300                1305

Arg Asp  Asp Phe Asn Ala Leu  Asn Tyr Glu Asp Lys  Gln Gln Thr
    1310                1315                1320

Leu Glu  Arg Ile Leu Asp Ala  Leu His Ala Ser Pro  Ala Ser Ser
    1325                1330                1335

Asp Leu  Lys Lys Ile Asn Leu  Ser Ser Gly Phe Gly  Arg Leu Phe
    1340                1345                1350

Ser Pro  Ser His Phe Thr Leu  Ala Asp Thr Asp Glu  Phe Ile Phe
    1355                1360                1365

Gln Ser  Val Thr Gly Leu Phe  Ser Thr Gln Lys Thr  Val Ala Gln
```

1370 1375 1380

Leu Tyr Gln Glu Thr Lys
1385

<210> 242
<211> 1425
<212> PRT
<213> Prevotella micans

<400> 242

Met Ile Gln Lys Ile Phe Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly
1 5 10 15

Ser Ser Val Arg Asn Leu Glu Leu Gly Glu Asn Leu Thr Glu Gln Leu
20 25 30

Glu Phe Phe Ser Ser Asp Ile Phe Gly Ser Ser Val Ser Lys Asn Ser
35 40 45

Asn Gly Arg Glu Tyr Ser Leu Ala Gly Asn Arg Ser Ala His Arg Arg
50 55 60

Ser Arg Gly Leu Asn Glu Ala Arg Arg Arg Lys Leu Trp Ala Thr Leu
65 70 75 80

Asp Leu Leu Ile Glu His Gly Leu Cys Pro Met Ser Pro Asp Ser Leu
85 90 95

Met Gln Trp Arg Thr Tyr Asp Lys Gln Lys Gly Leu Tyr Arg Gln Tyr
100 105 110

Pro Ile Glu Asp Lys Asp Phe Asn Ala Trp Ile Met Leu Asp Phe Asn
115 120 125

Gly Asp Gly Lys Pro Asp Tyr Ser Ser Pro Tyr Gln Leu Arg Arg Glu
130 135 140

```
Leu Val Val Arg Gln Phe Asp Phe Asp Gln Pro Ile Glu Arg Tyr Lys
145                 150                 155                 160

Leu Gly Arg Ala Leu Tyr His Ile Ala Gln His Arg Gly Phe Lys Ser
                165                 170                 175

Ser Lys Gly Glu Thr Ile Ala Asp Gln Glu Lys Asn Glu Lys Lys Pro
            180                 185                 190

Ile Ala Glu Glu Gly Ala Asp Ile Ala Asn Glu Met Lys Ala Ser Glu
        195                 200                 205

Thr Lys Leu Ser Lys Gly Leu Val Ala Tyr Met Gln Glu Asn His Leu
    210                 215                 220

Lys Thr Val Gly Glu Ala Phe Ala Lys Leu Glu Asp Glu Arg Val Arg
225                 230                 235                 240

Ile Arg Asn Asn Glu Ser Tyr Arg Ala Ile Arg Ser Gln Tyr Gln Asp
                245                 250                 255

Glu Ile Lys Glu Ile Phe Thr Tyr Gln Lys Lys Leu Ser Val Glu Ser
            260                 265                 270

Glu Leu Tyr Glu Arg Leu Thr Ser Glu Lys Lys Gly Val Gly Thr Ile
        275                 280                 285

Phe Tyr Lys Arg Pro Leu Arg Ser Gln Arg Gly Asn Val Gly Lys Cys
    290                 295                 300

Thr Leu Glu Arg Asn Lys Pro Arg Cys Pro Ile Gly Arg Pro Glu Phe
305                 310                 315                 320

Glu Glu Phe Arg Ala Trp Thr Leu Ile Asn Asn Ile Lys Ile Arg Glu
                325                 330                 335

Thr Ala Gly Glu Pro Tyr Lys Gln Leu Pro Ile Lys Leu Arg Gln Glu
            340                 345                 350
```

```
Leu Leu Lys Asp Cys Phe Leu Ser Lys Val Lys Ala Asp Phe Lys Phe
        355                 360                 365

Glu Asp Ile Arg Lys Tyr Ile Glu Lys Arg Leu Gly Leu Ser Phe Ser
    370                 375                 380

Asn Asp Asp Lys Thr Ile Asn Tyr Lys Asp Ser Val Ser Ile Ala Ala
385                 390                 395                 400

Cys Pro Val Thr Val Arg Met Lys Lys Leu Leu Gly Glu Asn Trp Ala
                405                 410                 415

Asn Cys Arg Ile Asp Gly Glu Lys Arg Arg Gln Ala His Gly Lys Asn
            420                 425                 430

Asn Asn Asn Glu His Ile Val Ser Tyr Thr Glu Glu Asp Ile Trp His
        435                 440                 445

Val Cys Tyr Asn Ala Glu Asp Pro Glu Glu Val Ser Asn Phe Ala Arg
    450                 455                 460

Lys Ala Leu His Trp Asp Glu Asn Lys Ile Lys Glu Leu Val Arg Leu
465                 470                 475                 480

Trp Thr Ser Ile Pro Gln Gly Tyr Ala Met Leu Ser Leu Lys Ala Ile
                485                 490                 495

Arg Asn Ile Asn Arg Met Leu Leu Leu Gly Leu Lys Tyr Ser Asp Ala
            500                 505                 510

Val Leu Leu Ala Lys Leu Pro Asp Ile Val Pro Val Ser Asp Glu Asp
        515                 520                 525

Ile Leu Ala Ile Thr Lys Glu Phe Leu Gln Leu Glu Asp Lys Leu Asn
    530                 535                 540
```

```
Gln Glu Lys Gln Ile Asn Asn Ile Val Asn Ser Leu Ile Ala Asn Tyr
545                 550                 555                 560

Lys Ser Lys Leu Glu Glu Asn Arg Phe Ala Asp His Asn Tyr Gln Tyr
                565                 570                 575

Gln Leu Gly Glu Gly Asp Asp Glu Asp Ile Asn Thr Gln Ile Lys Ser
            580                 585                 590

His Ile Gly Ala Lys Leu Trp Val Gln Ile Gly Ala Asp Glu Gln Thr
        595                 600                 605

Lys Ile Phe Gln Ala Val Arg Ser Lys Tyr Gln Asp Phe Phe Lys Ser
    610                 615                 620

Tyr Lys Arg Lys Phe Val Glu Ser Pro Lys Leu Gly Glu Leu Leu Val
625                 630                 635                 640

Ala Phe Leu Thr Glu Lys Phe Pro Asn Val Lys Ser Lys Gln Trp Glu
                645                 650                 655

Arg Leu Tyr His Pro Ser Gln Ile Ala Ile Tyr Arg Pro Ile Pro Val
            660                 665                 670

Asp Asn Asp Arg Ser Lys Leu Arg Leu Gly Asn Pro Asn Ile Gly Ala
        675                 680                 685

Ile Lys Asn Pro Thr Val Met Arg Val Leu Asn Thr Leu Arg Arg Arg
    690                 695                 700

Val Asn Gln Leu Leu Asp Asp Gly Val Ile Ser Pro Asp Glu Thr Arg
705                 710                 715                 720

Val Val Val Glu Thr Ala Arg Glu Leu Asn Asp Ala Asn Thr Lys Trp
                725                 730                 735

Ala Leu Asp Arg Tyr Asn Arg Ile Arg Arg Asp Glu Asn Glu Lys Ile
            740                 745                 750
```

```
Arg Lys Ile Leu Lys Glu Leu Asn Pro Thr Thr Asn Ser Ile Ser Glu
        755                 760                 765

Gln Asp Ile Asp Lys Ala Arg Tyr Ile Phe Glu Gln Cys Glu Thr Asp
    770                 775                 780

Phe Tyr Thr Asp Gly Lys Val Pro Tyr Tyr Asn Lys Asp Ile Lys Lys
785                 790                 795                 800

Tyr Lys Leu Trp Leu Glu Gln Gly Gly Gln Cys Leu Tyr Thr Gly Gln
                805                 810                 815

Thr Ile Asn Leu Thr Asn Leu Phe Asn Pro Asn Ala Phe Asp Met Glu
            820                 825                 830

His Thr Ile Pro Lys Ser Ile Ser Phe Asp Asn Ser Asp Gln Asn Leu
        835                 840                 845

Thr Leu Cys Glu Ser Tyr Tyr Asn Arg Phe Ile Lys Lys Asn Asn Ile
    850                 855                 860

Pro Thr Asp Met Pro Asn Tyr Asp Lys Asp Val Thr Ile Asn Gly Lys
865                 870                 875                 880

Glu Tyr Thr Ala Ile Lys Pro Arg Leu Gln Arg Trp Lys Glu Arg Val
                885                 890                 895

Asp Arg Leu Ser Arg Asn Val Asp Phe Trp Lys Gly Gln Ala Arg Arg
            900                 905                 910

Ala Gln Asp Lys Asp Arg Lys Asp Glu Cys Ile Arg Glu Lys His Leu
        915                 920                 925

Trp Asp Met Glu Leu Ala Tyr Trp Lys Gly Lys Leu Glu Arg Phe Thr
    930                 935                 940
```

```
Met Thr Asp Val Thr Asp Gly Phe Lys Asn Ser Gln Leu Val Asp Thr
945                 950                 955                 960


Arg Val Ile Thr Arg His Ala Val Leu Tyr Leu Lys Ser Ile Phe Asn
                965                 970                 975


His Val Glu Val Gln Arg Gly Glu Thr Thr Ala Glu Phe Arg Lys Ile
            980                 985                 990


Leu Gly Leu Gln Ser Ile Asp Glu  Lys Lys Asp Arg Ser  Leu His Ser
        995                 1000                1005


His His  Ala Ile Asp Ala Thr  Met Leu Thr Val Ile  Pro Ser Ala
    1010                1015                1020


Ala Lys  Arg Asp Arg Met Leu  Glu Leu Phe Tyr Lys  Ile Glu Glu
    1025                1030                1035


Thr Lys  Lys Ala Leu Lys Asn  Tyr Asn Asp Asn Asn  Lys Thr Gly
    1040                1045                1050


Leu Asn  Leu Glu Leu Lys Gly  Leu Glu Glu Lys Leu  Asp Lys Glu
    1055                1060                1065


Lys Lys  Asp Cys Arg Val Gly  Arg Arg Val Asn Asp  Leu Asp Arg
    1070                1075                1080


Phe Ile  Asn Glu Asn Ile Ile  Val Ser His His Thr  Lys Asp Gln
    1085                1090                1095


Ala Leu  Thr Pro Ala His Arg  Arg Leu Arg Lys Arg  Gly Lys Ile
    1100                1105                1110


Val Gly  Gly Lys Glu His Pro  Arg Trp Gln Thr Gly  Asp Ser Leu
    1115                1120                1125


Arg Gly  Glu Ile His Lys Ala  Ser Tyr Tyr Gly Ala  Ile Thr Gln
    1130                1135                1140
```

```
Phe Ala  Lys Asp Ala Asn Gly  Lys Val Leu Met Lys  Asp Gly Gln
    1145                1150                1155

Ala Gln  Ile Asp Pro Thr Ile  Tyr Tyr Val Ile Arg  Arg Glu Leu
    1160                1165                1170

Lys Tyr  Lys Arg Ser Thr Gln  Asp Ser Gly Phe Thr  Asn Trp Glu
    1175                1180                1185

Asp Leu  Glu Lys Val Ile Val  Asp Thr Asp Leu Phe  Gly Leu Met
    1190                1195                1200

Lys Gly  Gln Phe Pro Glu Gly  Thr Ser Phe Lys Asp  Ala Cys Glu
    1205                1210                1215

Gln Gly  Phe Tyr Met Ile Lys  Lys Gly Lys Asn Gly  Glu Gly Asp
    1220                1225                1230

Val Lys  Thr His Arg Ile Arg  His Val Arg Cys Lys  Ala Val Lys
    1235                1240                1245

Thr Ala  Leu Arg Ile Lys Glu  Gln Thr Tyr Lys Ser  Ser Lys Asp
    1250                1255                1260

Tyr Lys  Gln Phe Phe Tyr Ala  Ala Val Gly Asp Leu  Tyr Val Met
    1265                1270                1275

Cys Tyr  Tyr Thr Asp Gly Lys  Lys Arg Asp Phe Lys  Ile Tyr Ser
    1280                1285                1290

Leu Tyr  Asp Ile Ser Asn His  Arg Lys Ser Gly Thr  Glu Asp Ile
    1295                1300                1305

Pro Lys  Phe Ile Thr Asp Lys  Lys Gly Asn His Leu  Pro Leu Asp
    1310                1315                1320
```

```
Tyr Lys  Leu Arg Thr Gly Asp  Met Val Leu Leu Tyr  Lys Asp Asn
    1325                 1330                 1335


Pro Glu  Glu Leu Lys Asp Leu  Asp Gln Val Asn Leu  Lys Arg Arg
    1340                 1345                 1350


Leu Tyr  Lys Val Asn Arg Phe  Glu Ser Glu Gly Leu  Ile Ile Leu
    1355                 1360                 1365


Leu Thr  His His Leu Ser Thr  Thr Thr Glu Arg Gly  Cys Ser Ile
    1370                 1375                 1380


Gly Lys  Ile Glu Asn Tyr Gln  Asn Leu Pro Thr Ala  Ile Arg Cys
    1385                 1390                 1395


Gly Ile  Lys Thr Ile Lys Phe  Leu Ile Met Gly Lys  His Arg Asp
    1400                 1405                 1410


Phe Val  Ile Arg Asn Gly Asn  Ile Glu Phe Lys His
    1415                 1420                 1425


<210>  243
<211>  1473
<212>  PRT
<213>  Mucilaginibacter paludis

<400>  243

Met Lys Asn Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                  10                  15


Ala Leu Ile Glu Lys Asp Thr Asp Gln Lys Asn Gly Asn Ile Leu Gly
            20                  25                  30


Thr Gly Ser Arg Ile Ile Pro Met Ser Gln Asp Ile Lys Asp Glu Phe
        35                  40                  45


Gly Lys Gly Asn Ser Ile Ser Gln Thr Ala Asp Arg Thr Lys Phe Arg
    50                  55                  60
```

```
Ser Val Arg Arg Leu Arg Glu Arg His Leu Leu Arg Arg Glu Arg Leu
65                  70                  75                  80

His Arg Val Leu Asn Val Leu Gly Phe Leu Pro Lys His Tyr Ala Asp
                85                  90                  95

Gln Ile Asp Phe Lys Lys Arg Leu Gly Lys Leu Val Asn Glu Thr Glu
            100                 105                 110

Pro Lys Leu Val Tyr Asp Asn Lys Asn Phe Ile Phe Lys Lys Ser Phe
        115                 120                 125

Glu Ala Met Leu Ser Asp Phe Asn Gln His Gln Pro Leu Leu Leu Ala
    130                 135                 140

Asp Gly Lys Lys Val Pro Phe Asp Trp Thr Ile Tyr Tyr Leu Arg Lys
145                 150                 155                 160

Lys Ala Leu Thr Glu Lys Ile Glu Lys Glu Glu Leu Ala Trp Leu Ile
                165                 170                 175

Leu Asn Phe Asn Gln Lys Arg Gly Tyr Tyr Gln Leu Arg Gly Glu Glu
            180                 185                 190

Glu Glu Glu Asn Pro Asn Lys Met Val Ala Phe His Ser Leu Lys Ile
        195                 200                 205

Val Glu Val Ile Ala Asp Glu Ser Gln Lys Gly Lys Ala Glu Thr Trp
    210                 215                 220

Tyr Ser Leu Ile Leu Glu Asn Gly Trp Ile Tyr Arg Arg Ser Ser Lys
225                 230                 235                 240

Thr Pro Leu Tyr Asp Trp Lys Gly Lys Gln Arg Asp Phe Ile Val Thr
                245                 250                 255

Thr Asp Leu Asn Asp Asp Gly Ser Ile Lys Thr Asp Lys Glu Gly Leu
```

```
            260                 265                 270

Glu Lys Arg Ser Phe Arg Ala Pro Val Glu Asp Asp Trp Thr Leu Val
        275                 280                 285

Lys Lys Lys Thr Glu Gln Glu Ile Asn Arg Ser His Lys Thr Val Gly
    290                 295                 300

Thr Tyr Ile Tyr Glu Asn Leu Leu Gln Asp Pro Lys Gln Lys Ile Lys
305                 310                 315                 320

Gly Lys Leu Val Arg Thr Ile Glu Arg Glu Phe Tyr Lys Asp Glu Leu
                325                 330                 335

Lys Met Ile Leu Lys Asn Gln Gln Lys Phe His Pro Glu Leu Asn Asp
            340                 345                 350

Glu His Leu Tyr Ile Asn Cys Val Arg Glu Leu Tyr Arg Asn Asn Gln
        355                 360                 365

Ala His Gln Thr Ile Leu Ser Lys Lys Asp Phe Val His Leu Phe Ile
    370                 375                 380

Asp Asp Ile Ile Phe Tyr Gln Arg Pro Leu Arg Ser Gln Lys Ser Ser
385                 390                 395                 400

Ile Ser Asn Cys Thr Leu Glu Phe Arg Lys Tyr Lys Asn Glu Asn Gly
                405                 410                 415

Thr Asp Gln Thr Asp Tyr Leu Lys Ala Ile Pro Lys Ser His Pro Leu
            420                 425                 430

Phe Gln Glu Phe Arg Leu Trp Gln Trp Ile Tyr Asn Leu Gly Ile Tyr
        435                 440                 445

Gln Lys Glu Asp Asp Thr Asn Val Thr Asp Glu Leu Ile Lys Asn Ile
    450                 455                 460
```

```
Asp Gly Tyr Gln Asp Leu Phe Asp Phe Leu Asn Asn Lys Lys Glu Ile
465                 470                 475                 480


Arg Gln Asp Ile Leu Ile Lys Phe Leu Val Glu Gln Thr Gly Leu Lys
                485                 490                 495


Gly Lys Pro Leu Ser Ser Val Val Ala Lys Tyr Arg Trp Asn Phe Val
            500                 505                 510


Glu Asp Lys Ile Tyr Pro Cys Asn Glu Thr Gly Thr Gln Ile Arg Thr
        515                 520                 525


Arg Leu Ala Lys Val Glu Asn Thr Pro Glu Asp Phe Leu Thr Ala Glu
    530                 535                 540


Thr Glu Ile Lys Leu Trp His Ile Ile Tyr Ser Val Asn Asp Lys Ala
545                 550                 555                 560


Asp Tyr Glu Lys Ala Leu Lys Thr Phe Ala Glu Lys His Asn Leu Asp
                565                 570                 575


Thr His Ser Phe Val Glu Asn Phe Lys Lys Phe Pro Pro Phe Lys Ser
            580                 585                 590


Glu Tyr Gly Ser Phe Ser Glu Lys Ala Ile Lys Lys Leu Leu Pro Leu
        595                 600                 605


Ile Arg Leu Gly Lys Tyr Trp Ser Trp Glu Asn Ile Asp Lys Lys Thr
    610                 615                 620


Gln Glu Arg Ile Glu Lys Ile Leu Thr Gly Glu Phe Asp Glu Ala Ile
625                 630                 635                 640


Lys Ser Arg Val Arg Asp Lys Ala Ile His Leu Thr Glu Glu Asp His
                645                 650                 655


Phe Gln Gly Leu Gln Leu Trp Leu Ala Ser Tyr Val Val Tyr Gly Arg
```

```
            660                 665                 670

His Ser Glu Ala Asp Asn Leu Asp Lys Trp His Thr Val Ala Asp Leu
        675                 680                 685

Glu Asp Tyr Leu Ala Glu Phe Arg Gln His Ser Leu Arg Asn Pro Ile
    690                 695                 700

Val Glu Gln Val Ile Thr Glu Thr Leu Arg Val Val Lys Asp Ile Trp
705                 710                 715                 720

Leu Gln Tyr Gly Gln Gly Ala Lys Asp Phe Phe Ser Glu Ile His Ile
                725                 730                 735

Glu Leu Ala Arg Glu Met Lys Asn Thr Gly Asp Glu Arg Lys Arg Leu
            740                 745                 750

Thr Ser Leu Val Thr Asp Asn Glu Asn Thr Asn Leu Arg Ile Lys Val
        755                 760                 765

Leu Leu Ser Glu Leu Leu Asn Asp Gly Asn Val Glu Asn Val Arg Pro
    770                 775                 780

Tyr Ser Pro Met Gln Gln Glu Ala Leu Lys Ile Phe Glu Asp Gly Val
785                 790                 795                 800

Leu Asn Ser Asp Ile Glu Ile Glu Asp Asp Ile Leu Lys Ile Ser Lys
                805                 810                 815

Met Ala Gln Pro Thr Asn Thr Glu Leu Lys Arg Tyr Lys Leu Trp Leu
            820                 825                 830

Glu Gln Lys Tyr Arg Ser Pro Tyr Thr Gly Gln Ile Ile Pro Leu Asn
        835                 840                 845

Arg Leu Phe Thr Ala Asp Tyr Glu Ile Glu His Ile Ile Pro Gln Ser
    850                 855                 860
```

```
Arg Phe Phe Asp Asp Ser Phe Ser Asn Lys Ile Ile Cys Glu Ser Ala
865                 870                 875                 880


Val Asn Gln Leu Lys Asp Lys Gln Leu Gly Leu Glu Phe Ile Lys Asn
                885                 890                 895


His Ser Gly Thr Ile Val Lys Leu Gly Met Gly Lys Thr Ala Lys Ile
            900                 905                 910


Leu Asp Val Glu Ser Tyr Asn Glu Phe Val Lys Gly Asn Tyr Thr Lys
        915                 920                 925


Asn Ile Ser Lys Arg Asn Lys Leu Met Leu Glu Glu Ile Pro Asp Lys
    930                 935                 940


Met Ile Glu Arg Gln Leu Asn Asp Thr Arg Tyr Ile Ser Lys Phe Ile
945                 950                 955                 960


Ile Ser Ala Leu Ser Asn Ile Val Arg Ser Glu Ser Asn Asp Asp Gly
                965                 970                 975


Phe Asn Ser Lys Asn Val Leu Pro Gly Asn Gly Lys Ile Thr Ser Arg
            980                 985                 990


Leu Lys Gln Asp Trp Gly Met Asn  Asp Ile Trp Asn Glu  Leu Ile Leu
        995                 1000                1005


Pro Arg  Phe Glu Arg Met Asn  Lys Ile Thr Asp Ser  Ala Val Phe
    1010                1015                1020


Thr Ala  Trp Asn Glu Asn Asn  Gln Lys Phe Leu Pro  Ile Val Pro
    1025                1030                1035


Leu Glu  Phe Ser Lys Gly Phe  Gln Lys Lys Arg Ile  Asp His Arg
    1040                1045                1050


His His  Ala Leu Asp Ala Leu  Val Ile Ala Ala Ser  Thr Arg Glu
```

```
    1055                1060                1065

His Ile  Asn Leu Leu Asn Asn  Glu His Ala Lys Ser  Asp Lys Arg
    1070                1075                1080

Phe Asp  Leu Asn Arg Lys Leu  Arg Lys Phe Glu Lys  Val Ala Tyr
    1085                1090                1095

Asn Asp  Pro Lys Thr Gly Lys  Arg Ile Glu Lys Glu  Val Pro Thr
    1100                1105                1110

Ile Phe  Leu Lys Pro Trp Glu  Thr Phe Thr Val Asp  Ala Lys Asn
    1115                1120                1125

Ser Leu  Glu Ser Ile Ile Val  Ser Phe Lys Gln Asn  Leu Arg Val
    1130                1135                1140

Ile Asn  Arg Ala Thr Asn Tyr  Ser Glu Ser Tyr Asn  Asp Glu Asn
    1145                1150                1155

Gly Ala  Leu Arg Leu Gly Lys  Asp Gly Asn Pro Leu  Lys Glu Lys
    1160                1165                1170

Ile Lys  Gln Ser Lys Gly Asp  Ser Trp Ala Ile Arg  Lys Pro Met
    1175                1180                1185

His Lys  Asp Phe Val Tyr Gly  Lys Val His Leu Gln  Asn Val Lys
    1190                1195                1200

Leu Pro  Lys Asp Lys Phe Ile  Thr Ala Ile Arg Lys  Ser Leu Asp
    1205                1210                1215

Val Thr  Phe Asp Leu Lys Arg  Ile Glu Thr Ile Thr  Asp Thr Gly
    1220                1225                1230

Ile Gln  Lys Ile Leu Lys Asn  Tyr Leu His Ser Lys  Glu Asn Lys
    1235                1240                1245
```

```
Val Glu  Leu Ala Phe Ser Pro  Glu Gly Ile Glu Asp  Met Asn Gln
    1250                1255                1260

His Ile  Glu Arg Tyr Asn Asp  Gly Lys Lys His Gln  Pro Ile His
    1265                1270                1275

Lys Val  Arg Val Phe Glu Ile  Gly Ser Arg Phe Ser  Leu Gly Glu
    1280                1285                1290

Ser Gly  Asn Lys Lys Thr Lys  Phe Val Glu Ala Ala  Lys Gly Thr
    1295                1300                1305

Asn Leu  Phe Phe Ala Val Tyr  Gln Asp Asp Asn Lys  Gly Lys Arg
    1310                1315                1320

Asn Tyr  Glu Thr Ile Pro Leu  Asn Ile Val Ile Glu  Arg Gln Lys
    1325                1330                1335

Leu Gly  Leu His Ser Val Pro  Thr Glu Asp Ala Lys  Gly Gly Lys
    1340                1345                1350

Leu Leu  Phe His Leu Ser Pro  Asn Asp Met Val Tyr  Val Pro Thr
    1355                1360                1365

Ser Glu  Glu Leu Glu Asp Asn  Leu Ala Ser Val Asn  Ile Lys Arg
    1370                1375                1380

Leu Asn  Thr Ala Gln Arg Lys  Arg Ile Tyr Lys Val  Glu Lys Ala
    1385                1390                1395

Ser Gly  Val Glu Cys Tyr Phe  Ile Arg Gln Asp Ile  Ala Tyr Leu
    1400                1405                1410

Ile Lys  Asn Tyr Asp Ala Lys  Thr Lys Ile Gly Glu  Leu Glu Ser
    1415                1420                1425

Gln Asn  Lys Leu Gln Thr Thr  Met Thr Asp Asp Arg  Leu Lys Ile
```

```
    1430                1435                1440

Thr Asp  Val Cys Val Lys Leu  Asn Ile Asp Arg Leu  Gly Ser Ile
    1445                1450                1455

Ala Glu  Thr Phe Leu Gly Asn  Gln Tyr Gly Ala Ser  Lys Lys Thr
    1460                1465                1470
```

<210> 244
<211> 1365
<212> PRT
<213> Filifactor alocis

<400> 244

```
Met Thr Lys Glu Tyr Tyr Leu Gly Leu Asp Val Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ala Val Thr Asp Ser Gln Tyr Asn Leu Cys Lys Phe Lys Lys
            20                  25                  30

Lys Asp Met Trp Gly Ile Arg Leu Phe Glu Ser Ala Asn Thr Ala Lys
        35                  40                  45

Asp Arg Arg Leu Gln Arg Gly Asn Arg Arg Arg Leu Glu Arg Lys Lys
    50                  55                  60

Gln Arg Ile Asp Leu Leu Gln Glu Ile Phe Ser Pro Glu Ile Cys Lys
65                  70                  75                  80

Ile Asp Pro Thr Phe Phe Ile Arg Leu Asn Glu Ser Arg Leu His Leu
                85                  90                  95

Glu Asp Lys Ser Asn Asp Phe Lys Tyr Pro Leu Phe Ile Glu Lys Asp
            100                 105                 110

Tyr Ser Asp Ile Glu Tyr Tyr Lys Glu Phe Pro Thr Ile Phe His Leu
        115                 120                 125
```

```
Arg Lys His Leu Ile Glu Ser Glu Glu Lys Gln Asp Ile Arg Leu Ile
    130                 135                 140

Tyr Leu Ala Leu His Asn Ile Ile Lys Thr Arg Gly His Phe Leu Ile
145                 150                 155                 160

Asp Gly Asp Leu Gln Ser Ala Lys Gln Leu Arg Pro Ile Leu Asp Thr
                165                 170                 175

Phe Leu Leu Ser Leu Gln Glu Glu Gln Asn Leu Ser Val Ser Leu Ser
            180                 185                 190

Glu Asn Gln Lys Asp Glu Tyr Glu Glu Ile Leu Lys Asn Arg Ser Ile
        195                 200                 205

Ala Lys Ser Glu Lys Val Lys Lys Leu Lys Asn Leu Phe Glu Ile Ser
    210                 215                 220

Asp Glu Leu Glu Lys Glu Glu Lys Lys Ala Gln Ser Ala Val Ile Glu
225                 230                 235                 240

Asn Phe Cys Lys Phe Ile Val Gly Asn Lys Gly Asp Val Cys Lys Phe
                245                 250                 255

Leu Arg Val Ser Lys Glu Glu Leu Glu Ile Asp Ser Phe Ser Phe Ser
            260                 265                 270

Glu Gly Lys Tyr Glu Asp Asp Ile Val Lys Asn Leu Glu Glu Lys Val
        275                 280                 285

Pro Glu Lys Val Tyr Leu Phe Glu Gln Met Lys Ala Met Tyr Asp Trp
    290                 295                 300

Asn Ile Leu Val Asp Ile Leu Glu Thr Glu Glu Tyr Ile Ser Phe Ala
305                 310                 315                 320

Lys Val Lys Gln Tyr Glu Lys His Lys Thr Asn Leu Arg Leu Leu Arg
                325                 330                 335
```

```
Asp Ile Ile Leu Lys Tyr Cys Thr Lys Asp Glu Tyr Asn Arg Met Phe
            340                 345                 350

Asn Asp Glu Lys Glu Ala Gly Ser Tyr Thr Ala Tyr Val Gly Lys Leu
        355                 360                 365

Lys Lys Asn Asn Lys Lys Tyr Trp Ile Glu Lys Lys Arg Asn Pro Glu
    370                 375                 380

Glu Phe Tyr Lys Ser Leu Gly Lys Leu Leu Asp Lys Ile Glu Pro Leu
385                 390                 395                 400

Lys Glu Asp Leu Glu Val Leu Thr Met Met Ile Glu Glu Cys Lys Asn
                405                 410                 415

His Thr Leu Leu Pro Ile Gln Lys Asn Lys Asp Asn Gly Val Ile Pro
            420                 425                 430

His Gln Val His Glu Val Glu Leu Lys Lys Ile Leu Glu Asn Ala Lys
        435                 440                 445

Lys Tyr Tyr Ser Phe Leu Thr Glu Thr Asp Lys Asp Gly Tyr Ser Val
    450                 455                 460

Val Gln Lys Ile Glu Ser Ile Phe Arg Phe Arg Ile Pro Tyr Tyr Val
465                 470                 475                 480

Gly Pro Leu Ser Thr Arg His Gln Glu Lys Gly Ser Asn Val Trp Met
                485                 490                 495

Val Arg Lys Pro Gly Arg Glu Asp Arg Ile Tyr Pro Trp Asn Met Glu
            500                 505                 510

Glu Ile Ile Asp Phe Glu Lys Ser Asn Glu Asn Phe Ile Thr Arg Met
        515                 520                 525
```

```
Thr Asn Lys Cys Thr Tyr Leu Ile Gly Glu Asp Val Leu Pro Lys His
    530                 535                 540

Ser Leu Leu Tyr Ser Lys Tyr Met Val Leu Asn Glu Leu Asn Asn Val
545                 550                 555                 560

Lys Val Arg Gly Lys Lys Leu Pro Thr Ser Leu Lys Gln Lys Val Phe
                565                 570                 575

Glu Asp Leu Phe Glu Asn Lys Ser Lys Val Thr Gly Lys Asn Leu Leu
            580                 585                 590

Glu Tyr Leu Gln Ile Gln Asp Lys Asp Ile Gln Ile Asp Asp Leu Ser
        595                 600                 605

Gly Phe Asp Lys Asp Phe Lys Thr Ser Leu Lys Ser Tyr Leu Asp Phe
    610                 615                 620

Lys Lys Gln Ile Phe Gly Glu Glu Ile Glu Lys Glu Ser Ile Gln Asn
625                 630                 635                 640

Met Ile Glu Asp Ile Ile Lys Trp Ile Thr Ile Tyr Gly Asn Asp Lys
                645                 650                 655

Glu Met Leu Lys Arg Val Ile Arg Ala Asn Tyr Ser Asn Gln Leu Thr
            660                 665                 670

Glu Glu Gln Met Lys Lys Ile Thr Gly Phe Gln Tyr Ser Gly Trp Gly
        675                 680                 685

Asn Phe Ser Lys Met Phe Leu Lys Gly Ile Ser Gly Ser Asp Val Ser
    690                 695                 700

Thr Gly Glu Thr Phe Asp Ile Ile Thr Ala Met Trp Glu Thr Asp Asn
705                 710                 715                 720

Asn Leu Met Gln Ile Leu Ser Lys Lys Phe Thr Phe Met Asp Asn Val
                725                 730                 735
```

```
Glu Asp Phe Asn Ser Gly Lys Val Gly Lys Ile Asp Lys Ile Thr Tyr
            740                 745                 750

Asp Ser Thr Val Lys Glu Met Phe Leu Ser Pro Glu Asn Lys Arg Ala
        755                 760                 765

Val Trp Gln Thr Ile Gln Val Ala Glu Glu Ile Lys Lys Val Met Gly
    770                 775                 780

Cys Glu Pro Lys Lys Ile Phe Ile Glu Met Ala Arg Gly Gly Glu Lys
785                 790                 795                 800

Val Lys Lys Arg Thr Lys Ser Arg Lys Ala Gln Leu Leu Glu Leu Tyr
                805                 810                 815

Ala Ala Cys Glu Glu Asp Cys Arg Glu Leu Ile Lys Glu Ile Glu Asp
            820                 825                 830

Arg Asp Glu Arg Asp Phe Asn Ser Met Lys Leu Phe Leu Tyr Tyr Thr
        835                 840                 845

Gln Phe Gly Lys Cys Met Tyr Ser Gly Asp Asp Ile Asp Ile Asn Glu
    850                 855                 860

Leu Ile Arg Gly Asn Ser Lys Trp Asp Arg Asp His Ile Tyr Pro Gln
865                 870                 875                 880

Ser Lys Ile Lys Asp Asp Ser Ile Asp Asn Leu Val Leu Val Asn Lys
                885                 890                 895

Thr Tyr Asn Ala Lys Lys Ser Asn Glu Leu Leu Ser Glu Asp Ile Gln
            900                 905                 910

Lys Lys Met His Ser Phe Trp Leu Ser Leu Leu Asn Lys Lys Leu Ile
        915                 920                 925
```

```
Thr Lys Ser Lys Tyr Asp Arg Leu Thr Arg Lys Gly Asp Phe Thr Asp
    930                 935                 940

Glu Glu Leu Ser Gly Phe Ile Ala Arg Gln Leu Val Glu Thr Arg Gln
945                 950                 955                 960

Ser Thr Lys Ala Ile Ala Asp Ile Phe Lys Gln Ile Tyr Ser Ser Glu
                965                 970                 975

Val Val Tyr Val Lys Ser Ser Leu Val Ser Asp Phe Arg Lys Lys Pro
            980                 985                 990

Leu Asn Tyr Leu Lys Ser Arg Arg  Val Asn Asp Tyr His  His Ala Lys
        995                 1000                1005

Asp Ala  Tyr Leu Asn Ile Val  Val Gly Asn Val Tyr  Asn Lys Lys
    1010                1015                1020

Phe Thr  Ser Asn Pro Ile Gln  Trp Met Lys Lys Asn  Arg Asp Thr
    1025                1030                1035

Asn Tyr  Ser Leu Asn Lys Val  Phe Glu His Asp Val  Val Ile Asn
    1040                1045                1050

Gly Glu  Val Ile Trp Glu Lys  Cys Thr Tyr His Glu  Asp Thr Asn
    1055                1060                1065

Thr Tyr  Asp Gly Gly Thr Leu  Asp Arg Ile Arg Lys  Ile Val Glu
    1070                1075                1080

Arg Asp  Asn Ile Leu Tyr Thr  Glu Tyr Ala Tyr Cys  Glu Lys Gly
    1085                1090                1095

Glu Leu  Phe Asn Ala Thr Ile  Gln Asn Lys Asn Gly  Asn Ser Thr
    1100                1105                1110

Val Ser  Leu Lys Lys Gly Leu  Asp Val Lys Lys Tyr  Gly Gly Tyr
    1115                1120                1125
```

```
Phe Ser  Ala Asn Thr Ser Tyr  Phe Ser Leu Ile Glu  Phe Glu Asp
    1130                1135                1140

Lys Lys  Gly Asp Arg Ala Arg  His Ile Ile Gly Val  Pro Ile Tyr
    1145                1150                1155

Ile Ala  Asn Met Leu Glu His  Ser Pro Ser Ala Phe  Leu Glu Tyr
    1160                1165                1170

Cys Glu  Gln Lys Gly Tyr Gln  Asn Val Arg Ile Leu  Val Glu Lys
    1175                1180                1185

Ile Lys  Lys Asn Ser Leu Leu  Ile Ile Asn Gly Tyr  Pro Leu Arg
    1190                1195                1200

Ile Arg  Gly Glu Asn Glu Val  Asp Thr Ser Phe Lys  Arg Ala Ile
    1205                1210                1215

Gln Leu  Lys Leu Asp Gln Lys  Asn Tyr Glu Leu Val  Arg Asn Ile
    1220                1225                1230

Glu Lys  Phe Leu Glu Lys Tyr  Val Glu Lys Lys Gly  Asn Tyr Pro
    1235                1240                1245

Ile Asp  Glu Asn Arg Asp His  Ile Thr His Glu Lys  Met Asn Gln
    1250                1255                1260

Leu Tyr  Glu Val Leu Leu Ser  Lys Met Lys Lys Phe  Asn Lys Lys
    1265                1270                1275

Gly Met  Ala Asp Pro Ser Asp  Arg Ile Glu Lys Ser  Lys Pro Lys
    1280                1285                1290

Phe Ile  Lys Leu Glu Asp Leu  Ile Asp Lys Ile Asn  Val Ile Asn
    1295                1300                1305
```

```
Lys Met  Leu Asn Leu Leu Arg  Cys Asp Asn Asp Thr  Lys Ala Asp
    1310                1315                1320


Leu Ser  Leu Ile Glu Leu Pro  Lys Asn Ala Gly Ser  Phe Val Val
    1325                1330                1335


Lys Lys  Asn Thr Ile Gly Lys  Ser Lys Ile Ile Leu  Val Asn Gln
    1340                1345                1350


Ser Val  Thr Gly Leu Tyr Glu  Asn Arg Arg Glu Leu
    1355                1360                1365
```

<210> 245
<211> 1130
<212> PRT
<213> Streptococcus macedonicus

<400> 245

```
Met Thr Asn Gly Lys Ile Leu Gly Leu Asp Ile Gly Ile Ala Ser Val
1               5                   10                  15


Gly Val Gly Ile Ile Glu Ala Lys Thr Gly Lys Val Val His Ala Asn
            20                  25                  30


Ser Arg Leu Phe Ser Ala Ala Asn Ala Glu Asn Asn Ala Glu Arg Arg
        35                  40                  45


Gly Phe Arg Gly Ser Arg Arg Leu Asn Arg Arg Lys Lys His Arg Val
    50                  55                  60


Lys Arg Val Arg Asp Leu Phe Glu Lys Tyr Gly Ile Val Thr Asp Phe
65                  70                  75                  80


Arg Asn Leu Asn Leu Asn Pro Tyr Glu Leu Arg Val Lys Gly Leu Thr
                85                  90                  95


Glu Gln Leu Thr Asn Glu Glu Leu Phe Ala Ala Leu Arg Thr Ile Ser
            100                 105                 110
```

```
Lys Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Glu Asp Asp Ser Thr
        115                 120                 125

Gly Ser Thr Asp Tyr Ala Lys Ser Ile Asp Glu Asn Arg Arg Leu Leu
    130                 135                 140

Lys Thr Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Leu Glu Lys Tyr
145                 150                 155                 160

Gly Gln Leu Arg Gly Asn Phe Thr Val Tyr Asp Glu Asn Gly Glu Ala
                165                 170                 175

His Arg Leu Ile Asn Val Phe Ser Thr Ser Asp Tyr Glu Lys Glu Ala
            180                 185                 190

Arg Lys Ile Leu Glu Thr Gln Ala Asp Tyr Asn Lys Lys Ile Thr Ala
        195                 200                 205

Glu Phe Ile Asp Asp Tyr Val Glu Ile Leu Thr Gln Lys Arg Lys Tyr
    210                 215                 220

Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg Phe
225                 230                 235                 240

Arg Thr Asp Gly Thr Thr Leu Glu Asn Ile Phe Gly Ile Leu Ile Gly
                245                 250                 255

Lys Cys Asn Phe Tyr Pro Asp Glu Tyr Arg Ala Ser Lys Ala Ser Tyr
            260                 265                 270

Thr Ala Gln Glu Tyr Asn Phe Leu Asn Asp Leu Asn Asn Leu Lys Val
        275                 280                 285

Pro Thr Glu Thr Gly Lys Leu Ser Thr Glu Gln Lys Glu Ser Leu Val
    290                 295                 300

Glu Phe Ala Lys Asn Thr Ala Ile Leu Gly Pro Ala Lys Leu Leu Lys
```

```
305                 310                 315                 320

Glu Ile Ala Lys Ile Leu Asp Cys Lys Val Asp Glu Ile Lys Gly Tyr
                325                 330                 335

Arg Glu Asp Asp Lys Gly Lys Pro Asp Leu His Thr Phe Glu Pro Tyr
            340                 345                 350

Arg Lys Leu Lys Phe Asn Leu Asp Ser Val Asn Ile Asp Tyr Leu Ser
        355                 360                 365

Arg Glu Val Leu Asp Lys Leu Ala Asp Ile Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Glu Asp Ala Ile Lys Arg Asn Leu Pro Asn Gln Phe
385                 390                 395                 400

Thr Glu Glu Gln Ile Ser Glu Ile Ile Asn Val Arg Lys Ser Gln Ser
                405                 410                 415

Thr Ala Phe Asn Lys Gly Trp His Ser Phe Ser Ala Lys Leu Met Asn
            420                 425                 430

Glu Leu Ile Pro Glu Leu Tyr Ala Thr Ser Asp Glu Gln Met Thr Ile
        435                 440                 445

Leu Thr Arg Leu Glu Lys Phe Lys Val Lys Lys Lys Ser Ser Lys Asn
    450                 455                 460

Ile Lys Thr Ile Asp Glu Lys Glu Ile Thr Asp Glu Ile Tyr Asn Pro
465                 470                 475                 480

Val Val Ala Lys Ser Val Arg Gln Thr Ile Lys Ile Ile Asn Ala Ala
                485                 490                 495

Val Lys Lys Tyr Gly Asp Phe Asp Lys Ile Val Ile Glu Met Pro Arg
            500                 505                 510
```

```
Asp Lys Asn Ala Asp Asp Glu Lys Lys Phe Ile Asn Lys Arg Asn Lys
        515                 520                 525

Glu Asn Lys Lys Glu Lys Asp Asp Ala Leu Lys Arg Ala Ala Tyr Leu
    530                 535                 540

Tyr Asn Gly Thr Asp Lys Leu Pro Asp Glu Val Phe His Gly Asn Lys
545                 550                 555                 560

Gln Leu Glu Thr Lys Ile Arg Leu Trp Tyr Gln Gln Gly Glu Arg Cys
                565                 570                 575

Leu Tyr Ser Gly Lys Pro Ile Pro Ile Gln Glu Leu Val His Asn Ser
            580                 585                 590

Asn Asn Phe Glu Ile Asp His Ile Leu Pro Leu Ser Leu Ser Phe Asp
        595                 600                 605

Asp Ser Leu Ala Asn Lys Val Leu Val Tyr Ser Trp Thr Asn Gln Glu
    610                 615                 620

Lys Gly Gln Lys Thr Pro Tyr Gln Val Ile Asp Ser Met Asp Ala Ala
625                 630                 635                 640

Trp Ser Phe Arg Glu Met Lys Glu Tyr Val Leu Lys Gln Lys Gly Leu
                645                 650                 655

Gly Lys Lys Lys Arg Asp Tyr Leu Leu Thr Thr Glu Asn Ile Asp Lys
            660                 665                 670

Ile Glu Val Lys Lys Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Ala Ser Arg Val Val Leu Asn Ser Leu Gln Ser Ala Leu Arg Glu
    690                 695                 700

Leu Gly Lys Asp Thr Lys Val Ser Val Val Arg Gly Gln Phe Thr Ser
```

```
705                 710                 715                 720

Gln Leu Arg Arg Lys Trp Lys Ile Asp Lys Ser Arg Glu Thr Tyr His
                725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Lys
            740                 745                 750

Leu Trp Glu Lys Gln Asp Asn Pro Met Phe Val Asp Tyr Gly Asn Asn
        755                 760                 765

Gln Val Val Asp Lys Gln Thr Gly Glu Ile Leu Ser Val Ser Asp Asn
    770                 775                 780

Glu Tyr Lys Glu Leu Val Phe Gln Pro Pro Tyr Gln Gly Phe Val Asn
785                 790                 795                 800

Thr Ile Ser Ser Lys Gly Phe Glu Asp Glu Ile Leu Phe Ser Tyr Gln
                805                 810                 815

Val Asp Ser Lys Tyr Asn Arg Lys Val Ser Asp Ala Thr Ile Tyr Ser
            820                 825                 830

Thr Arg Lys Ala Lys Ile Gly Lys Asp Lys Lys Glu Glu Thr Tyr Val
        835                 840                 845

Leu Gly Lys Ile Lys Asp Ile Tyr Ser Gln Asn Gly Phe Asp Thr Phe
    850                 855                 860

Val Lys Lys Tyr Asn Lys Asp Lys Thr Gln Phe Leu Met Tyr Gln Lys
865                 870                 875                 880

Asp Pro Leu Thr Trp Glu Asn Val Ile Glu Val Ile Leu Gly Asp Tyr
                885                 890                 895

Pro Thr Thr Lys Lys Ser Glu Asp Gly Lys Asn Asp Val Lys Cys Asn
            900                 905                 910
```

```
Pro Phe Glu Glu Tyr Arg Arg Glu Asn Gly Leu Ile Cys Lys Tyr Ser
        915                 920                 925

Lys Lys Gly Lys Gly Thr Pro Ile Lys Ser Leu Lys Tyr Tyr Asp Lys
    930                 935                 940

Lys Leu Gly Asn Cys Ile Asp Ile Thr Pro Glu Glu Ser Arg Asn Lys
945                 950                 955                 960

Val Ile Leu Gln Ser Ile Asn Pro Trp Arg Ala Asp Val Tyr Phe Asn
                965                 970                 975

Pro Glu Thr Leu Lys Tyr Glu Leu Met Gly Leu Lys Tyr Ser Asp Leu
            980                 985                 990

Ser Phe Glu Lys Gly Thr Gly Asn  Tyr His Ile Ser Gln  Glu Lys Tyr
        995                 1000                1005

Asp Ala  Ile Lys Glu Lys Glu  Gly Ile Gly Lys Lys  Ser Glu Phe
    1010                1015                1020

Lys Phe  Thr Leu Tyr Arg Asn  Asp Leu Ile Leu Ile  Lys Asp Ile
    1025                1030                1035

Ala Ser  Gly Glu Gln Glu Ile  Tyr Arg Phe Leu Ser  Arg Thr Met
    1040                1045                1050

Pro Asn  Val Asn His Tyr Val  Glu Leu Lys Pro Tyr  Asp Lys Glu
    1055                1060                1065

Lys Phe  Asp Asn Val Gln Glu  Leu Val Glu Ala Leu  Gly Glu Ala
    1070                1075                1080

Asp Lys  Val Gly Arg Cys Ile  Lys Ser Leu Asn Lys  Pro Asn Ile
    1085                1090                1095

Ser Ile  Tyr Lys Val Arg Thr  Asp Val Leu Gly Asn  Lys Tyr Phe
```

```
    1100                1105                1110

Val Lys  Lys Glu Gly Asp Lys  Pro Lys Leu Asp Phe  Lys Asn Asn
    1115                1120                1125

Lys Lys
    1130
```

<210> 246
<211> 1367
<212> PRT
<213> Streptococcus pyogenes

<400> 246

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Gly Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125
```

```
His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Ile Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Arg Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Arg Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335
```

```
Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525
```

```
Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Ala Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Gly Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly His Ser Leu
705                 710                 715                 720

His Glu Gln Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735
```

```
Ile Leu Gln Thr Val Lys Ile Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
        755                 760                 765

Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu
    770                 775                 780

Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val
785                 790                 795                 800

Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln
                805                 810                 815

Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu
            820                 825                 830

Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp
        835                 840                 845

Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly
    850                 855                 860

Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn
865                 870                 875                 880

Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe
                885                 890                 895

Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys
            900                 905                 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925
```

```
His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu
    930                 935                 940

Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys
945                 950                 955                 960

Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu
                965                 970                 975

Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val
            980                 985                 990

Gly Thr Ala Leu Ile Lys Lys Tyr  Pro Lys Leu Glu Ser  Glu Phe Val
        995                 1000                1005

Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg Lys Met  Ile Ala Lys
    1010                1015                1020

Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala Lys Tyr  Phe Phe Tyr
    1025                1030                1035

Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu Ile Thr  Leu Ala Asn
    1040                1045                1050

Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu Thr Asn  Gly Glu Thr
    1055                1060                1065

Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp Phe Ala  Thr Val Arg
    1070                1075                1080

Lys Val  Leu Ser Met Pro Gln  Val Asn Ile Val Lys  Lys Thr Glu
    1085                1090                1095

Val Gln  Thr Gly Gly Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Arg
    1100                1105                1110

Asn Ser  Asp Lys Leu Ile Ala  Arg Lys Lys Asp Trp  Asp Pro Lys
    1115                1120                1125
```

```
Lys Tyr  Gly Gly Phe Asp Ser  Pro Thr Val Ala Tyr  Ser Val Leu
    1130                1135                1140

Val Val  Ala Lys Val Glu Lys  Gly Lys Ser Lys Lys  Leu Lys Ser
    1145                1150                1155

Val Lys  Glu Leu Leu Gly Ile  Thr Ile Met Glu Arg  Ser Ser Phe
    1160                1165                1170

Glu Lys  Asn Pro Ile Asp Phe  Leu Glu Ala Lys Gly  Tyr Lys Glu
    1175                1180                1185

Val Lys  Lys Asp Leu Ile Ile  Lys Leu Pro Lys Tyr  Ser Leu Phe
    1190                1195                1200

Glu Leu  Glu Asn Gly Arg Lys  Arg Met Leu Ala Ser  Ala Gly Glu
    1205                1210                1215

Leu Gln  Lys Gly Asn Glu Leu  Ala Leu Pro Ser Lys  Tyr Val Asn
    1220                1225                1230

Phe Leu  Tyr Leu Ala Ser His  Tyr Glu Lys Leu Lys  Gly Ser Pro
    1235                1240                1245

Glu Asp  Asn Glu Gln Lys Gln  Leu Phe Val Glu Gln  His Lys His
    1250                1255                1260

Tyr Leu  Asp Glu Ile Ile Glu  Gln Ile Ser Glu Phe  Ser Lys Arg
    1265                1270                1275

Val Ile  Leu Ala Asp Ala Asn  Leu Asp Lys Val Leu  Ser Ala Tyr
    1280                1285                1290

Asn Lys  His Arg Asp Lys Pro  Ile Arg Glu Gln Ala  Glu Asn Ile
    1295                1300                1305
```

```
Ile His  Leu Phe Thr Leu Thr  Asn Leu Gly Ala Pro  Ala Ala Phe
    1310                1315                1320


Lys Tyr  Phe Asp Thr Thr Ile  Asp Arg Lys Arg Tyr  Thr Ser Thr
    1325                1330                1335


Lys Glu  Val Leu Asp Ala Thr  Leu Ile His Gln Ser  Ile Thr Gly
    1340                1345                1350


Leu Tyr  Glu Thr Arg Ile Asp  Leu Ser Gln Leu Gly  Gly Asp
    1355                1360                1365
```

<210> 247
<211> 1233
<212> PRT
<213> Mycoplasma canis

<400> 247

```
Met Glu Lys Lys Arg Lys Val Thr Leu Gly Phe Asp Leu Gly Ile Ala
1               5                   10                  15


Ser Val Gly Trp Ala Ile Val Asp Ser Glu Thr Asn Gln Val Tyr Lys
            20                  25                  30


Leu Gly Ser Arg Leu Phe Asp Ala Pro Asp Thr Asn Leu Glu Arg Arg
        35                  40                  45


Thr Gln Arg Gly Thr Arg Arg Leu Leu Arg Arg Arg Lys Tyr Arg Asn
    50                  55                  60


Gln Lys Phe Tyr Asn Leu Val Lys Arg Thr Glu Val Phe Gly Leu Ser
65                  70                  75                  80


Ser Arg Glu Ala Ile Glu Asn Arg Phe Arg Glu Leu Ser Ile Lys Tyr
                85                  90                  95


Pro Asn Ile Ile Glu Leu Lys Thr Lys Ala Leu Ser Gln Glu Val Cys
            100                 105                 110
```

```
Pro Asp Glu Ile Ala Trp Ile Leu His Asp Tyr Leu Lys Asn Arg Gly
        115                 120                 125

Tyr Phe Tyr Asp Glu Lys Glu Thr Lys Glu Asp Phe Asp Gln Gln Thr
    130                 135                 140

Val Glu Ser Met Pro Ser Tyr Lys Leu Asn Glu Phe Tyr Lys Lys Tyr
145                 150                 155                 160

Gly Tyr Phe Lys Gly Ala Leu Ser Gln Pro Thr Glu Ser Glu Met Lys
                165                 170                 175

Asp Asn Lys Asp Leu Lys Glu Ala Phe Phe Phe Asp Phe Ser Asn Lys
            180                 185                 190

Glu Trp Leu Lys Glu Ile Asn Tyr Phe Phe Asn Val Gln Lys Asn Ile
        195                 200                 205

Leu Ser Glu Thr Phe Ile Glu Glu Phe Lys Lys Ile Phe Ser Phe Thr
    210                 215                 220

Arg Asp Ile Ser Lys Gly Pro Gly Ser Asp Asn Met Pro Ser Pro Tyr
225                 230                 235                 240

Gly Ile Phe Gly Glu Phe Gly Asp Asn Gly Gln Gly Gly Arg Tyr Glu
                245                 250                 255

His Ile Trp Asp Lys Asn Ile Gly Lys Cys Ser Ile Phe Thr Asn Glu
            260                 265                 270

Gln Arg Ala Pro Lys Tyr Leu Pro Ser Ala Leu Ile Phe Asn Phe Leu
        275                 280                 285

Asn Glu Leu Ala Asn Ile Arg Leu Tyr Ser Thr Asp Lys Lys Asn Ile
    290                 295                 300

Gln Pro Leu Trp Lys Leu Ser Ser Val Asp Lys Leu Asn Ile Leu Leu
```

```
305                 310                 315                 320

Asn Leu Phe Asn Leu Pro Ile Ser Glu Lys Lys Lys Lys Leu Thr Ser
                325                 330                 335

Thr Asn Ile Asn Asp Ile Val Lys Lys Glu Ser Ile Lys Ser Ile Met
            340                 345                 350

Ile Ser Val Glu Asp Ile Asp Met Ile Lys Asp Glu Trp Ala Gly Lys
        355                 360                 365

Glu Pro Asn Val Tyr Gly Val Gly Leu Ser Gly Leu Asn Ile Glu Glu
    370                 375                 380

Ser Ala Lys Glu Asn Lys Phe Lys Phe Gln Asp Leu Lys Ile Leu Asn
385                 390                 395                 400

Val Leu Ile Asn Leu Leu Asp Asn Val Gly Ile Lys Phe Glu Phe Lys
                405                 410                 415

Asp Arg Asn Asp Ile Ile Lys Asn Leu Glu Leu Leu Asp Asn Leu Tyr
            420                 425                 430

Leu Phe Leu Ile Tyr Gln Lys Glu Ser Asn Asn Lys Asp Ser Ser Ile
        435                 440                 445

Asp Leu Phe Ile Ala Lys Asn Glu Ser Leu Asn Ile Glu Asn Leu Lys
    450                 455                 460

Leu Lys Leu Lys Glu Phe Leu Leu Gly Ala Gly Asn Glu Phe Glu Asn
465                 470                 475                 480

His Asn Ser Lys Thr His Ser Leu Ser Lys Lys Ala Ile Asp Glu Ile
                485                 490                 495

Leu Pro Lys Leu Leu Asp Asn Asn Glu Gly Trp Asn Leu Glu Ala Ile
            500                 505                 510
```

```
Lys Asn Tyr Asp Glu Glu Ile Lys Ser Gln Ile Glu Asp Asn Ser Ser
        515                 520                 525

Leu Met Ala Lys Gln Asp Lys Lys Tyr Leu Asn Asp Asn Phe Leu Lys
    530                 535                 540

Asp Ala Ile Leu Pro Pro Asn Val Lys Val Thr Phe Gln Gln Ala Ile
545                 550                 555                 560

Leu Ile Phe Asn Lys Ile Ile Gln Lys Phe Ser Lys Asp Phe Glu Ile
                565                 570                 575

Asp Lys Val Val Ile Glu Leu Ala Arg Glu Met Thr Gln Asp Gln Glu
            580                 585                 590

Asn Asp Ala Leu Lys Gly Ile Ala Lys Ala Gln Lys Ser Lys Lys Ser
        595                 600                 605

Leu Val Glu Glu Arg Leu Glu Ala Asn Asn Ile Asp Lys Ser Val Phe
    610                 615                 620

Asn Asp Lys Tyr Glu Lys Leu Ile Tyr Lys Ile Phe Leu Trp Ile Ser
625                 630                 635                 640

Gln Asp Phe Lys Asp Pro Tyr Thr Gly Ala Gln Ile Ser Val Asn Glu
                645                 650                 655

Ile Val Asn Asn Lys Val Glu Ile Asp His Ile Ile Pro Tyr Ser Leu
            660                 665                 670

Cys Phe Asp Asp Ser Ser Ala Asn Lys Val Leu Val His Lys Gln Ser
        675                 680                 685

Asn Gln Glu Lys Ser Asn Ser Leu Pro Tyr Glu Tyr Ile Lys Gln Gly
    690                 695                 700

His Ser Gly Trp Asn Trp Asp Glu Phe Thr Lys Tyr Val Lys Arg Val
```

```
705                 710                 715                 720

Phe Val Asn Asn Val Asp Ser Ile Leu Ser Lys Lys Glu Arg Leu Lys
                725                 730                 735

Lys Ser Glu Asn Leu Leu Thr Ala Ser Tyr Asp Gly Tyr Asp Lys Leu
            740                 745                 750

Gly Phe Leu Ala Arg Asn Leu Asn Asp Thr Arg Tyr Ala Thr Ile Leu
        755                 760                 765

Phe Arg Asp Gln Leu Asn Asn Tyr Ala Glu His His Leu Ile Asp Asn
    770                 775                 780

Lys Lys Met Phe Lys Val Ile Ala Met Asn Gly Ala Val Thr Ser Phe
785                 790                 795                 800

Ile Arg Lys Asn Met Ser Tyr Asp Asn Lys Leu Arg Leu Lys Asp Arg
                805                 810                 815

Ser Asp Phe Ser His His Ala Tyr Asp Ala Ala Ile Ile Ala Leu Phe
            820                 825                 830

Ser Asn Lys Thr Lys Thr Leu Tyr Asn Leu Ile Asp Pro Ser Leu Asn
        835                 840                 845

Gly Ile Ile Ser Lys Arg Ser Glu Gly Tyr Trp Val Ile Glu Asp Arg
    850                 855                 860

Tyr Thr Gly Glu Ile Lys Glu Leu Lys Lys Glu Asp Trp Thr Ser Ile
865                 870                 875                 880

Lys Asn Asn Val Gln Ala Arg Lys Ile Ala Lys Glu Ile Glu Glu Tyr
                885                 890                 895

Leu Ile Asp Leu Asp Asp Glu Val Phe Phe Ser Arg Lys Thr Lys Arg
            900                 905                 910
```

```
Lys Thr Asn Arg Gln Leu Tyr Asn Glu Thr Ile Tyr Gly Ile Ala Thr
        915                 920                 925


Lys Thr Asp Glu Asp Gly Ile Thr Asn Tyr Tyr Lys Lys Glu Lys Phe
    930                 935                 940


Ser Ile Leu Asp Asp Lys Asp Ile Tyr Leu Arg Leu Leu Arg Glu Arg
945                 950                 955                 960


Glu Lys Phe Val Ile Asn Gln Ser Asn Pro Glu Val Ile Asp Gln Ile
                965                 970                 975


Ile Glu Ile Ile Glu Ser Tyr Gly Lys Glu Asn Asn Ile Pro Ser Arg
            980                 985                 990


Asp Glu Ala Ile Asn Ile Lys Tyr  Thr Lys Asn Lys Ile  Asn Tyr Asn
        995                 1000                1005


Leu Tyr  Leu Lys Gln Tyr Met  Arg Ser Leu Thr Lys  Ser Leu Asp
    1010                1015                1020


Gln Phe  Ser Glu Glu Phe Ile  Asn Gln Met Ile Ala  Asn Lys Thr
    1025                1030                1035


Phe Val  Leu Tyr Asn Pro Thr  Lys Asn Thr Thr Arg  Lys Ile Lys
    1040                1045                1050


Phe Leu  Arg Leu Val Asn Asp  Val Lys Ile Asn Asp  Ile Arg Lys
    1055                1060                1065


Asn Gln  Val Ile Asn Lys Phe  Asn Gly Lys Asn Asn  Glu Pro Lys
    1070                1075                1080


Ala Phe  Tyr Glu Asn Ile Asn  Ser Leu Gly Ala Ile  Val Phe Lys
    1085                1090                1095


Asn Ser  Ala Asn Asn Phe Lys  Thr Leu Ser Ile Asn  Thr Gln Ile
```

```
    1100                1105                1110

Ala Ile  Phe Gly Asp Lys Asn  Trp Asp Ile Glu Asp  Phe Lys Thr
    1115                1120                1125

Tyr Asn  Met Glu Lys Ile Glu  Lys Tyr Lys Glu Ile  Tyr Gly Ile
    1130                1135                1140

Asp Lys  Thr Tyr Asn Phe His  Ser Phe Ile Phe Pro  Gly Thr Ile
    1145                1150                1155

Leu Leu  Asp Lys Gln Asn Lys  Glu Phe Tyr Tyr Ile  Ser Ser Ile
    1160                1165                1170

Gln Thr  Val Arg Asp Ile Ile  Glu Ile Lys Phe Leu  Asn Lys Ile
    1175                1180                1185

Glu Phe  Lys Asp Glu Asn Lys  Asn Gln Asp Thr Ser  Lys Thr Pro
    1190                1195                1200

Lys Arg  Leu Met Phe Gly Ile  Lys Ser Ile Met Asn  Asn Tyr Glu
    1205                1210                1215

Gln Val  Asp Ile Ser Pro Phe  Gly Ile Asn Lys Lys  Ile Phe Glu
    1220                1225                1230
```

<210> 248
<211> 1375
<212> PRT
<213> Lactobacillus johnsonii

<400> 248

```
Met Thr Lys Ile Lys Asp Asp Tyr Ile Val Gly Leu Asp Ile Gly Thr
1               5                   10                  15

Asp Ser Cys Gly Trp Val Ala Met Asn Ser Asn Asn Asp Ile Leu Lys
            20                  25                  30
```

```
Leu Gln Gly Lys Thr Ala Ile Gly Ser Arg Leu Phe Glu Gly Gly Lys
        35                  40                  45

Ser Ala Ala Glu Arg Arg Leu Phe Arg Thr Thr His Arg Arg Ile Lys
    50                  55                  60

Arg Arg Arg Trp Arg Leu Lys Leu Leu Glu Glu Phe Phe Asp Pro Tyr
65                  70                  75                  80

Met Ala Glu Val Asp Pro Tyr Phe Phe Ala Arg Leu Lys Glu Ser Gly
                85                  90                  95

Leu Ser Pro Leu Asp Lys Arg Lys Thr Val Ser Ser Ile Val Phe Pro
            100                 105                 110

Thr Ser Ala Glu Asp Lys Lys Phe Tyr Asp Asp Tyr Pro Thr Ile Tyr
        115                 120                 125

His Leu Arg Tyr Lys Leu Met Thr Glu Asp Glu Lys Phe Asp Leu Arg
    130                 135                 140

Glu Val Tyr Leu Ala Ile His His Ile Ile Lys Tyr Arg Gly Asn Phe
145                 150                 155                 160

Leu Tyr Asn Thr Ser Val Lys Asp Phe Lys Ala Ser Lys Ile Asp Val
                165                 170                 175

Lys Ser Ser Ile Glu Lys Leu Asn Glu Leu Tyr Glu Asn Leu Gly Leu
            180                 185                 190

Asp Leu Asn Val Glu Phe Asn Ile Ser Asn Thr Ala Glu Ile Glu Lys
        195                 200                 205

Val Leu Lys Asp Lys Gln Ile Phe Lys Arg Asp Lys Val Lys Lys Ile
    210                 215                 220

Ala Glu Leu Phe Ala Ile Lys Thr Asp Asn Lys Glu Gln Ser Lys Arg
225                 230                 235                 240
```

```
Ile Lys Asp Ile Ser Lys Gln Val Ala Asn Ala Val Leu Gly Tyr Lys
                245                 250                 255

Thr Arg Phe Asp Thr Ile Ala Leu Lys Glu Ile Ser Lys Asp Glu Leu
            260                 265                 270

Ser Asp Trp Asn Phe Lys Leu Ser Asp Ile Asp Ala Asp Ser Lys Phe
        275                 280                 285

Glu Ala Leu Met Gly Asn Leu Asp Glu Asn Glu Gln Ala Ile Leu Leu
    290                 295                 300

Thr Ile Lys Glu Leu Phe Asn Glu Val Thr Leu Asn Gly Ile Val Glu
305                 310                 315                 320

Asp Gly Asn Thr Leu Ser Glu Ser Met Ile Asn Lys Tyr Asn Asp His
                325                 330                 335

Arg Asp Asp Leu Lys Leu Leu Lys Glu Val Ile Glu Asn His Ile Asp
            340                 345                 350

Arg Lys Lys Ala Lys Glu Leu Ala Leu Ala Tyr Asp Leu Tyr Val Asn
        355                 360                 365

Asn Arg His Gly Gln Leu Leu Gln Ala Lys Lys Lys Leu Gly Lys Ile
    370                 375                 380

Lys Pro Arg Ser Lys Glu Asp Phe Tyr Lys Val Val Asn Lys Asn Leu
385                 390                 395                 400

Asp Asp Ser Arg Ala Ser Lys Glu Ile Lys Lys Lys Ile Glu Leu Asp
                405                 410                 415

Ser Phe Met Pro Lys Gln Arg Thr Asn Ala Asn Gly Val Ile Pro Tyr
            420                 425                 430
```

```
Gln Leu Gln Gln Leu Glu Leu Asp Lys Ile Ile Glu Asn Gln Ser Lys
        435                 440                 445

Tyr Tyr Pro Phe Leu Lys Glu Ile Asn Pro Val Ser Ser His Leu Lys
    450                 455                 460

Glu Ala Pro Tyr Lys Leu Asp Glu Leu Ile Arg Phe Arg Val Pro Tyr
465                 470                 475                 480

Tyr Val Gly Pro Leu Ile Ser Pro Asn Glu Ser Thr Lys Asp Ile Gln
                485                 490                 495

Thr Lys Lys Asn Gln Asn Phe Ala Trp Met Ile Arg Lys Glu Glu Gly
            500                 505                 510

Arg Ile Thr Pro Trp Asn Phe Asp Gln Lys Val Asp Arg Ile Glu Ser
        515                 520                 525

Ala Asn Lys Phe Ile Lys Arg Met Thr Thr Lys Asp Thr Tyr Leu Phe
    530                 535                 540

Gly Glu Asp Val Leu Pro Ala Asn Ser Leu Leu Tyr Gln Lys Phe Thr
545                 550                 555                 560

Val Leu Asn Glu Leu Asn Asn Ile Arg Ile Asn Gly Lys Arg Ile Ser
                565                 570                 575

Val Asp Leu Lys Gln Glu Ile Tyr Glu Asn Leu Phe Lys Lys His Thr
            580                 585                 590

Thr Val Thr Val Lys Lys Leu Glu Asn Tyr Leu Lys Glu Asn His Asn
        595                 600                 605

Leu Val Lys Val Glu Ile Lys Gly Leu Ala Asp Glu Lys Lys Phe Asn
    610                 615                 620

Ser Gly Leu Thr Thr Tyr Asn Arg Phe Lys Asn Leu Asn Ile Phe Asp
625                 630                 635                 640
```

```
Asn Gln Ile Asp Asp Leu Lys Tyr Arg Asn Asp Phe Glu Lys Ile Ile
               645                 650                 655

Glu Trp Ser Thr Ile Phe Glu Asp Lys Ser Ile Tyr Lys Glu Lys Leu
            660                 665                 670

Arg Ser Ile Asp Trp Leu Asn Glu Lys Gln Ile Asn Ala Leu Ser Asn
        675                 680                 685

Ile Arg Leu Gln Gly Trp Gly Arg Leu Ser Lys Lys Leu Leu Ala Gln
    690                 695                 700

Leu His Asp His Asn Gly Gln Thr Ile Ile Glu Gln Leu Trp Asp Ser
705                 710                 715                 720

Gln Asn Asn Phe Met Gln Ile Val Thr Gln Ala Asp Phe Lys Asp Ala
               725                 730                 735

Ile Ala Lys Ala Asn Gln Asn Leu Leu Val Ala Thr Ser Val Glu Asp
            740                 745                 750

Ile Leu Asn Asn Ala Tyr Thr Ser Pro Ala Asn Lys Lys Ala Ile Arg
        755                 760                 765

Gln Val Ile Lys Val Val Asp Asp Ile Val Lys Ala Ala Ser Gly Lys
    770                 775                 780

Val Pro Lys Gln Ile Ala Ile Glu Phe Thr Arg Asp Ala Asp Glu Asn
785                 790                 795                 800

Pro Lys Arg Ser Gln Thr Arg Gly Ser Lys Leu Gln Lys Val Tyr Lys
               805                 810                 815

Asp Leu Ser Thr Glu Leu Ala Ser Lys Thr Ile Ala Glu Glu Leu Asn
            820                 825                 830
```

```
Glu Ala Ile Lys Asp Lys Lys Leu Val Gln Asp Lys Tyr Tyr Leu Tyr
        835                 840                 845

Phe Met Gln Leu Gly Arg Asp Ala Tyr Thr Gly Glu Pro Ile Asn Ile
    850                 855                 860

Asp Glu Ile Gln Lys Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Phe
865                 870                 875                 880

Ile Lys Asp Asp Ala Leu Asp Asn Arg Val Leu Val Ser Arg Ala Val
                885                 890                 895

Asn Asn Gly Lys Ser Asp Asn Val Pro Val Lys Leu Phe Gly Asn Glu
            900                 905                 910

Met Ala Ala Asn Leu Gly Met Thr Ile Arg Lys Met Trp Glu Glu Trp
        915                 920                 925

Lys Asn Ile Gly Leu Ile Ser Lys Thr Lys Tyr Asn Asn Leu Leu Thr
    930                 935                 940

Asp Pro Asp His Ile Asn Lys Tyr Lys Ser Ala Gly Phe Ile Arg Arg
945                 950                 955                 960

Gln Leu Val Glu Thr Ser Gln Ile Ile Lys Leu Val Ser Thr Ile Leu
                965                 970                 975

Gln Ser Arg Tyr Pro Asn Thr Glu Ile Ile Thr Val Lys Ala Lys Tyr
            980                 985                 990

Asn His Tyr Leu Arg Glu Lys Phe  Asp Leu Tyr Lys Ser  Arg Glu Val
        995                 1000                1005

Asn Asp  Tyr His His Ala Ile  Asp Ala Tyr Leu Ser  Ala Ile Cys
    1010                1015                1020

Gly Asn  Leu Leu Tyr Gln Asn  Tyr Pro Asn Leu Arg  Pro Phe Phe
    1025                1030                1035
```

```
Val Tyr  Gly Gln Tyr Lys Lys  Phe Ser Ser Asp Pro  Asp Lys Glu
    1040                1045                1050

Lys Ala  Ile Phe Asn Lys Thr  Arg Lys Phe Ser Phe  Ile Ser Gln
    1055                1060                1065

Leu Leu  Lys Asn Lys Ser Glu  Asn Ser Lys Glu Ile  Ala Lys Lys
    1070                1075                1080

Leu Lys  Arg Ala Tyr Gln Phe  Lys Tyr Met Leu Val  Ser Arg Glu
    1085                1090                1095

Thr Glu  Thr Arg Asp Gln Glu  Met Phe Lys Met Thr  Val Tyr Pro
    1100                1105                1110

Arg Phe  Ser His Asp Thr Val  Lys Ala Pro Arg Asn  Leu Ile Pro
    1115                1120                1125

Lys Lys  Met Gly Met Ser Pro  Asp Ile Tyr Gly Gly  Tyr Thr Asn
    1130                1135                1140

Asn Ser  Asp Ala Tyr Met Val  Ile Val Arg Ile Asp  Lys Lys Lys
    1145                1150                1155

Gly Thr  Glu Tyr Lys Ile Leu  Gly Ile Pro Thr Arg  Glu Leu Val
    1160                1165                1170

Asn Leu  Lys Lys Ala Glu Lys  Glu Asp His Tyr Lys  Ser Tyr Leu
    1175                1180                1185

Lys Glu  Ile Leu Thr Pro Arg  Ile Leu Tyr Asn Lys  Asn Gly Lys
    1190                1195                1200

Arg Asp  Lys Lys Ile Thr Ser  Phe Glu Ile Val Lys  Ser Lys Ile
    1205                1210                1215
```

```
Pro Tyr  Lys Gln Val Ile Gln  Asp Gly Asp Lys Lys  Phe Met Leu
    1220                1225                1230

Gly Ser  Ser Thr Tyr Val Tyr  Asn Ala Lys Gln Leu  Thr Leu Ser
    1235                1240                1245

Thr Glu  Ser Met Lys Ala Ile  Thr Asn Asn Phe Asp  Lys Asp Ser
    1250                1255                1260

Asp Glu  Asn Asp Ala Leu Ile  Lys Ala Tyr Asp Glu  Ile Leu Asp
    1265                1270                1275

Lys Val  Asp Lys Tyr Leu Pro  Leu Phe Asp Ile Asn  Lys Phe Arg
    1280                1285                1290

Glu Lys  Leu His Ser Gly Arg  Glu Lys Phe Ile Lys  Leu Ser Leu
    1295                1300                1305

Glu Asp  Lys Lys Asp Thr Ile  Leu Lys Val Leu Glu  Gly Leu His
    1310                1315                1320

Asp Asn  Ala Val Met Thr Lys  Ile Pro Thr Ile Gly  Leu Ser Thr
    1325                1330                1335

Pro Leu  Gly Phe Met Gln Phe  Pro Asn Gly Val Ile  Leu Ser Glu
    1340                1345                1350

Asn Ala  Lys Leu Ile Tyr Gln  Ser Pro Thr Gly Leu  Phe Lys Lys
    1355                1360                1365

Ser Val  Lys Ile Ser Asp Leu
    1370                1375
```

<210> 249
<211> 1053
<212> PRT
<213> Staphylococcus aureus

<400> 249

```
Met Lys Arg Asn Tyr Ile Leu Gly Leu Asp Ile Gly Ile Thr Ser Val
1               5                  10                  15

Gly Tyr Gly Ile Ile Asp Tyr Glu Thr Arg Asp Val Ile Asp Ala Gly
            20                  25                  30

Val Arg Leu Phe Lys Glu Ala Asn Val Glu Asn Asn Glu Gly Arg Arg
        35                  40                  45

Ser Lys Arg Gly Ala Arg Arg Leu Lys Arg Arg Arg Arg His Arg Ile
    50                  55                  60

Gln Arg Val Lys Lys Leu Leu Phe Asp Tyr Asn Leu Leu Thr Asp His
65                  70                  75                  80

Ser Glu Leu Ser Gly Ile Asn Pro Tyr Glu Ala Arg Val Lys Gly Leu
                85                  90                  95

Ser Gln Lys Leu Ser Glu Glu Glu Phe Ser Ala Ala Leu Leu His Leu
            100                 105                 110

Ala Lys Arg Arg Gly Val His Asn Val Asn Glu Val Glu Glu Asp Thr
        115                 120                 125

Gly Asn Glu Leu Ser Thr Lys Glu Gln Ile Ser Arg Asn Ser Lys Ala
    130                 135                 140

Leu Glu Glu Lys Tyr Val Ala Glu Leu Gln Leu Glu Arg Leu Lys Lys
145                 150                 155                 160

Asp Gly Glu Val Arg Gly Ser Ile Asn Arg Phe Lys Thr Ser Asp Tyr
                165                 170                 175

Val Lys Glu Ala Lys Gln Leu Leu Lys Val Gln Lys Ala Tyr His Gln
            180                 185                 190

Leu Asp Gln Ser Phe Ile Asp Thr Tyr Ile Asp Leu Leu Glu Thr Arg
```

```
        195                 200                 205

Arg Thr Tyr Tyr Glu Gly Pro Gly Glu Gly Ser Pro Phe Gly Trp Lys
    210                 215                 220

Asp Ile Lys Glu Trp Tyr Glu Met Leu Met Gly His Cys Thr Tyr Phe
225                 230                 235                 240

Pro Glu Glu Leu Arg Ser Val Lys Tyr Ala Tyr Asn Ala Asp Leu Tyr
                245                 250                 255

Asn Ala Leu Asn Asp Leu Asn Asn Leu Val Ile Thr Arg Asp Glu Asn
            260                 265                 270

Glu Lys Leu Glu Tyr Tyr Glu Lys Phe Gln Ile Ile Glu Asn Val Phe
        275                 280                 285

Lys Gln Lys Lys Lys Pro Thr Leu Lys Gln Ile Ala Lys Glu Ile Leu
    290                 295                 300

Val Asn Glu Glu Asp Ile Lys Gly Tyr Arg Val Thr Ser Thr Gly Lys
305                 310                 315                 320

Pro Glu Phe Thr Asn Leu Lys Val Tyr His Asp Ile Lys Asp Ile Thr
                325                 330                 335

Ala Arg Lys Glu Ile Ile Glu Asn Ala Glu Leu Leu Asp Gln Ile Ala
            340                 345                 350

Lys Ile Leu Thr Ile Tyr Gln Ser Ser Glu Asp Ile Gln Glu Glu Leu
        355                 360                 365

Thr Asn Leu Asn Ser Glu Leu Thr Gln Glu Glu Ile Glu Gln Ile Ser
    370                 375                 380

Asn Leu Lys Gly Tyr Thr Gly Thr His Asn Leu Ser Leu Lys Ala Ile
385                 390                 395                 400
```

```
Asn Leu Ile Leu Asp Glu Leu Trp His Thr Asn Asp Asn Gln Ile Ala
                405                 410                 415

Ile Phe Asn Arg Leu Lys Leu Val Pro Lys Lys Val Asp Leu Ser Gln
            420                 425                 430

Gln Lys Glu Ile Pro Thr Thr Leu Val Asp Asp Phe Ile Leu Ser Pro
        435                 440                 445

Val Val Lys Arg Ser Phe Ile Gln Ser Ile Lys Val Ile Asn Ala Ile
    450                 455                 460

Ile Lys Lys Tyr Gly Leu Pro Asn Asp Ile Ile Ile Glu Leu Ala Arg
465                 470                 475                 480

Glu Lys Asn Ser Lys Asp Ala Gln Lys Met Ile Asn Glu Met Gln Lys
                485                 490                 495

Arg Asn Arg Gln Thr Asn Glu Arg Ile Glu Glu Ile Ile Arg Thr Thr
            500                 505                 510

Gly Lys Glu Asn Ala Lys Tyr Leu Ile Glu Lys Ile Lys Leu His Asp
        515                 520                 525

Met Gln Glu Gly Lys Cys Leu Tyr Ser Leu Glu Ala Ile Pro Leu Glu
    530                 535                 540

Asp Leu Leu Asn Asn Pro Phe Asn Tyr Glu Val Asp His Ile Ile Pro
545                 550                 555                 560

Arg Ser Val Ser Phe Asp Asn Ser Phe Asn Asn Lys Val Leu Val Lys
                565                 570                 575

Gln Glu Glu Asn Ser Lys Lys Gly Asn Arg Thr Pro Phe Gln Tyr Leu
            580                 585                 590

Ser Ser Ser Asp Ser Lys Ile Ser Tyr Glu Thr Phe Lys Lys His Ile
```

```
        595                 600                 605

Leu Asn Leu Ala Lys Gly Lys Gly Arg Ile Ser Lys Thr Lys Lys Glu
    610                 615                 620

Tyr Leu Leu Glu Glu Arg Asp Ile Asn Arg Phe Ser Val Gln Lys Asp
625                 630                 635                 640

Phe Ile Asn Arg Asn Leu Val Asp Thr Arg Tyr Ala Thr Arg Gly Leu
                645                 650                 655

Met Asn Leu Leu Arg Ser Tyr Phe Arg Val Asn Asn Leu Asp Val Lys
            660                 665                 670

Val Lys Ser Ile Asn Gly Gly Phe Thr Ser Phe Leu Arg Arg Lys Trp
        675                 680                 685

Lys Phe Lys Lys Glu Arg Asn Lys Gly Tyr Lys His His Ala Glu Asp
    690                 695                 700

Ala Leu Ile Ile Ala Asn Ala Asp Phe Ile Phe Lys Glu Trp Lys Lys
705                 710                 715                 720

Leu Asp Lys Ala Lys Lys Val Met Glu Asn Gln Met Phe Glu Glu Lys
                725                 730                 735

Gln Ala Glu Ser Met Pro Glu Ile Glu Thr Glu Gln Glu Tyr Lys Glu
            740                 745                 750

Ile Phe Ile Thr Pro His Gln Ile Lys His Ile Lys Asp Phe Lys Asp
        755                 760                 765

Tyr Lys Tyr Ser His Arg Val Asp Lys Lys Pro Asn Arg Glu Leu Ile
    770                 775                 780

Asn Asp Thr Leu Tyr Ser Thr Arg Lys Asp Asp Lys Gly Asn Thr Leu
785                 790                 795                 800
```

```
Ile Val Asn Asn Leu Asn Gly Leu Tyr Asp Lys Asp Asn Asp Lys Leu
               805                 810                 815

Lys Lys Leu Ile Asn Lys Ser Pro Glu Lys Leu Leu Met Tyr His His
            820                 825                 830

Asp Pro Gln Thr Tyr Gln Lys Leu Lys Leu Ile Met Glu Gln Tyr Gly
        835                 840                 845

Asp Glu Lys Asn Pro Leu Tyr Lys Tyr Tyr Glu Glu Thr Gly Asn Tyr
    850                 855                 860

Leu Thr Lys Tyr Ser Lys Lys Asp Asn Gly Pro Val Ile Lys Lys Ile
865                 870                 875                 880

Lys Tyr Tyr Gly Asn Lys Leu Asn Ala His Leu Asp Ile Thr Asp Asp
               885                 890                 895

Tyr Pro Asn Ser Arg Asn Lys Val Val Lys Leu Ser Leu Lys Pro Tyr
            900                 905                 910

Arg Phe Asp Val Tyr Leu Asp Asn Gly Val Tyr Lys Phe Val Thr Val
        915                 920                 925

Lys Asn Leu Asp Val Ile Lys Lys Glu Asn Tyr Tyr Glu Val Asn Ser
    930                 935                 940

Lys Cys Tyr Glu Glu Ala Lys Lys Leu Lys Lys Ile Ser Asn Gln Ala
945                 950                 955                 960

Glu Phe Ile Ala Ser Phe Tyr Asn Asn Asp Leu Ile Lys Ile Asn Gly
               965                 970                 975

Glu Leu Tyr Arg Val Ile Gly Val Asn Asn Asp Leu Leu Asn Arg Ile
            980                 985                 990

Glu Val Asn Met Ile Asp Ile Thr  Tyr Arg Glu Tyr Leu  Glu Asn Met
```

995 1000 1005

Asn Asp Lys Arg Pro Pro Arg Ile Ile Lys Thr Ile Ala Ser Lys
1010 1015 1020

Thr Gln Ser Ile Lys Lys Tyr Ser Thr Asp Ile Leu Gly Asn Leu
1025 1030 1035

Tyr Glu Val Lys Ser Lys Lys His Pro Gln Ile Ile Lys Lys Gly
1040 1045 1050

<210> 250
<211> 1063
<212> PRT
<213> Simonsiella muelleri

<400> 250

Met Glu Lys Phe His Tyr Val Leu Gly Leu Asp Leu Gly Ile Ala Ser
1 5 10 15

Val Gly Trp Ala Ala Ile Glu Ile Asp Lys Glu Thr Glu Thr Ser Ile
20 25 30

Gly Leu Leu Asp Cys Gly Val Arg Thr Phe Glu Arg Ala Glu Val Pro
35 40 45

Lys Thr Gly Asp Ser Leu Ala Lys Ala Arg Arg Glu Ala Arg Ser Thr
50 55 60

Arg Arg Leu Ile Arg Arg Arg Ser His Arg Leu Leu Arg Leu Lys Arg
65 70 75 80

Leu Leu Lys Arg Glu Ile Phe Arg Gln Pro Glu Thr Phe Lys Asp Leu
85 90 95

Pro Ile Asn Ala Trp Gln Leu Arg Val Lys Gly Leu Asp Ser Arg Leu
100 105 110

```
Asn Glu Tyr Glu Trp Ala Ala Val Leu Leu His Leu Val Lys His Arg
        115                 120                 125

Gly Tyr Leu Ser Gln Arg Lys Ser Glu Met Ser Glu Thr Asp Ser Lys
    130                 135                 140

Ser Glu Met Gly Arg Leu Leu Ala Gly Val Ala Glu Asn His Gln Leu
145                 150                 155                 160

Leu Gln Gln Glu Gln Tyr Arg Thr Pro Ala Glu Leu Ala Leu Lys Lys
                165                 170                 175

Phe Val Lys His Phe Arg Asn Lys Gly Gly Asp Tyr Ala His Thr Phe
            180                 185                 190

Asn Arg Leu Asp Leu Gln Ala Glu Leu His Leu Leu Phe Gln Lys Gln
        195                 200                 205

Arg Glu Leu Gly Asn Pro Phe Thr Ser Pro Glu Leu Glu Arg Gln Val
    210                 215                 220

Asp Asp Leu Leu Met Thr Gln Arg Ser Ala Leu Gln Gly Asp Ala Ile
225                 230                 235                 240

Leu Lys Met Leu Gly His Cys Gly Phe Glu Pro Glu Gln Phe Lys Ala
                245                 250                 255

Ala Lys Asn Thr Phe Ser Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu
            260                 265                 270

Asn Asn Leu Arg Ile Gln Asp Gln Gly Lys Glu Arg Ala Leu Thr Ala
        275                 280                 285

Asp Glu Arg Thr Lys Leu Leu Asp Glu Pro Tyr Lys Lys Ser Lys Leu
    290                 295                 300

Thr Tyr Ala Gln Val Arg Lys Leu Leu Ser Leu Pro Gln Thr Ala Ile
305                 310                 315                 320
```

```
Phe Lys Gly Leu Arg Tyr Asp Leu Glu His Asp Lys Lys Ala Glu Asn
                325                 330                 335

Ser Thr Leu Met Glu Met Lys Ser Tyr His Asn Ile Arg Gln Thr Leu
            340                 345                 350

Glu Lys Ser Gly Leu Lys Thr Glu Trp Gln Ser Ile Ala Thr Gln Pro
        355                 360                 365

Glu Ile Leu Asp Ala Ile Gly Thr Ala Phe Ser Ile Tyr Lys Thr Asp
    370                 375                 380

Glu Asp Ile Ser His Glu Leu Lys Thr Cys Arg Leu Pro Glu Asn Val
385                 390                 395                 400

Leu Asn Glu Leu Leu Lys Asn Ile Asn Phe Asp Gly Phe Ile Gln Leu
                405                 410                 415

Ser Leu Thr Ala Leu Arg Lys Ile Leu Pro Leu Met Glu Gln Gly Tyr
            420                 425                 430

Arg Tyr Asp Glu Ala Cys Thr Gln Ile Tyr Gly Asn His His Ser Gly
        435                 440                 445

Ser Leu Gln Gln Glu Ser Lys Gln Phe Leu Pro His Ile Pro Ile Asp
    450                 455                 460

Asp Val Arg Asn Pro Val Val Phe Arg Thr Leu Thr Gln Ala Arg Lys
465                 470                 475                 480

Val Val Asn Ala Ile Ile Arg Arg Tyr Gly Ser Pro Ala Arg Val His
                485                 490                 495

Ile Glu Met Ala Arg Glu Leu Gly Lys Ser Lys Ser Asp Arg Asp Arg
            500                 505                 510
```

```
Ile Glu Lys Gln Gln Gln Lys Asn Lys Lys Glu Arg Glu Asn Ala Val
        515                 520                 525

Ala Lys Phe Lys Glu Asp Phe Pro Asp Phe Val Gly Glu Pro Arg Gly
    530                 535                 540

Lys Asp Ile Leu Lys Met Arg Leu Tyr Glu Gln Gln His Gly Lys Cys
545                 550                 555                 560

Leu Tyr Ser Gly His Asp Ile Asp Ile Asn Arg Leu Asn Glu Lys Gly
                565                 570                 575

Tyr Val Glu Ile Asp His Ala Leu Pro Phe Ser Arg Thr Trp Asp Asp
            580                 585                 590

Ser Gln Asn Asn Lys Val Leu Val Leu Gly Ser Glu Asn Gln Asn Lys
        595                 600                 605

Arg Asn Gln Thr Pro Asp Glu Tyr Leu Asp Gly Ala Asn Asn Ser Gln
    610                 615                 620

Arg Trp Leu Glu Phe Gln Ala Arg Val Gln Thr Cys His Phe Ser Tyr
625                 630                 635                 640

Gly Lys Lys Gln Arg Ile Gln Leu Ala Lys Leu Asp Asp Glu Thr Glu
                645                 650                 655

Lys Gly Phe Leu Glu Arg Asn Leu Asn Asp Thr Arg Tyr Ile Ala Arg
            660                 665                 670

Phe Met Cys Gln Phe Val Gln Glu Asn Leu Tyr Leu Thr Gly Lys Gly
        675                 680                 685

Lys Arg Leu Val Phe Ala Ser Asn Gly Gly Met Thr Ala Thr Leu Arg
    690                 695                 700

Asn Leu Trp Gly Leu Arg Lys Val Arg Glu Asp Asn Asp Arg His His
705                 710                 715                 720
```

```
Ala Leu Asp Ala Ile Val Val Ala Cys Ser Thr Ala Ser Met Gln Gln
               725                 730                 735

Lys Ile Thr Lys Ala Phe Gln Arg His Glu Ser Ile Glu Tyr Val Asp
            740                 745                 750

Thr Glu Thr Gly Glu Val Lys Phe Arg Ile Pro Gln Pro Trp Asp Phe
        755                 760                 765

Phe Arg Gln Glu Val Met Ile Arg Val Phe Ser Asp Gln Pro Cys Glu
    770                 775                 780

Asp Leu Val Glu Lys Leu Ser Ala Arg Pro Glu Ala Leu His Asp Asn
785                 790                 795                 800

Val Thr Pro Leu Phe Val Ser Arg Ala Pro Asn Arg Lys Met Ser Gly
               805                 810                 815

Gln Gly His Leu Glu Thr Ile Lys Ser Ala Lys Arg Leu Ser Glu Glu
            820                 825                 830

Asn Ser Met Val Lys Lys Pro Leu Thr Thr Leu Lys Leu Lys Asp Ile
        835                 840                 845

Pro Glu Ile Val Gly Tyr Pro Ser Arg Glu Pro Gln Leu Tyr Ala Ala
    850                 855                 860

Leu Lys Thr Arg Leu Glu Thr His Asp Asp Asp Pro Ile Lys Ala Phe
865                 870                 875                 880

Ala Lys Pro Phe Tyr Lys Pro Asn Lys Asn Gly Glu Leu Gly Ala Leu
               885                 890                 895

Val Arg Ser Val Arg Val Lys Gly Val Gln Asn Thr Gly Val Met Val
            900                 905                 910
```

```
His Asp Gly Lys Gly Ile Ala Asp Asn Ala Thr Met Val Arg Val Asp
        915                 920                 925


Val Tyr Thr Lys Ala Gly Lys Asn Tyr Leu Val Pro Val Tyr Val Trp
    930                 935                 940


Gln Val Ala Gln Gly Ile Leu Pro Asn Arg Ala Val Thr Ser Gly Lys
945                 950                 955                 960


Ser Glu Ala Asp Trp Asp Leu Ile Asp Glu Ser Phe Glu Phe Lys Phe
                965                 970                 975


Ser Leu Ser Arg Gly Asp Leu Val Glu Met Ile Ser Asn Lys Gly Arg
            980                 985                 990


Ile Phe Gly Tyr Tyr Asn Gly Leu  Asp Arg Ala Asn Gly  Ser Ile Gly
        995                 1000                1005


Ile Arg  Glu His Asp Leu Glu  Lys Ser Lys Gly Lys  Asp Gly Val
    1010                1015                1020


His Arg  Val Gly Val Lys Thr  Ala Thr Ala Phe Asn  Lys Tyr His
    1025                1030                1035


Val Asp  Pro Leu Gly Lys Glu  Ile His Arg Cys Ser  Ser Glu Pro
    1040                1045                1050


Arg Pro  Thr Leu Lys Ile Lys  Ser Lys Lys
    1055                1060
```

<210> 251
<211> 1509
<212> PRT
<213> Psychroflexus torquis

<400> 251

```
Met Lys Arg Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15
```

```
Ser Leu Ile Glu His Asp Phe Lys Asn Lys Gln Gly Gln Ile Glu Gly
            20                  25                  30

Leu Gly Val Arg Ile Ile Pro Met Ser Gln Glu Ile Leu Gly Lys Phe
        35                  40                  45

Asp Ala Gly Gln Ser Ile Ser Gln Thr Ala Asp Arg Thr Lys Tyr Arg
    50                  55                  60

Gly Val Arg Arg Leu Tyr Gln Arg Asp Asn Leu Arg Arg Glu Arg Leu
65                  70                  75                  80

His Arg Val Leu Lys Ile Leu Asp Phe Leu Pro Lys His Tyr Ser Glu
                85                  90                  95

Ser Ile Asp Phe Gln Asp Lys Val Gly Gln Phe Lys Pro Lys Gln Glu
            100                 105                 110

Val Lys Leu Asn Tyr Arg Lys Asn Glu Lys Asn Lys His Glu Phe Val
        115                 120                 125

Phe Met Asn Ser Phe Ile Glu Met Val Ser Glu Phe Lys Asn Ala Gln
    130                 135                 140

Pro Glu Leu Phe Tyr Asn Lys Gly Asn Gly Glu Glu Thr Lys Ile Pro
145                 150                 155                 160

Tyr Asp Trp Thr Leu Tyr Tyr Leu Arg Lys Lys Ala Leu Thr Gln Gln
                165                 170                 175

Ile Thr Lys Glu Glu Leu Ala Trp Leu Ile Leu Asn Phe Asn Gln Lys
            180                 185                 190

Arg Gly Tyr Tyr Gln Leu Arg Gly Glu Asp Ile Asp Glu Asp Lys Asn
        195                 200                 205

Lys Lys Tyr Met Gln Leu Lys Val Asn Asn Leu Ile Asp Ser Gly Ala
```

```
    210                 215                 220

Lys Val Lys Gly Lys Val Leu Tyr Asn Val Ile Phe Asp Asn Gly Trp
225                 230                 235                 240

Lys Tyr Glu Lys Gln Ile Val Asn Lys Asp Glu Trp Glu Gly Arg Thr
                245                 250                 255

Lys Glu Phe Ile Ile Thr Thr Lys Thr Leu Lys Asn Gly Asn Ile Lys
            260                 265                 270

Arg Thr Tyr Lys Ala Val Asp Ser Glu Ile Asp Trp Ala Ala Ile Lys
        275                 280                 285

Ala Lys Thr Glu Gln Asp Ile Asn Lys Ala Asn Lys Thr Val Gly Glu
    290                 295                 300

Tyr Ile Tyr Glu Ser Leu Leu Asp Asn Pro Ser Gln Lys Ile Arg Gly
305                 310                 315                 320

Lys Leu Val Lys Thr Ile Glu Arg Lys Phe Tyr Lys Glu Glu Phe Glu
                325                 330                 335

Lys Leu Leu Ser Lys Gln Ile Glu Leu Gln Pro Glu Leu Phe Asn Glu
            340                 345                 350

Ser Leu Tyr Lys Ala Cys Ile Lys Glu Leu Tyr Pro Arg Asn Glu Asn
        355                 360                 365

His Gln Ser Asn Asn Lys Lys Gln Gly Phe Glu Tyr Leu Phe Thr Glu
    370                 375                 380

Asp Ile Ile Phe Tyr Gln Arg Pro Leu Lys Ser Gln Lys Ser Asn Ile
385                 390                 395                 400

Ser Gly Cys Gln Phe Glu His Lys Ile Tyr Lys Gln Lys Asn Lys Lys
                405                 410                 415
```

```
Thr Gly Lys Leu Glu Leu Ile Lys Glu Pro Ile Lys Thr Ile Ser Arg
            420                 425                 430

Ser His Pro Leu Phe Gln Glu Phe Arg Ile Trp Gln Trp Leu Gln Asn
        435                 440                 445

Leu Lys Ile Tyr Asn Lys Glu Lys Ile Glu Asn Gly Lys Leu Glu Asp
    450                 455                 460

Val Thr Thr Gln Leu Leu Pro Asn Asn Glu Ala Tyr Val Thr Leu Phe
465                 470                 475                 480

Asp Phe Leu Asn Thr Lys Lys Glu Leu Glu Gln Lys Gln Phe Ile Glu
                485                 490                 495

Tyr Phe Val Lys Lys Lys Leu Ile Asp Lys Lys Glu Lys Glu His Phe
            500                 505                 510

Arg Trp Asn Phe Val Glu Asp Lys Lys Tyr Pro Phe Ser Glu Thr Arg
        515                 520                 525

Ala Gln Phe Leu Ser Arg Leu Ala Lys Val Lys Gly Ile Lys Asn Thr
    530                 535                 540

Glu Asp Phe Leu Asn Lys Asn Thr Gln Val Gly Ser Lys Glu Asn Ser
545                 550                 555                 560

Pro Phe Ile Lys Arg Ile Glu Gln Leu Trp His Ile Ile Tyr Ser Val
                565                 570                 575

Ser Asp Leu Lys Glu Tyr Glu Lys Ala Leu Glu Lys Phe Ala Glu Lys
            580                 585                 590

His Asn Leu Glu Lys Asp Ser Phe Leu Lys Asn Phe Lys Lys Phe Pro
        595                 600                 605

Pro Phe Val Ser Asp Tyr Ala Ser Tyr Ser Lys Lys Ala Ile Ser Lys
```

```
    610                 615                 620

Leu Leu Pro Ile Met Arg Met Gly Lys Tyr Trp Ser Glu Ser Ala Val
625                 630                 635                 640

Pro Thr Gln Val Lys Glu Arg Ser Leu Ser Ile Met Glu Arg Val Lys
                645                 650                 655

Val Leu Pro Leu Lys Glu Gly Tyr Ser Asp Lys Asp Leu Ala Asp Leu
            660                 665                 670

Leu Ser Arg Val Ser Asp Asp Asp Ile Pro Lys Gln Leu Ile Lys Ser
        675                 680                 685

Phe Ile Ser Phe Lys Asp Lys Asn Pro Leu Lys Gly Leu Asn Thr Tyr
    690                 695                 700

Gln Ala Asn Tyr Leu Val Tyr Gly Arg His Ser Glu Thr Gly Asp Ile
705                 710                 715                 720

Gln His Trp Lys Thr Pro Glu Asp Ile Asp Arg Tyr Leu Asn Asn Phe
                725                 730                 735

Lys Gln His Ser Leu Arg Asn Pro Ile Val Glu Gln Val Val Met Glu
            740                 745                 750

Thr Leu Arg Val Val Arg Asp Ile Trp Glu His Tyr Gly Asn Asn Glu
        755                 760                 765

Lys Asp Phe Phe Lys Glu Ile His Val Glu Leu Gly Arg Glu Met Lys
    770                 775                 780

Ser Pro Ala Gly Lys Arg Glu Lys Leu Ser Gln Arg Asn Thr Glu Asn
785                 790                 795                 800

Glu Asn Thr Asn His Arg Ile Arg Glu Val Leu Lys Glu Leu Met Asn
                805                 810                 815
```

```
Asp Ala Ser Val Glu Gly Gly Val Arg Asp Tyr Ser Pro Ser Gln Gln
            820                 825                 830

Glu Ile Leu Lys Leu Tyr Glu Glu Gly Ile Tyr Gln Asn Pro Asn Thr
        835                 840                 845

Asn Tyr Leu Lys Val Asp Glu Asp Glu Ile Leu Lys Ile Arg Lys Lys
    850                 855                 860

Asn Asn Pro Thr Gln Lys Glu Ile Gln Arg Tyr Lys Leu Trp Leu Glu
865                 870                 875                 880

Gln Gly Tyr Ile Ser Pro Tyr Thr Gly Lys Ile Ile Pro Leu Thr Lys
                885                 890                 895

Leu Phe Thr His Glu Tyr Gln Ile Glu His Ile Ile Pro Gln Ser Arg
            900                 905                 910

Tyr Tyr Asp Asn Ser Leu Gly Asn Lys Ile Ile Cys Glu Ser Glu Val
        915                 920                 925

Asn Glu Asp Lys Asp Asn Lys Thr Ala Tyr Glu Tyr Leu Lys Val Glu
    930                 935                 940

Lys Gly Ser Ile Val Phe Gly His Lys Leu Leu Asn Leu Asp Glu Tyr
945                 950                 955                 960

Glu Ala His Val Asn Lys Tyr Phe Lys Lys Asn Lys Thr Lys Leu Lys
                965                 970                 975

Asn Leu Leu Ser Glu Asp Ile Pro Glu Gly Phe Ile Asn Arg Gln Leu
            980                 985                 990

Asn Asp Ser Arg Tyr Ile Ser Lys  Leu Val Lys Gly Leu  Leu Ser Asn
        995                 1000                1005

Ile Val  Arg Glu Asn Gly Glu  Gln Glu Ala Thr Ser  Lys Asn Leu
```

```
    1010                1015                1020

Ile Pro  Val Thr Gly Val Val  Thr Ser Lys Leu Lys  Gln Asp Trp
    1025                1030                1035

Gly Leu  Asn Asp Lys Trp Asn  Glu Ile Ile Ala Pro  Arg Phe Lys
    1040                1045                1050

Arg Leu  Asn Lys Leu Thr Asn  Ser Asn Asp Phe Gly  Phe Trp Asp
    1055                1060                1065

Asn Asp  Ile Asn Ala Phe Arg  Ile Gln Val Pro Asp  Ser Leu Ile
    1070                1075                1080

Lys Gly  Phe Ser Lys Lys Arg  Ile Asp His Arg His  His Ala Leu
    1085                1090                1095

Asp Ala  Leu Val Val Ala Cys  Thr Ser Arg Asn His  Thr His Tyr
    1100                1105                1110

Leu Ser  Ala Leu Asn Ala Glu  Asn Lys Asn Tyr Ser  Leu Arg Asp
    1115                1120                1125

Lys Leu  Val Ile Lys Asn Glu  Asn Gly Asp Tyr Thr  Lys Thr Phe
    1130                1135                1140

Gln Ile  Pro Trp Gln Gly Phe  Thr Ile Glu Ala Lys  Asn Asn Leu
    1145                1150                1155

Glu Lys  Thr Val Val Ser Phe  Lys Lys Asn Leu Arg  Val Ile Asn
    1160                1165                1170

Lys Thr  Asn Asn Lys Phe Trp  Ser Tyr Lys Asp Glu  Asn Gly Asn
    1175                1180                1185

Leu Asn  Leu Gly Lys Asp Gly  Lys Pro Lys Lys Lys  Leu Arg Lys
    1190                1195                1200
```

```
Gln Thr  Lys Gly Tyr Asn Trp  Ala Ile Arg Lys Pro  Leu His Lys
    1205                1210                1215

Glu Thr  Val Ser Gly Ile Tyr  Asn Ile Asn Ala Pro  Lys Asn Lys
    1220                1225                1230

Ile Ala  Thr Ser Val Arg Thr  Leu Leu Thr Glu Ile  Lys Asn Glu
    1235                1240                1245

Lys His  Leu Ala Lys Ile Thr  Asp Leu Arg Ile Arg  Glu Thr Ile
    1250                1255                1260

Leu Pro  Asn His Leu Lys His  Tyr Leu Asn Asn Lys  Gly Glu Ala
    1265                1270                1275

Asn Phe  Ser Glu Ala Phe Ser  Gln Gly Gly Ile Glu  Asp Leu Asn
    1280                1285                1290

Lys Lys  Ile Thr Thr Leu Asn  Glu Gly Lys Lys His  Gln Pro Ile
    1295                1300                1305

Tyr Arg  Val Lys Ile Phe Glu  Val Gly Ser Lys Phe  Ser Ile Ser
    1310                1315                1320

Glu Asp  Glu Asn Ser Ala Lys  Ser Lys Lys Tyr Val  Glu Ala Ala
    1325                1330                1335

Lys Gly  Thr Asn Leu Phe Phe  Ala Ile Tyr Leu Asp  Glu Glu Asn
    1340                1345                1350

Lys Lys  Arg Asn Tyr Glu Thr  Ile Pro Leu Asn Glu  Val Ile Thr
    1355                1360                1365

His Gln  Lys Gln Val Ala Gly  Phe Pro Lys Ser Glu  Arg Leu Ser
    1370                1375                1380

Val Gln  Pro Asp Ser Gln Lys  Gly Thr Phe Leu Phe  Thr Leu Ser
```

```
    1385                1390                1395

Pro Asn  Asp Leu Val Tyr Val  Pro Asn Asn Glu Glu  Leu Glu Asn
    1400                1405                1410

Arg Asp  Leu Phe Asn Leu Gly  Asn Leu Asn Val Glu  Gln Ile Ser
    1415                1420                1425

Arg Ile  Tyr Lys Phe Thr Asp  Ser Ser Asp Lys Thr  Cys Asn Phe
    1430                1435                1440

Ile Pro  Phe Gln Val Ser Lys  Leu Ile Phe Asn Leu  Lys Lys Lys
    1445                1450                1455

Glu Gln  Lys Lys Leu Asp Val  Asp Phe Ile Ile Gln  Asn Glu Phe
    1460                1465                1470

Gly Leu  Gly Ser Pro Gln Ser  Lys Asn Gln Lys Ser  Ile Asp Asp
    1475                1480                1485

Val Met  Ile Lys Glu Lys Cys  Ile Lys Leu Lys Ile  Asp Arg Leu
    1490                1495                1500

Gly Asn  Ile Ser Lys Ala
    1505
```

<210> 252
<211> 1112
<212> PRT
<213> Staphylococcus simulans

<400> 252

```
Met Leu Val Gly Leu Lys Phe Lys Gln Ser Ile Leu Phe Glu Asn Met
1               5                   10                  15

Glu Asn Ala Glu Asp Ile Lys Glu Ser Ala Thr Gly Ser Asp Ala Ile
            20                  25                  30
```

```
Ser Leu Ser Asp Asp Tyr Tyr Glu Asn Leu Ser Glu Phe Leu Thr Asp
        35                  40                  45

Glu Gln Leu Asn Phe Ile Glu Ser Ala Asn Thr Phe Phe Met Gly Ile
    50                  55                  60

Met Leu Asp Arg Ile Leu Lys Gly Ala Thr Ser Ile Ser Ala Ala Lys
65                  70                  75                  80

Val Arg Asp Tyr Lys Ile Phe Lys Ser Gln Leu Lys Leu Ile Lys Asp
                85                  90                  95

Ile Val Tyr Gln Asn Lys Tyr Asp Lys Tyr His Glu Phe Phe Val Thr
            100                 105                 110

Ser Lys Glu Asp Met Arg Ala Tyr Gln Glu Asn Pro Asp Ala Lys Asn
        115                 120                 125

Phe Gly Lys Leu Ser Lys Phe Asp Gln Tyr Leu Ile His Ser Lys Asp
    130                 135                 140

Gln Tyr Ala Lys Leu Met Lys Asp Leu Lys Gly Leu Val Pro Lys Glu
145                 150                 155                 160

Tyr Thr Glu Val Leu Asn Leu Ile Asp Glu Gln Lys Phe Leu Val Val
                165                 170                 175

Gln Asn Thr Thr Asp Asn Ala Ser Ile Pro Tyr Gln Asn Asn Val Phe
            180                 185                 190

Glu Ala Glu Asn Ile Leu Arg Asn Gln Gln Lys Tyr Tyr Pro Glu Ile
        195                 200                 205

Thr Glu Glu Met Ile Gly Lys Val Ile Asn Leu Ile Ser Phe Arg Ile
    210                 215                 220

Pro Tyr Tyr Val Gly Pro Leu Thr Asn Lys Asn Gly Gln Ser Asp Phe
225                 230                 235                 240
```

```
Ala Trp Met Ile Arg Lys Ser Asp Glu Gln Thr Leu Pro Trp Asn Phe
                245                 250                 255

Asp Lys Val Ile Asp Lys Ser Lys Ser Ala Glu Lys Phe Ile Arg Arg
            260                 265                 270

Met Thr Ser Lys Cys Thr Tyr Leu Leu Glu Glu Asp Val Leu Pro Lys
        275                 280                 285

His Ser Leu Leu Tyr Gln Glu Met Glu Val Leu Asn Glu Leu Asn Asn
    290                 295                 300

Val Gln Leu Arg Gly Glu Asn Glu Pro Lys His Arg Ile His Arg Leu
305                 310                 315                 320

Asp Pro Lys Val Lys Gln Phe Ile Tyr His Asn Leu Phe Gln Lys Lys
                325                 330                 335

Lys Asn Val Thr His Lys Asp Leu Ile Thr Leu Leu Gln Asn Ser Glu
            340                 345                 350

His Arg Asn Thr Leu Asn Lys Thr Ser Gly Gln Lys Leu Lys Val Phe
        355                 360                 365

Gly Thr Gln Asn Asp Ser Lys Phe Ala Ser Lys Leu Ser Thr Tyr Asn
    370                 375                 380

Asp Met Lys Ala Ile Leu Gly Ser Val Glu Asn Lys Arg Gln Met Ile
385                 390                 395                 400

Glu Glu Leu Val Leu Trp Ile Thr Ile Phe Glu Asp Lys Ala Ile Leu
                405                 410                 415

Lys Gln Lys Ile Gly Glu Lys Tyr Pro Asn Ile Thr Glu Lys Gln Leu
            420                 425                 430
```

```
Asn Gln Ile Val Lys Leu Asn Tyr Ser Gly Trp Gly Arg Leu Ser Glu
        435                 440                 445

Lys Leu Leu Thr Lys Glu Val Asn Gly Arg Ser Leu Ile Asp Leu Met
    450                 455                 460

Tyr Ser Thr Glu Asn Asn Phe Met Glu Ile Ile Thr Asp Lys Thr Leu
465                 470                 475                 480

Gly Phe Asp Cys Phe Ile Lys Asn Ser Asn Lys Val Lys Asn Ala Lys
                485                 490                 495

Ile Ser Tyr Lys Asp Val Ala Glu Leu Arg Thr Ser Pro Ala Leu Lys
            500                 505                 510

Lys Gly Ile Trp Asn Ala Ile Lys Met Val Arg Glu Ile Ser Asn Leu
        515                 520                 525

Phe Gly Ala Pro Glu Lys Ile Ile Ile Glu Phe Ala Thr Glu Asp Gln
    530                 535                 540

Ala Lys Gly Lys Arg Gln Lys Ser Arg Ser Glu Leu Trp Asp Asp Leu
545                 550                 555                 560

Val Lys Lys Asn Asn Leu Lys Arg Asn Lys Glu Phe Glu Gly Leu Phe
                565                 570                 575

Glu Glu Leu Lys Ala Tyr Pro Asp Leu Asp Phe Ser Asn Pro Lys Leu
            580                 585                 590

Trp Leu Tyr Ile His Gln Asn Gly Lys Cys Met Tyr Thr Lys Lys Pro
        595                 600                 605

Ile Asp Leu Glu Arg Leu Met Ser Asp Thr Asn Asn Gln Leu Tyr Glu
    610                 615                 620

Ile Asp His Ile Leu Pro Arg Thr Phe Val Lys Asp Asp Ser Ile Asn
625                 630                 635                 640
```

```
Asn Lys Val Leu Val Ile Gln Ser Ala Asn Gln Lys Lys Ser Gly Asp
                645                 650                 655

Lys Met Pro Leu Glu Ile Phe Asp Asn His Val Leu Val Pro Phe Trp
            660                 665                 670

Lys Met Leu Tyr Glu Asn Asp Leu Ile Ser Ser Ser Lys Leu Ser Lys
        675                 680                 685

Leu Met Lys Lys Glu Phe Asn Asp Leu Asp Lys Glu Gly Phe Ile Gln
    690                 695                 700

Arg Gln Leu Val Glu Thr Arg Gln Ile Ile Ser His Val Ser Asp Phe
705                 710                 715                 720

Leu Thr Glu Glu Tyr Pro Ser Thr Thr Val Val Pro Met Lys Ala Asn
                725                 730                 735

Val Val Ser Glu Leu Arg Arg Lys Phe Asp Ile Pro Lys Ile Arg Gln
            740                 745                 750

Leu Asn Asp Trp His His Ala Val Asp Ala Tyr Leu Asn Gly Phe Val
        755                 760                 765

Tyr Gln Ala Ala Arg Val Phe Tyr Pro Lys Val Asn Leu Phe Glu Phe
    770                 775                 780

Asn Phe Lys Trp Glu Lys Val Arg Glu Lys Trp Arg Gln Leu Gly Glu
785                 790                 795                 800

Phe Thr Glu Asn Asn Lys Lys Arg Glu Phe Phe Leu Phe Lys Arg Met
                805                 810                 815

Glu Asn Tyr Val Asn Glu Tyr Gly Glu Gly Met Ile Ser Lys Leu Ile
            820                 825                 830
```

```
Phe Asp Leu Asp Asn Phe Lys Phe Asn Tyr Ser Arg Lys Val Glu Ser
        835                 840                 845

Thr Glu Ser Ala Phe Tyr Lys Gln Ser Ala Phe Ser Pro Lys Asn Thr
    850                 855                 860

Thr Ala Gln Tyr Asp Ser Asp Lys Asn Lys Thr Ala Ile Tyr Lys Glu
865                 870                 875                 880

Met Lys Asn Lys Arg Gly Ile Val Val Ser Tyr Thr Tyr Val Lys Lys
                885                 890                 895

Asp Gln Glu Leu Ile Gly Tyr Gly Val Phe Asn Glu Thr Val Phe Glu
            900                 905                 910

Tyr Val Asn Asn Ala Asp Val Asp Met Asn Thr Arg Ala Leu Lys Ile
        915                 920                 925

Val Arg Lys Ala Phe Pro Lys Leu Asp Ile Lys Lys Ala Gln Tyr Leu
    930                 935                 940

Phe Ser Ile Asn Lys Gly Asp Ala Leu Leu Val Asn Gly His Pro Phe
945                 950                 955                 960

Leu Phe Val Ser Ala Tyr Glu Arg Ile Asn Gly Lys Gln Leu Glu Phe
                965                 970                 975

Asp Ile Ala Met Gln Arg Lys Ile Lys Gln Ala Leu Ser Pro Tyr Asn
            980                 985                 990

Asn Met Thr Glu Gln Glu Lys Val  Glu Phe Tyr Asn Gln  Phe Ala Glu
        995                 1000                1005

Lys Val  Ile Glu Glu Phe Arg  Asn Ser Ile Gly Leu  Gln Ser Arg
    1010                1015                1020

Asp Arg  Lys Val Asn Leu Ile  Lys Asn Leu Phe Asn  Asn Thr Glu
    1025                1030                1035
```

Lys Ser Asn Asp Ser Met Thr Gln Ser Ile Leu Glu Val Leu Lys
    1040   1045   1050

Met Thr Lys Val Ser Ala Glu Arg Ser Lys Glu Leu Lys Ile Arg
    1055   1060   1065

Trp Asn Gly Gln Thr Pro Asn Thr Phe Ile Asp Thr Lys Asn Asn
    1070   1075   1080

Ala Glu Ile Gln Tyr Lys Ser Ile Thr Gly Leu Lys Thr Thr Lys
    1085   1090   1095

Pro Lys Ser Ile Phe Lys Leu Ala Glu Ser Lys Asn Glu Leu
    1100   1105   1110

<210> 253
<211> 1274
<212> PRT
<213> Mycoplasma gallisept

<400> 253

Met Asn Ile Asn Met Asn Asn Ser Ile Lys Ser Lys Pro Glu Val Thr
1   5   10   15

Ile Gly Leu Asp Leu Gly Val Gly Ser Val Gly Trp Ala Ile Val Asp
            20   25   30

Asn Glu Thr Asn Ile Ile His His Leu Gly Ser Arg Leu Phe Ser Gln
        35   40   45

Ala Lys Thr Ala Glu Asp Arg Arg Ser Phe Arg Gly Val Arg Arg Leu
    50   55   60

Ile Arg Arg Arg Lys Tyr Lys Leu Lys Arg Phe Val Asn Leu Ile Trp
65   70   75   80

Lys Tyr Asn Ser Tyr Phe Gly Phe Lys Asn Lys Glu Asp Ile Leu Asn

```
                85                  90                  95

Asn Tyr Gln Glu Gln Gln Lys Leu His Asn Thr Val Leu Asn Leu Lys
            100                 105                 110

Leu Glu Ala Leu Asn Ala Lys Ile Asp Pro Lys Ala Leu Ser Trp Ile
        115                 120                 125

Leu His Asp Tyr Leu Lys Asn Arg Gly His Phe Tyr Glu Asp Asn Arg
    130                 135                 140

Asp Phe Asn Val Tyr Pro Thr Glu Glu Leu Ala Asn Tyr Phe Asp Glu
145                 150                 155                 160

Phe Gly Tyr Tyr Lys Gly Ile Ile Asp Ser Lys Asn Asp Asp Asp Asp
                165                 170                 175

Lys Leu Glu Glu Gly Leu Thr Lys Tyr Lys Phe Ser Asn Gln His Trp
            180                 185                 190

Leu Glu Glu Val Lys Lys Val Leu Ser Asn Gln Thr Gly Leu Pro Glu
        195                 200                 205

Lys Phe Lys Glu Glu Tyr Glu Ser Leu Phe Ser Tyr Val Arg Asn Tyr
    210                 215                 220

Ser Glu Gly Pro Gly Ser Ile Asn Ser Val Ser Pro Tyr Gly Ile Tyr
225                 230                 235                 240

His Leu Asp Glu Lys Glu Gly Lys Val Val Gln Lys Tyr Asn Asn Ile
                245                 250                 255

Trp Asp Lys Thr Ile Gly Lys Cys Ser Ile Phe Pro Asp Glu Tyr Arg
            260                 265                 270

Ala Pro Lys Asn Ser Pro Ile Ala Met Ile Phe Asn Glu Ile Asn Glu
        275                 280                 285
```

```
Leu Ser Thr Ile Arg Ser Tyr Ser Ile Tyr Leu Thr Gly Trp Phe Ile
    290                 295                 300

Asn Gln Glu Phe Lys Lys Ala Tyr Leu Asn Lys Leu Leu Asp Leu Leu
305                 310                 315                 320

Ile Lys Thr Asn Ser Glu Lys Pro Ile Asp Ala Arg Gln Phe Lys Lys
                325                 330                 335

Leu Arg Glu Glu Thr Ile Ala Glu Ser Ile Gly Lys Glu Thr Leu Lys
            340                 345                 350

Asp Val Glu Ser Glu Glu Lys Leu Glu Lys Asp Asp His Lys Trp Lys
        355                 360                 365

Leu Lys Gly Leu Lys Leu Asn Thr Asn Gly Lys Ile Gln Tyr Asn Asp
    370                 375                 380

Leu Ser Ser Leu Ala Lys Phe Val His Lys Leu Lys Gln His Leu Lys
385                 390                 395                 400

Leu Asp Phe Leu Leu Glu Asp Gln Tyr Thr Pro Leu Asp Lys Ile Asn
                405                 410                 415

Phe Leu Gln Ser Leu Tyr Val Tyr Leu Gly Lys His Leu Arg Tyr Ser
            420                 425                 430

Asn Arg Val Asp Ser Ala Asn Leu Lys Glu Phe Ser Asp Ser Ser Arg
        435                 440                 445

Leu Phe Glu Arg Val Leu Gln Glu Gln Lys Asp Gly Leu Phe Lys Leu
    450                 455                 460

Phe Glu Gln Thr Asp Lys Asp Asp Glu Lys Ile Leu Thr Gln Thr His
465                 470                 475                 480

Ser Leu Ser Thr Lys Ala Met Leu Leu Ala Ile Thr Arg Met Thr Asn
```

```
                485                 490                 495

Leu Asp Asn Asp Glu Asp Asn Gln Lys Asn Asn Asp Lys Gly Trp Asn
            500                 505                 510

Phe Glu Ala Ile Lys Asn Phe Asp Gln Lys Phe Ile Asp Ile Thr Lys
        515                 520                 525

Thr Asn Asn Asn Leu Ser Leu Lys Gln Asp Lys Arg Tyr Leu Asp Asp
    530                 535                 540

Gln Phe Ile Asn Asp Ala Ile Leu Ser Pro Gly Val Lys Arg Ile Leu
545                 550                 555                 560

Arg Glu Ala Thr Lys Val Phe Asn Ala Ile Leu Lys Gln Phe Ser Glu
                565                 570                 575

Glu Tyr Asp Val Thr Lys Val Val Ile Glu Leu Ala Arg Glu Leu Ser
            580                 585                 590

Glu Glu Lys Glu Leu Glu Asn Thr Lys Asn Tyr Lys Lys Leu Ile Lys
        595                 600                 605

Lys Asn Gly Asp Lys Ile Ser Glu Gly Leu Lys Ala Leu Gly Ile Ala
    610                 615                 620

Glu Asp Lys Ile Glu Glu Ile Leu Lys Ser Pro Thr Lys Ser Tyr Lys
625                 630                 635                 640

Val Leu Leu Trp Leu Gln Gln Asp His Ile Asp Pro Tyr Ser Gln Lys
                645                 650                 655

Glu Ile Ala Phe Asp Asp Ile Leu Thr Lys Thr Glu Lys Thr Glu Ile
            660                 665                 670

Asp His Ile Ile Pro Tyr Ser Ile Ser Phe Asp Asp Ser Ser Ser Asn
        675                 680                 685
```

```
Lys Leu Leu Val Leu Ala Glu Ser Asn Gln Ala Lys Ser Asn Gln Thr
    690                 695                 700

Pro Tyr Glu Phe Ile Asn Ser Gly Lys Ala Glu Ile Thr Trp Glu Val
705                 710                 715                 720

Tyr Glu Ala Tyr Cys His Lys Phe Lys Asn Gly Asp Ser Ser Leu Leu
                725                 730                 735

Asp Ser Thr Gln Arg Ser Lys Lys Phe Ala Lys Met Met Lys Thr Asp
            740                 745                 750

Thr Ser Ser Lys Tyr Asp Ile Gly Phe Leu Ala Arg Asn Leu Asn Asp
        755                 760                 765

Thr Arg Tyr Ala Thr Ile Val Phe Arg Asp Ala Leu Lys Asp Tyr Ala
    770                 775                 780

Asn Asn His Leu Val Glu Asp Lys Pro Met Phe Lys Val Val Cys Ile
785                 790                 795                 800

Asn Gly Gly Val Thr Ser Phe Leu Arg Lys Asn Phe Asp Pro Lys Ser
                805                 810                 815

Trp Tyr Ala Lys Lys Asp Arg Asp Lys Asn Ile His His Ala Val Asp
            820                 825                 830

Ala Ser Ile Ile Ser Ile Phe Ser Asn Glu Thr Lys Thr Leu Phe Asn
        835                 840                 845

Gln Leu Thr Lys Phe Ala Asp Tyr Lys Leu Phe Lys Asn Thr Asp Gly
    850                 855                 860

Ser Trp Lys Lys Ile Asp Pro Lys Thr Gly Val Val Ser Glu Val Thr
865                 870                 875                 880

Asp Glu Asn Trp Lys Gln Ile Arg Val Arg Asn Gln Val Ser Glu Ile
```

```
               885                 890                 895

Ala Lys Val Ile Asp Lys Tyr Ile Gln Asp Ser Asn Ile Glu Arg Lys
            900                 905                 910

Ala Arg Tyr Ser Arg Lys Ile Glu Asn Lys Thr Asn Ile Ser Leu Phe
        915                 920                 925

Asn Asp Thr Val Tyr Ser Ala Lys Lys Val Gly Tyr Glu Asp Gln Ile
    930                 935                 940

Lys Arg Lys Asn Leu Lys Thr Leu Asp Ile His Glu Ser Ala Glu Glu
945                 950                 955                 960

Asn Lys Asn Ser Lys Val Lys Lys Gln Phe Val Tyr Arg Lys Leu Val
               965                 970                 975

Asn Val Ser Leu Leu Asn Asn Asp Lys Leu Ala Asp Leu Phe Ala Glu
            980                 985                 990

Lys Glu Asp Ile Leu Met Tyr Arg  Ala Asn Pro Trp Val  Ile Asn Leu
        995                 1000                1005

Ala Glu  Gln Ile Phe Asn Glu  Tyr Thr Glu Asn Lys  Lys Ile Lys
    1010                1015                1020

Ser Gln  Asn Val Phe Glu Lys  Tyr Met Leu Asp Leu  Thr Lys Glu
    1025                1030                1035

Phe Pro  Glu Lys Phe Ser Glu  Ala Phe Val Lys Ser  Met Ile Arg
    1040                1045                1050

Asn Lys  Thr Ala Ile Ile Tyr  Asn Val Glu Lys Asp  Val Val His
    1055                1060                1065

Arg Ile  Lys Arg Leu Lys Ile  Leu Ser Ser Glu Leu  Lys Glu Asn
    1070                1075                1080
```

```
Lys Trp  Ser Asn Val Ile Ile  Arg Ser Lys Asn Glu  Ser Gly Thr
    1085                1090                1095

Lys Leu  Ser Tyr Gln Asp Thr  Ile Asn Ser Ile Ala  Leu Met Ile
    1100                1105                1110

Met Arg  Ser Ile Asp Pro Thr  Ala Lys Lys Gln Tyr  Ile Arg Val
    1115                1120                1125

Pro Leu  Asn Thr Leu Asn Leu  His Leu Gly Asp Gln  Asp Phe Asp
    1130                1135                1140

Leu His  Asn Ile Asp Ala Tyr  Leu Lys Lys Pro Lys  Phe Val Lys
    1145                1150                1155

Tyr Leu  Lys Ala Asn Glu Ile  Gly Asp Glu Tyr Lys  Pro Trp Arg
    1160                1165                1170

Val Leu  Thr Ser Gly Thr Leu  Leu Ile His Lys Lys  Asp Lys Lys
    1175                1180                1185

Leu Met  Tyr Ile Ser Ser Phe  Gln Asn Leu Asn Asp  Leu Ile Glu
    1190                1195                1200

Ile Lys  Asn Leu Ile Glu Thr  Glu Tyr Lys Glu Asn  Val Asp Ser
    1205                1210                1215

Asp Pro  Lys Lys Lys Lys Lys  Ala Ser Gln Ile Leu  Arg Ser Leu
    1220                1225                1230

Ser Val  Ile Leu Asn Asp Tyr  Ile Leu Leu Asp Ala  Lys Tyr Asn
    1235                1240                1245

Phe Asp  Ile Leu Gly Leu Ser  Lys Asn Lys Ile Asp  Glu Ile Leu
    1250                1255                1260

Asn Ser  Lys Leu Asp Leu Asp  Lys Ile Ala Lys
```

1265 1270

<210> 254
<211> 1122
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Sequence

<400> 254

Met Ser Asp Leu Val Leu Gly Leu Asp Ile Gly Ile Gly Ser Val Gly
1 5 10 15

Val Gly Ile Leu Asn Lys Val Thr Gly Glu Ile Ile His Lys Asn Ser
20 25 30

Arg Ile Phe Pro Ala Ala Gln Ala Glu Asn Asn Leu Val Arg Arg Thr
35 40 45

Asn Arg Gln Gly Arg Arg Leu Thr Arg Arg Lys Lys His Arg Ile Val
50 55 60

Arg Leu Asn Arg Leu Phe Glu Glu Ser Gly Leu Ile Thr Asp Phe Thr
65 70 75 80

Lys Ile Ser Ile Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly Leu
85 90 95

Thr Asp Glu Leu Ser Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Met
100 105 110

Val Lys His Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Asp Asp Gly
115 120 125

Asn Ser Ser Val Gly Asp Tyr Ala Gln Ile Val Lys Glu Asn Ser Lys
130 135 140

Gln Leu Glu Thr Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Tyr Gln

```
145                 150                 155                 160

Thr Tyr Gly Gln Leu Arg Gly Asp Phe Thr Val Glu Lys Asp Gly Lys
                165                 170                 175

Lys His Arg Leu Ile Asn Val Phe Pro Thr Ser Ala Tyr Arg Ser Glu
            180                 185                 190

Ala Leu Arg Ile Leu Gln Thr Gln Gln Glu Phe Asn Ser Gln Ile Thr
        195                 200                 205

Asp Glu Phe Ile Asn Arg Tyr Leu Glu Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240

Tyr Arg Thr Asn Gly Glu Thr Leu Asp Asn Ile Phe Gly Ile Leu Ile
                245                 250                 255

Gly Lys Cys Thr Phe Tyr Pro Asp Glu Phe Arg Ala Ala Lys Ala Ser
            260                 265                 270

Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285

Val Pro Thr Glu Thr Lys Lys Leu Ser Lys Glu Gln Lys Asn Gln Ile
    290                 295                 300

Ile Asn Tyr Val Lys Asn Glu Lys Val Met Gly Pro Ala Lys Leu Phe
305                 310                 315                 320

Lys Tyr Ile Ala Lys Leu Leu Ser Cys Asp Val Ala Asp Ile Lys Gly
                325                 330                 335

His Arg Ile Asp Lys Ser Gly Lys Ala Glu Ile His Thr Phe Glu Ala
            340                 345                 350
```

```
Tyr Arg Lys Met Lys Thr Leu Glu Thr Leu Asp Ile Glu Gln Met Asp
        355                 360                 365

Arg Glu Thr Leu Asp Lys Leu Ala Tyr Val Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Gln Glu Ala Leu Glu His Glu Phe Ala Asp Gly Ser
385                 390                 395                 400

Phe Ser Gln Lys Gln Val Asp Glu Leu Val Gln Phe Arg Lys Ala Asn
                405                 410                 415

Ser Ser Ile Phe Gly Lys Gly Trp His Asn Phe Ser Val Lys Leu Met
            420                 425                 430

Met Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr
        435                 440                 445

Ile Leu Thr Arg Leu Gly Lys Gln Lys Thr Thr Ser Ser Ser Asn Lys
    450                 455                 460

Thr Lys Tyr Ile Asp Glu Lys Leu Leu Thr Glu Glu Ile Tyr Asn Pro
465                 470                 475                 480

Val Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Val Asn Ala Ala
                485                 490                 495

Ile Lys Glu Tyr Gly Asp Phe Asp Asn Ile Val Ile Glu Met Ala Arg
            500                 505                 510

Glu Thr Asn Glu Asp Asp Glu Lys Lys Ala Ile Gln Lys Ile Gln Lys
        515                 520                 525

Ala Asn Lys Asp Glu Lys Asp Ala Ala Met Leu Lys Ala Ala Asn Gln
    530                 535                 540

Tyr Asn Gly Lys Ala Glu Leu Pro His Ser Val Phe His Gly His Lys
```

```
545                 550                 555                 560

Gln Leu Ala Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Arg Cys
                565                 570                 575

Leu Tyr Thr Gly Lys Thr Ile Ser Ile His Asp Leu Ile Asn Asn Pro
            580                 585                 590

Asn Gln Phe Glu Val Asp His Ile Leu Pro Leu Ser Ile Thr Phe Asp
        595                 600                 605

Asp Ser Leu Ala Asn Lys Val Leu Val Tyr Ala Thr Ala Asn Gln Glu
    610                 615                 620

Lys Gly Gln Arg Thr Pro Tyr Gln Ala Leu Asp Ser Met Asp Asp Ala
625                 630                 635                 640

Trp Ser Phe Arg Glu Leu Lys Ala Phe Val Arg Glu Ser Lys Thr Leu
                645                 650                 655

Ser Asn Lys Lys Lys Glu Tyr Leu Leu Thr Glu Glu Asp Ile Ser Lys
            660                 665                 670

Phe Asp Val Arg Lys Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Ala Ser Arg Val Val Leu Asn Ala Leu Gln Glu His Phe Arg Ala
    690                 695                 700

His Lys Ile Asp Thr Lys Val Ser Val Val Arg Gly Gln Phe Thr Ser
705                 710                 715                 720

Gln Leu Arg Arg His Trp Gly Ile Glu Lys Thr Arg Asp Thr Tyr His
                725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Asn
            740                 745                 750
```

```
Leu Trp Lys Lys Gln Lys Asn Thr Leu Val Ser Tyr Ser Glu Glu Gln
        755                 760                 765

Leu Leu Asp Ile Glu Thr Gly Glu Leu Ile Ser Asp Asp Glu Tyr Lys
    770                 775                 780

Glu Ser Val Phe Lys Ala Pro Tyr Gln His Phe Val Asp Thr Leu Lys
785                 790                 795                 800

Ser Lys Glu Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln Val Asp Ser
                805                 810                 815

Lys Phe Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg Gln
            820                 825                 830

Ala Lys Val Gly Lys Asp Lys Lys Asp Glu Thr Tyr Val Leu Gly Lys
        835                 840                 845

Ile Lys Asp Ile Tyr Thr Gln Asp Gly Tyr Asp Ala Phe Met Lys Ile
    850                 855                 860

Tyr Lys Lys Asp Lys Ser Lys Phe Leu Met Tyr Arg His Asp Pro Gln
865                 870                 875                 880

Thr Phe Glu Lys Val Ile Glu Pro Ile Leu Glu Asn Tyr Pro Asn Lys
                885                 890                 895

Glu Met Asn Glu Lys Gly Lys Glu Val Pro Cys Asn Pro Phe Leu Lys
            900                 905                 910

Tyr Lys Glu Glu His Gly Tyr Ile Arg Lys Tyr Ser Lys Lys Gly Asn
        915                 920                 925

Gly Pro Glu Ile Lys Ser Leu Lys Tyr Tyr Asp Ser Lys Leu Leu Gly
    930                 935                 940

Asn Pro Ile Asp Ile Thr Pro Glu Asn Ser Lys Asn Lys Val Val Leu
```

945 950 955 960

Gln Ser Leu Lys Pro Trp Arg Thr Asp Val Tyr Phe Asn Lys Asn Thr
965 970 975

Gly Lys Tyr Glu Ile Leu Gly Leu Lys Tyr Ala Asp Leu Gln Phe Glu
980 985 990

Lys Lys Thr Gly Thr Tyr Lys Ile Ser Gln Glu Lys Tyr Asn Gly Ile
995 1000 1005

Met Lys Glu Glu Gly Val Asp Ser Asp Ser Glu Phe Lys Phe Thr
1010 1015 1020

Leu Tyr Lys Asn Asp Leu Leu Leu Val Lys Asp Thr Glu Thr Lys
1025 1030 1035

Glu Gln Gln Leu Phe Arg Phe Leu Ser Arg Thr Met Pro Asn Val
1040 1045 1050

Lys Tyr Tyr Val Glu Leu Lys Pro Tyr Ser Lys Asp Lys Phe Glu
1055 1060 1065

Lys Asn Glu Ser Leu Ile Glu Ile Leu Gly Ser Ala Asp Lys Ser
1070 1075 1080

Gly Arg Cys Ile Lys Gly Leu Gly Lys Ser Asn Ile Ser Ile Tyr
1085 1090 1095

Lys Val Arg Thr Asp Val Leu Gly Asn Gln His Ile Ile Lys Asn
1100 1105 1110

Glu Gly Asp Lys Pro Lys Leu Asp Phe
1115 1120

<210> 255
<211> 1236
<212> PRT

<213> Artificial Sequence

<220>
<223> Synthetic Sequence

<400> 255

```
Met Tyr Phe Tyr Lys Asn Lys Glu Asn Lys Leu Asn Lys Lys Val Val
1               5                  10                  15


Leu Gly Leu Asp Leu Gly Ile Ala Ser Val Gly Trp Cys Leu Thr Asp
            20                  25                  30


Ile Ser Gln Lys Glu Asp Asn Lys Phe Pro Ile Ile Leu His Gly Val
        35                  40                  45


Arg Leu Phe Glu Thr Val Asp Asp Ser Asp Asp Lys Leu Leu Asn Glu
    50                  55                  60


Thr Arg Arg Lys Lys Arg Gly Gln Arg Arg Arg Asn Arg Arg Leu Phe
65                  70                  75                  80


Thr Arg Lys Arg Asp Phe Ile Lys Tyr Leu Ile Asp Asn Asn Ile Ile
                85                  90                  95


Glu Leu Glu Phe Asp Lys Asn Pro Lys Ile Leu Val Arg Asn Phe Ile
            100                 105                 110


Glu Lys Tyr Ile Asn Pro Phe Ser Lys Asn Leu Glu Leu Lys Tyr Lys
        115                 120                 125


Ser Val Thr Asn Leu Pro Ile Gly Phe His Asn Leu Arg Lys Ala Ala
    130                 135                 140


Ile Asn Glu Lys Tyr Lys Leu Asp Lys Ser Glu Leu Ile Val Leu Leu
145                 150                 155                 160


Tyr Phe Tyr Leu Ser Leu Arg Gly Ala Phe Phe Asp Asn Pro Glu Asp
                165                 170                 175
```

```
Thr Lys Ser Lys Glu Met Asn Lys Asn Glu Ile Glu Ile Phe Asp Lys
            180                 185                 190

Asn Glu Ser Ile Lys Asn Ala Glu Phe Pro Ile Asp Lys Ile Ile Glu
        195                 200                 205

Phe Tyr Lys Ile Ser Gly Lys Ile Arg Ser Thr Ile Asn Leu Lys Phe
    210                 215                 220

Gly His Gln Asp Tyr Leu Lys Glu Ile Lys Gln Val Phe Glu Lys Gln
225                 230                 235                 240

Asn Ile Asp Phe Met Asn Tyr Glu Lys Phe Ala Met Glu Glu Lys Ser
                245                 250                 255

Phe Phe Ser Arg Ile Arg Asn Tyr Ser Glu Gly Pro Gly Asn Glu Lys
            260                 265                 270

Ser Phe Ser Lys Tyr Gly Leu Tyr Ala Asn Glu Asn Gly Asn Pro Glu
        275                 280                 285

Leu Ile Ile Asn Glu Lys Gly Gln Lys Ile Tyr Thr Lys Ile Phe Lys
    290                 295                 300

Thr Leu Trp Glu Ser Lys Ile Gly Lys Cys Ser Tyr Asp Lys Lys Leu
305                 310                 315                 320

Tyr Arg Ala Pro Lys Asn Ser Phe Ser Ala Lys Val Phe Asp Ile Thr
                325                 330                 335

Asn Lys Leu Thr Asp Trp Lys His Lys Asn Glu Tyr Ile Ser Glu Arg
            340                 345                 350

Leu Lys Arg Lys Ile Leu Leu Ser Arg Phe Leu Asn Lys Asp Ser Lys
        355                 360                 365

Ser Ala Val Glu Lys Ile Leu Lys Glu Glu Asn Ile Lys Phe Glu Asn
```

```
    370                 375                 380

Leu Ser Glu Ile Ala Tyr Asn Lys Asp Asp Asn Lys Ile Asn Leu Pro
385                 390                 395                 400

Ile Ile Asn Ala Tyr His Ser Leu Thr Thr Ile Phe Lys Lys His Leu
                405                 410                 415

Ile Asn Phe Glu Asn Tyr Leu Ile Ser Asn Glu Asn Asp Leu Ser Lys
            420                 425                 430

Leu Met Ser Phe Tyr Lys Gln Gln Ser Glu Lys Leu Phe Val Pro Asn
        435                 440                 445

Glu Lys Gly Ser Tyr Glu Ile Asn Gln Asn Asn Asn Val Leu His Ile
    450                 455                 460

Phe Asp Ala Ile Ser Asn Ile Leu Asn Lys Phe Ser Thr Ile Gln Asp
465                 470                 475                 480

Arg Ile Arg Ile Leu Glu Gly Tyr Phe Glu Phe Ser Asn Leu Lys Lys
                485                 490                 495

Asp Val Lys Ser Ser Glu Ile Tyr Ser Glu Ile Ala Lys Leu Arg Glu
            500                 505                 510

Phe Ser Gly Thr Ser Ser Leu Ser Phe Gly Ala Tyr Tyr Lys Phe Ile
        515                 520                 525

Pro Asn Leu Ile Ser Glu Gly Ser Lys Asn Tyr Ser Thr Ile Ser Tyr
    530                 535                 540

Glu Glu Lys Ala Leu Gln Asn Gln Lys Asn Asn Phe Ser His Ser Asn
545                 550                 555                 560

Leu Phe Glu Lys Thr Trp Val Glu Asp Leu Ile Ala Ser Pro Thr Val
                565                 570                 575
```

```
Lys Arg Ser Leu Arg Gln Thr Met Asn Leu Leu Lys Glu Ile Phe Lys
            580                 585                 590

Tyr Ser Glu Lys Asn Asn Leu Glu Ile Glu Lys Ile Val Val Glu Val
        595                 600                 605

Thr Arg Ser Ser Asn Asn Lys His Glu Arg Lys Lys Ile Glu Gly Ile
    610                 615                 620

Asn Lys Tyr Arg Lys Glu Lys Tyr Glu Glu Leu Lys Lys Val Tyr Asp
625                 630                 635                 640

Leu Pro Asn Glu Asn Thr Thr Leu Leu Lys Lys Leu Trp Leu Leu Arg
                645                 650                 655

Gln Gln Gln Gly Tyr Asp Ala Tyr Ser Leu Arg Lys Ile Glu Ala Asn
            660                 665                 670

Asp Val Ile Asn Lys Pro Trp Asn Tyr Asp Ile Asp His Ile Val Pro
        675                 680                 685

Arg Ser Ile Ser Phe Asp Asp Ser Phe Ser Asn Leu Val Ile Val Asn
    690                 695                 700

Lys Leu Asp Asn Ala Lys Lys Ser Asn Asp Leu Ser Ala Lys Gln Phe
705                 710                 715                 720

Ile Glu Lys Ile Tyr Gly Ile Glu Lys Leu Lys Glu Ala Lys Glu Asn
                725                 730                 735

Trp Gly Asn Trp Tyr Leu Arg Asn Ala Asn Gly Lys Ala Phe Asn Asp
            740                 745                 750

Lys Gly Lys Phe Ile Lys Leu Tyr Thr Ile Asp Asn Leu Asp Glu Phe
        755                 760                 765

Asp Asn Ser Asp Phe Ile Asn Arg Asn Leu Ser Asp Thr Ser Tyr Ile
```

```
    770                 775                 780

Thr Asn Ala Leu Val Asn His Leu Thr Phe Ser Asn Ser Lys Tyr Lys
785                 790                 795                 800

Tyr Ser Val Val Ser Val Asn Gly Lys Gln Thr Ser Asn Leu Arg Asn
                805                 810                 815

Gln Ile Ala Phe Val Gly Ile Lys Asn Asn Lys Glu Thr Glu Arg Glu
            820                 825                 830

Trp Lys Arg Pro Glu Gly Phe Lys Ser Ile Asn Ser Asn Asp Phe Leu
        835                 840                 845

Ile Arg Glu Glu Gly Lys Asn Asp Val Lys Asp Asp Val Leu Ile Lys
    850                 855                 860

Asp Arg Ser Phe Asn Gly His His Ala Glu Asp Ala Tyr Phe Ile Thr
865                 870                 875                 880

Ile Ile Ser Gln Tyr Phe Arg Ser Phe Lys Arg Ile Glu Arg Leu Asn
                885                 890                 895

Val Asn Tyr Arg Lys Glu Thr Arg Glu Leu Asp Asp Leu Glu Lys Asn
            900                 905                 910

Asn Ile Lys Phe Lys Glu Lys Ala Ser Phe Asp Asn Phe Leu Leu Ile
        915                 920                 925

Asn Ala Leu Asp Glu Leu Asn Glu Lys Leu Asn Gln Met Arg Phe Ser
    930                 935                 940

Arg Met Val Ile Thr Lys Lys Asn Thr Gln Leu Phe Asn Glu Thr Leu
945                 950                 955                 960

Tyr Ser Gly Lys Tyr Asp Lys Gly Lys Asn Thr Ile Lys Lys Val Glu
                965                 970                 975
```

```
Lys Leu Asn Leu Leu Asp Asn Arg Thr Asp Lys Ile Lys Lys Ile Glu
            980                 985                 990


Glu Phe Phe Asp Glu Asp Lys Leu  Lys Glu Asn Glu Leu  Thr Lys Leu
        995                 1000                1005


His Ile  Phe Asn His Asp Lys  Asn Leu Tyr Glu Thr  Leu Lys Ile
    1010                1015                1020


Ile Trp  Asn Glu Val Lys Ile  Glu Ile Lys Asn Lys  Asn Leu Asn
    1025                1030                1035


Glu Lys  Asn Tyr Phe Lys Tyr  Phe Val Asn Lys Lys  Leu Gln Glu
    1040                1045                1050


Gly Lys  Ile Ser Phe Asn Glu  Trp Val Pro Ile Leu  Asp Asn Asp
    1055                1060                1065


Phe Lys  Ile Ile Arg Lys Ile  Arg Tyr Ile Lys Phe  Ser Ser Glu
    1070                1075                1080


Glu Lys  Glu Thr Asp Glu Ile  Ile Phe Ser Gln Ser  Asn Phe Leu
    1085                1090                1095


Lys Ile  Asp Gln Arg Gln Asn  Phe Ser Phe His Asn  Thr Leu Tyr
    1100                1105                1110


Trp Val  Gln Ile Trp Val Tyr  Lys Asn Gln Lys Asp  Gln Tyr Cys
    1115                1120                1125


Phe Ile  Ser Ile Asp Ala Arg  Asn Ser Lys Phe Glu  Lys Asp Glu
    1130                1135                1140


Ile Lys  Ile Asn Tyr Glu Lys  Leu Lys Thr Gln Lys  Glu Lys Leu
    1145                1150                1155


Gln Ile  Ile Asn Glu Glu Pro  Ile Leu Lys Ile Asn  Lys Gly Asp
```

1160 1165 1170

Leu Phe Glu Asn Glu Glu Lys Glu Leu Phe Tyr Ile Val Gly Arg
1175 1180 1185

Asp Glu Lys Pro Gln Lys Leu Glu Ile Lys Tyr Ile Leu Gly Lys
1190 1195 1200

Lys Ile Lys Asp Gln Lys Gln Ile Gln Lys Pro Val Lys Lys Tyr
1205 1210 1215

Phe Pro Asn Trp Lys Lys Val Asn Leu Thr Tyr Met Gly Glu Ile
1220 1225 1230

Phe Lys Lys
1235

<210> 256
<211> 1059
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Sequence

<400> 256

Met Ile Glu Arg Ile Leu Gly Val Asp Leu Gly Ile Ser Ser Leu Gly
1 5 10 15

Trp Ala Ile Val Glu Tyr Asp Lys Asp Asp Glu Ala Ala Asn Arg Ile
20 25 30

Ile Asp Cys Gly Val Arg Leu Phe Thr Ala Ala Glu Thr Pro Lys Lys
35 40 45

Lys Glu Ser Pro Asn Lys Ala Arg Arg Glu Ala Arg Gly Ile Arg Arg
50 55 60

Val Leu Asn Arg Arg Arg Val Arg Met Asn Met Ile Lys Lys Leu Phe

```
65                  70                  75                  80

Leu Arg Ala Gly Leu Ile Gln Asp Val Asp Leu Asp Gly Glu Gly Gly
                85                  90                  95

Met Phe Tyr Ser Lys Ala Asn Arg Ala Asp Val Trp Glu Leu Arg His
            100                 105                 110

Asp Gly Leu Tyr Arg Leu Leu Lys Gly Asp Glu Leu Ala Arg Val Leu
        115                 120                 125

Ile His Ile Ala Lys His Arg Gly Tyr Lys Phe Ile Gly Asp Asp Glu
    130                 135                 140

Ala Asp Glu Glu Ser Gly Lys Val Lys Lys Ala Gly Val Val Leu Arg
145                 150                 155                 160

Gln Asn Phe Glu Ala Ala Gly Cys Arg Thr Val Gly Glu Trp Leu Trp
                165                 170                 175

Arg Glu Arg Gly Ala Asn Gly Lys Lys Arg Asn Lys His Gly Asp Tyr
            180                 185                 190

Glu Ile Ser Ile His Arg Asp Leu Leu Val Glu Glu Val Glu Ala Ile
        195                 200                 205

Phe Val Ala Gln Gln Glu Met Arg Ser Thr Ile Ala Thr Asp Ala Leu
    210                 215                 220

Lys Ala Ala Tyr Arg Glu Ile Ala Phe Phe Val Arg Pro Met Gln Arg
225                 230                 235                 240

Ile Glu Lys Met Val Gly His Cys Thr Tyr Phe Pro Glu Glu Arg Arg
                245                 250                 255

Ala Pro Lys Ser Ala Pro Thr Ala Glu Lys Phe Ile Ala Ile Ser Lys
            260                 265                 270
```

```
Phe Phe Ser Thr Val Ile Ile Asp Asn Glu Gly Trp Glu Gln Lys Ile
        275                 280                 285

Ile Glu Arg Lys Thr Leu Glu Glu Leu Leu Asp Phe Ala Val Ser Arg
    290                 295                 300

Glu Lys Val Glu Phe Arg His Leu Arg Lys Phe Leu Asp Leu Ser Asp
305                 310                 315                 320

Asn Glu Ile Phe Lys Gly Leu His Tyr Lys Gly Lys Pro Lys Thr Ala
                325                 330                 335

Lys Lys Arg Glu Ala Thr Leu Phe Asp Pro Asn Glu Pro Thr Glu Leu
            340                 345                 350

Glu Phe Asp Lys Val Glu Ala Glu Lys Lys Ala Trp Ile Ser Leu Arg
        355                 360                 365

Gly Ala Ala Lys Leu Arg Glu Ala Leu Gly Asn Glu Phe Tyr Gly Arg
    370                 375                 380

Phe Val Ala Leu Gly Lys His Ala Asp Glu Ala Thr Lys Ile Leu Thr
385                 390                 395                 400

Tyr Tyr Lys Asp Glu Gly Gln Lys Arg Arg Glu Leu Thr Lys Leu Pro
                405                 410                 415

Leu Glu Ala Glu Met Val Glu Arg Leu Val Lys Ile Gly Phe Ser Asp
            420                 425                 430

Phe Leu Lys Leu Ser Leu Lys Ala Ile Arg Asp Ile Leu Pro Ala Met
        435                 440                 445

Glu Ser Gly Ala Arg Tyr Asp Glu Ala Val Leu Met Leu Gly Val Pro
    450                 455                 460

His Lys Glu Lys Ser Ala Ile Leu Pro Pro Leu Asn Lys Thr Asp Ile
```

```
465                 470                 475                 480

Asp Ile Leu Asn Pro Thr Val Ile Arg Ala Phe Ala Gln Phe Arg Lys
                485                 490                 495

Val Ala Asn Ala Leu Val Arg Lys Tyr Gly Ala Phe Asp Arg Val His
            500                 505                 510

Phe Glu Leu Ala Arg Glu Ile Asn Thr Lys Gly Glu Ile Glu Asp Ile
        515                 520                 525

Lys Glu Ser Gln Arg Lys Asn Glu Lys Glu Arg Lys Glu Ala Ala Asp
    530                 535                 540

Trp Ile Ala Glu Thr Ser Phe Gln Val Pro Leu Thr Arg Lys Asn Ile
545                 550                 555                 560

Leu Lys Lys Arg Leu Tyr Ile Gln Gln Asp Gly Arg Cys Ala Tyr Thr
                565                 570                 575

Gly Asp Val Ile Glu Leu Glu Arg Leu Phe Asp Glu Gly Tyr Cys Glu
            580                 585                 590

Ile Asp His Ile Leu Pro Arg Ser Arg Ser Ala Asp Asp Ser Phe Ala
        595                 600                 605

Asn Lys Val Leu Cys Leu Ala Arg Ala Asn Gln Gln Lys Thr Asp Arg
    610                 615                 620

Thr Pro Tyr Glu Trp Phe Gly His Asp Ala Ala Arg Trp Asn Ala Phe
625                 630                 635                 640

Glu Thr Arg Thr Ser Ala Pro Ser Asn Arg Val Arg Thr Gly Lys Gly
                645                 650                 655

Lys Ile Asp Arg Leu Leu Lys Lys Asn Phe Asp Glu Asn Ser Glu Met
            660                 665                 670
```

```
Ala Phe Lys Asp Arg Asn Leu Asn Asp Thr Arg Tyr Met Ala Arg Ala
        675                 680                 685

Ile Lys Thr Tyr Cys Glu Gln Tyr Trp Val Phe Lys Asn Ser His Thr
    690                 695                 700

Lys Ala Pro Val Gln Val Arg Ser Gly Lys Leu Thr Ser Val Leu Arg
705                 710                 715                 720

Tyr Gln Trp Gly Leu Glu Ser Lys Asp Arg Glu Ser His Thr His His
                725                 730                 735

Ala Val Asp Ala Ile Ile Ile Ala Phe Ser Thr Gln Gly Met Val Gln
            740                 745                 750

Lys Leu Ser Glu Tyr Tyr Arg Phe Lys Glu Thr His Arg Glu Lys Glu
        755                 760                 765

Arg Pro Lys Leu Ala Val Pro Leu Ala Asn Phe Arg Asp Ala Val Glu
    770                 775                 780

Glu Ala Thr Arg Ile Glu Asn Thr Glu Thr Val Lys Glu Gly Val Glu
785                 790                 795                 800

Val Lys Arg Leu Leu Ile Ser Arg Pro Pro Arg Ala Arg Val Thr Gly
                805                 810                 815

Gln Ala His Glu Gln Thr Ala Lys Pro Tyr Pro Arg Ile Lys Gln Val
            820                 825                 830

Lys Asn Lys Lys Lys Trp Arg Leu Ala Pro Ile Asp Glu Glu Lys Phe
        835                 840                 845

Glu Ser Phe Lys Ala Asp Arg Val Ala Ser Ala Asn Gln Lys Asn Phe
    850                 855                 860

Tyr Glu Thr Ser Thr Ile Pro Arg Val Asp Val Tyr His Lys Lys Gly
```

```
865                 870                 875                 880

Lys Phe His Leu Val Pro Ile Tyr Leu His Glu Met Val Leu Asn Glu
                885                 890                 895

Leu Pro Asn Leu Ser Leu Gly Thr Asn Pro Glu Ala Met Asp Glu Asn
            900                 905                 910

Phe Phe Lys Phe Ser Ile Phe Lys Asp Asp Leu Ile Ser Ile Gln Thr
        915                 920                 925

Gln Gly Thr Pro Lys Lys Pro Ala Lys Ile Ile Met Gly Tyr Phe Lys
    930                 935                 940

Asn Met His Gly Ala Asn Met Val Leu Ser Ser Ile Asn Asn Ser Pro
945                 950                 955                 960

Cys Glu Gly Phe Thr Cys Thr Pro Val Ser Met Asp Lys Lys His Lys
                965                 970                 975

Asp Lys Cys Lys Leu Cys Pro Glu Glu Asn Arg Ile Ala Gly Arg Cys
            980                 985                 990

Leu Gln Gly Phe Leu Asp Tyr Trp  Ser Gln Glu Gly Leu  Arg Pro Pro
        995                 1000                1005

Arg Lys  Glu Phe Glu Cys Asp  Gln Gly Val Lys Phe  Ala Leu Asp
    1010                1015                1020

Val Lys  Lys Tyr Gln Ile Asp  Pro Leu Gly Tyr Tyr  Tyr Glu Val
    1025                1030                1035

Lys Gln  Glu Lys Arg Leu Gly  Thr Ile Pro Gln Met  Arg Ser Ala
    1040                1045                1050

Lys Lys  Leu Val Lys Lys
    1055
```

<210> 257
<211> 1166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Sequence

<400> 257

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Met His Val Glu Ile Asp Phe Pro His Phe Ser Arg Gly Asp Ser His
1               5                  10                  15


Leu Ala Met Asn Lys Asn Glu Ile Leu Arg Gly Ser Ser Val Leu Tyr
            20                  25                  30


Arg Leu Gly Leu Asp Leu Gly Ser Asn Ser Leu Gly Trp Phe Val Thr
        35                  40                  45


His Leu Glu Lys Arg Gly Asp Arg His Glu Pro Val Ala Leu Gly Pro
    50                  55                  60


Gly Gly Val Arg Ile Phe Pro Asp Gly Arg Asp Pro Gln Ser Gly Thr
65                  70                  75                  80


Ser Asn Ala Val Asp Arg Arg Met Ala Arg Gly Ala Arg Lys Arg Arg
                85                  90                  95


Asp Arg Phe Val Glu Arg Arg Lys Glu Leu Ile Ala Ala Leu Ile Lys
            100                 105                 110


Tyr Asn Leu Leu Pro Asp Asp Ala Arg Glu Arg Arg Ala Leu Glu Val
        115                 120                 125


Leu Asp Pro Tyr Ala Leu Arg Lys Thr Ala Leu Thr Asp Thr Leu Pro
    130                 135                 140


Ala His His Val Gly Arg Ala Leu Phe His Leu Asn Gln Arg Arg Gly
145                 150                 155                 160
```

```
Phe Gln Ser Asn Arg Lys Thr Asp Ser Lys Gln Ser Glu Asp Gly Ala
                165                 170                 175

Ile Lys Gln Ala Ala Ser Arg Leu Ala Thr Asp Lys Gly Asn Glu Thr
            180                 185                 190

Leu Gly Val Phe Phe Ala Asp Met His Leu Arg Lys Ser Tyr Glu Asp
        195                 200                 205

Arg Gln Thr Ala Ile Arg Ala Glu Leu Val Arg Leu Gly Lys Asp His
    210                 215                 220

Leu Thr Gly Asn Ala Arg Lys Lys Ile Trp Ala Lys Val Arg Lys Arg
225                 230                 235                 240

Leu Phe Gly Asp Glu Val Leu Pro Arg Ala Asp Ala Pro His Gly Val
                245                 250                 255

Arg Ala Arg Ala Thr Ile Thr Gly Thr Lys Ala Ser Tyr Asp Tyr Tyr
            260                 265                 270

Pro Thr Arg Asp Met Leu Arg Asp Glu Phe Asn Ala Ile Trp Ala Gly
        275                 280                 285

Gln Ser Ala His His Ala Thr Ile Thr Asp Glu Ala Arg Thr Glu Ile
    290                 295                 300

Glu His Ile Ile Phe Tyr Gln Arg Pro Leu Lys Pro Ala Ile Val Gly
305                 310                 315                 320

Lys Cys Thr Leu Asp Pro Ala Thr Arg Pro Phe Lys Glu Asp Pro Glu
                325                 330                 335

Gly Tyr Arg Ala Pro Trp Ser His Pro Leu Ala Gln Arg Phe Arg Ile
            340                 345                 350

Leu Ser Glu Ala Arg Asn Leu Glu Ile Arg Asp Thr Gly Lys Gly Ser
```

```
        355                 360                 365

Arg Arg Leu Thr Lys Glu Gln Ser Asp Leu Val Val Ala Ala Leu Leu
    370                 375                 380

Ala Asn Arg Glu Val Lys Phe Asp Lys Leu Arg Thr Leu Leu Lys Leu
385                 390                 395                 400

Pro Ala Glu Ala Arg Phe Asn Leu Glu Ser Asp Arg Arg Ala Ala Leu
                405                 410                 415

Asp Gly Asp Gln Thr Ala Ala Arg Leu Ser Asp Lys Lys Gly Phe Asn
            420                 425                 430

Lys Ala Trp Arg Gly Phe Pro Pro Glu Arg Gln Ile Ala Ile Val Ala
        435                 440                 445

Arg Leu Glu Glu Thr Glu Asp Glu Asn Glu Leu Ile Ala Trp Leu Glu
    450                 455                 460

Lys Glu Cys Ala Leu Asp Gly Ala Ala Ala Ala Arg Val Ala Asn Thr
465                 470                 475                 480

Thr Leu Pro Asp Gly His Cys Arg Leu Gly Leu Arg Ala Ile Lys Lys
                485                 490                 495

Ile Val Pro Ile Met Gln Asp Gly Leu Asp Glu Asp Gly Val Ala Gly
            500                 505                 510

Ala Gly Tyr His Ile Ala Ala Lys Arg Ala Gly Tyr Asp His Ala Lys
        515                 520                 525

Leu Pro Thr Gly Glu Gln Leu Gly Arg Leu Pro Tyr Tyr Gly Gln Trp
    530                 535                 540

Leu Gln Asp Ala Val Val Gly Ser Gly Asp Ala Arg Asp Gln Lys Glu
545                 550                 555                 560
```

```
Lys Gln Tyr Gly Gln Phe Pro Asn Pro Thr Val His Ile Gly Leu Gly
               565                 570                 575

Gln Leu Arg Arg Val Val Asn Asp Leu Ile Asp Lys Tyr Gly Pro Pro
            580                 585                 590

Thr Glu Ile Ser Ile Glu Phe Thr Arg Ala Leu Lys Leu Ser Glu Gln
        595                 600                 605

Gln Lys Ala Glu Arg Gln Arg Glu Gln Arg Arg Asn Gln Asp Lys Asn
    610                 615                 620

Lys Ala Arg Ala Glu Glu Leu Ala Lys Phe Gly Arg Pro Ala Asn Pro
625                 630                 635                 640

Arg Asn Leu Leu Lys Met Arg Leu Trp Glu Glu Leu Ala His Asp Pro
               645                 650                 655

Leu Asp Arg Lys Cys Val Tyr Thr Gly Glu Gln Ile Ser Ile Glu Arg
            660                 665                 670

Leu Leu Ser Asp Glu Val Asp Ile Asp His Ile Leu Pro Val Ala Met
        675                 680                 685

Thr Leu Asp Asp Ser Pro Ala Asn Lys Ile Ile Cys Met Arg Tyr Ala
    690                 695                 700

Asn Arg His Lys Arg Lys Gln Thr Pro Ser Glu Ala Phe Gly Ser Ser
705                 710                 715                 720

Pro Thr Leu Gln Gly His Arg Tyr Asn Trp Asp Asp Ile Ala Ala Arg
               725                 730                 735

Ala Thr Gly Leu Pro Arg Asn Lys Arg Trp Arg Phe Asp Ala Asn Ala
            740                 745                 750

Arg Glu Glu Phe Asp Lys Arg Gly Gly Phe Leu Ala Arg Gln Leu Asn
```

```
        755                 760                 765

Glu Thr Gly Trp Leu Ala Arg Leu Ala Lys Gln Tyr Leu Gly Ala Val
    770                 775                 780

Thr Asp Pro Asn Gln Ile Trp Val Val Pro Gly Arg Leu Thr Ser Met
785                 790                 795                 800

Leu Arg Gly Lys Trp Gly Leu Asn Gly Leu Leu Pro Ser Asp Asn Tyr
                805                 810                 815

Ala Gly Val Gln Asp Lys Ala Glu Glu Phe Leu Ala Ser Thr Asp Asp
            820                 825                 830

Met Glu Phe Ser Gly Val Lys Asn Arg Ala Asp His Arg His His Ala
        835                 840                 845

Ile Asp Gly Leu Val Thr Ala Leu Thr Asp Arg Ser Leu Leu Trp Lys
    850                 855                 860

Met Ala Asn Ala Tyr Asp Glu Glu His Glu Lys Phe Val Ile Glu Pro
865                 870                 875                 880

Pro Trp Pro Thr Met Arg Asp Asp Leu Lys Ala Ala Leu Glu Lys Met
                885                 890                 895

Val Val Ser His Lys Pro Asp His Gly Ile Glu Gly Lys Leu His Glu
            900                 905                 910

Asp Ser Ala Tyr Gly Phe Val Lys Pro Leu Asp Ala Thr Gly Leu Lys
        915                 920                 925

Glu Glu Glu Ala Gly Asn Leu Val Tyr Arg Lys Ala Ile Glu Ser Leu
    930                 935                 940

Asn Glu Asn Glu Val Asp Arg Ile Arg Asp Ile Gln Leu Arg Thr Ile
945                 950                 955                 960
```

```
Val Arg Asp His Val Asn Val Glu Lys Thr Lys Gly Val Ala Leu Ala
               965                 970                 975


Asp Ala Leu Arg Gln Leu Gln Ala Pro Ser Asp Asp Tyr Pro Gln Phe
            980                 985                 990


Lys His Gly Leu Arg His Val Arg  Ile Leu Lys Lys Glu  Lys Gly Asp
        995                 1000                1005


Tyr Leu  Val Pro Ile Ala Asn  Arg Ala Ser Gly Val  Ala Tyr Lys
    1010                1015                1020


Ala Tyr  Ser Ala Gly Glu Asn  Phe Cys Val Glu Val  Phe Glu Thr
    1025                1030                1035


Ala Gly  Gly Lys Trp Asp Gly  Glu Ala Val Arg Arg  Phe Asp Ala
    1040                1045                1050


Asn Lys  Lys Asn Ala Gly Pro  Lys Ile Ala His Ala  Pro Gln Trp
    1055                1060                1065


Arg Asp  Ala Asn Glu Gly Ala  Lys Leu Val Met Arg  Ile His Lys
    1070                1075                1080


Gly Asp  Leu Ile Arg Leu Asp  His Glu Gly Arg Ala  Arg Ile Met
    1085                1090                1095


Val Val  His Arg Leu Asp Ala  Ala Ala Gly Arg Phe  Lys Leu Ala
    1100                1105                1110


Asp His  Asn Glu Thr Gly Asn  Leu Asp Lys Arg His  Ala Thr Asn
    1115                1120                1125


Asn Asp  Ile Asp Pro Phe Arg  Trp Leu Met Ala Ser  Tyr Asn Thr
    1130                1135                1140


Leu Lys  Lys Leu Ala Ala Val  Pro Val Arg Val Asp  Glu Leu Gly
```

1145 1150 1155

Arg Val Trp Arg Val Met Pro Asn
1160 1165

<210> 258
<211> 1149
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Sequence

<400> 258

Met Glu Arg Tyr His Ile Gly Leu Asp Ile Gly Thr Ser Ser Ile Gly
1 5 10 15

Trp Ala Val Ile Gly Asp Asp Phe Lys Ile Lys Arg Lys Lys Gly Lys
20 25 30

Asn Leu Ile Gly Val Arg Leu Phe Lys Glu Gly Asp Thr Ala Ala Glu
35 40 45

Arg Arg Gly Phe Arg Thr Gln Arg Arg Arg Leu Asn Arg Arg Lys Trp
50 55 60

Arg Leu Lys Leu Leu Glu Glu Ile Phe Asp Pro Tyr Met Ala Glu Val
65 70 75 80

Asp Lys Tyr Phe Phe Ala Arg Leu Lys Glu Ser Asn Leu Ser Pro Lys
85 90 95

Asp Ser Asn Lys Lys Tyr Leu Gly Ser Leu Leu Phe Pro Asp Ile Ser
100 105 110

Asp Ser Asn Phe Tyr Asp Lys Tyr Pro Thr Ile Tyr His Leu Arg Arg
115 120 125

Asp Leu Met Glu Lys Asp Lys Lys Phe Asp Leu Arg Glu Ile Tyr Leu

```
    130                 135                 140

Ala Ile His His Ile Val Lys Tyr Arg Gly Asn Phe Leu Glu Lys Val
145                 150                 155                 160

Pro Ala Lys Asn Tyr Lys Asn Ser Gly Ala Ser Ile Gly Phe Leu Leu
                165                 170                 175

Glu Glu Val Asn Asp Leu Tyr Gly Asn Ile Ile Gly Asn Glu Asp Val
            180                 185                 190

Ala Ile Leu Asp Asn Asp Lys Phe Glu Asp Val Glu Lys Ile Ile Leu
        195                 200                 205

Asn Asp Glu Ile Arg Asn Ile Asp Lys Gln Lys Asn Val Gly Arg Leu
    210                 215                 220

Leu Val Lys Asp Lys Lys Glu Lys Asn Ile Val Thr Ala Phe Ser Lys
225                 230                 235                 240

Ala Ile Phe Gly Tyr Lys Phe Asn Leu Glu Asp Leu Leu Leu Ile Glu
                245                 250                 255

Ser Asp Glu Lys Asn Lys Leu Thr Phe Asn Asp Glu Asn Ile Asp Asp
            260                 265                 270

Ile Phe Asn Glu Leu Ser His Ser Leu Asn Asp Asn Gln Met Asp Leu
        275                 280                 285

Leu Thr Lys Thr Arg Glu Ile Tyr Phe Lys Phe Lys Leu Asn Met Ile
    290                 295                 300

Val Pro Thr Gly Tyr Thr Ile Ser Glu Ser Met Ile Glu Lys Tyr Glu
305                 310                 315                 320

Met His Lys Ala His Leu Lys Met Tyr Lys Glu Phe Ile Asn Thr Leu
                325                 330                 335
```

```
Asn Ala Lys Asp Arg Lys Ile Leu Lys Asn Ala Tyr Ser Asp Tyr Ile
            340                 345                 350

Asn Asn Glu Lys Ala Lys Ala Ala Asn Ala Gln Glu Asn Phe Tyr Lys
        355                 360                 365

Thr Val Lys Lys Thr Ile Lys Glu Asn Asp Ser Asp Thr Ala Lys Lys
    370                 375                 380

Ile Ile Gly Leu Ile Asp Glu Gly Asn Phe Met Pro Lys Gln Arg Thr
385                 390                 395                 400

Gly Glu Asn Gly Val Ile Pro His Gln Leu His Gln Ile Glu Leu Asp
                405                 410                 415

Arg Ile Ile Glu Asn Gln Ala Lys Tyr Tyr Pro Trp Leu Ala Glu Glu
            420                 425                 430

Asn Pro Val Glu Lys Asn Arg Lys Phe Ala Lys Tyr Lys Leu Asp Glu
        435                 440                 445

Leu Val Thr Phe Arg Val Pro Tyr Tyr Val Gly Pro Leu Ile Asp Lys
    450                 455                 460

Thr Glu Ser Asn Lys Asn Glu Lys Glu Thr Lys Phe Ala Trp Met Val
465                 470                 475                 480

Arg Lys Ala Lys Gly Thr Ile Thr Pro Trp Asn Phe Glu Asn Leu Val
                485                 490                 495

Asp Arg Thr Glu Ser Ala Asn Arg Phe Ile Lys Arg Met Thr Ser Lys
            500                 505                 510

Asp Thr Tyr Ile Ile Gly Glu Asp Val Leu Pro Ala Ser Ser Leu Leu
        515                 520                 525

Tyr Glu Lys Tyr Lys Val Leu Asn Glu Leu Asn Asn Ile Lys Val Asn
```

```
    530                 535                 540

Lys Lys Lys Leu Asp Val Glu Gln Lys Gln His Val Tyr Leu Asp Leu
545                 550                 555                 560

Phe Thr Thr Arg Lys Asn Val Thr Lys Asp Asp Leu Ala Thr Ser Leu
                565                 570                 575

Asn Cys Asp Val Glu Ser Ile Thr Gly Leu Thr Asp Asn Lys Lys Phe
            580                 585                 590

Asn Ser Ser Leu Ser Ser Tyr Ile Asp Leu Lys Ala Ile Leu Gly Asn
        595                 600                 605

Ile Val Asp Asp Tyr Ser Lys Asn Glu Asp Leu Glu Lys Ile Ile Glu
    610                 615                 620

Tyr Ser Thr Ile Phe Glu Asp Gly Asn Ile Tyr Lys Glu Lys Leu Ser
625                 630                 635                 640

Glu Ile Ser Trp Leu Thr Asp Glu Gln Ile Glu Lys Leu Ser Asn Ile
                645                 650                 655

His Phe Lys Gly Trp Gly Arg Leu Ser Lys Lys Leu Leu Thr Gln Ile
            660                 665                 670

Thr Asn Glu Asn Gly Glu Arg Ile Ile Asp Thr Leu Trp Asn Thr Ser
        675                 680                 685

Asn Asn Phe Ile Gln Val Ile Ser Asp Glu Ser Ile Gln Ala Lys Leu
    690                 695                 700

Ala Glu Ile Asn Gly Glu Tyr Ala Asn Lys Tyr Asn Leu Glu Asp Ile
705                 710                 715                 720

Leu Asp Glu Ala Tyr Thr Ser Pro Gln Asn Lys Lys Ala Ile Arg Gln
                725                 730                 735
```

```
Val Met Lys Val Val Glu Asp Ile Glu Lys Ala Met Lys Cys Glu Pro
            740                 745                 750

Thr Ser Ile Ala Ile Glu Phe Thr Arg Glu Lys Arg Lys Ser Lys Leu
        755                 760                 765

Thr Asn Thr Arg Tyr Lys Lys Ile Ser Glu Thr Tyr Glu Lys Ile Thr
    770                 775                 780

Asp Glu Leu Ile Ser Glu Tyr Glu Leu Gly Lys Leu Gln Ser Glu Leu
785                 790                 795                 800

Asp Ser Lys Val Asn Asn Met Arg Asp Arg Tyr Tyr Leu Tyr Phe Met
                805                 810                 815

Gln Leu Gly Arg Asp Met Tyr Thr Gly Glu Lys Met Asn Ile Asp Glu
            820                 825                 830

Leu His Gln Lys Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Phe Ile
        835                 840                 845

Lys Asp Asp Ser Leu Asn Asn Arg Val Leu Thr Ser Lys Ser Val Asn
    850                 855                 860

Ile Lys Glu Lys Ser Asp Lys Thr Ala Ala Asp Leu Tyr Ala Ala Lys
865                 870                 875                 880

Met Gly Asp Phe Trp Arg Lys Leu Arg Lys Gln Gly Leu Met Thr Glu
                885                 890                 895

Gln Lys Tyr Lys Asn Leu Leu Thr Arg Thr Asp Ser Ile Asn Lys Tyr
            900                 905                 910

Thr Lys Gln Ser Phe Ile Lys Arg Gln Leu Val Glu Thr Ser Gln Val
        915                 920                 925

Val Lys Leu Ala Ala Asn Ile Leu Gln Asp Lys Tyr Arg Asn Thr Lys
```

```
    930                 935                 940

Ile Ile Glu Ile Arg Ala Arg Leu Asn Ser Asp Leu Arg Lys Lys Tyr
945                 950                 955                 960

Glu Leu Ile Lys Asn Arg Glu Val Asn Asp Tyr His His Ala Ile Asp
                965                 970                 975

Gly Tyr Leu Thr Thr Phe Val Gly Gln Tyr Leu Tyr Lys Val Tyr Pro
            980                 985                 990

Lys Leu Arg Ser Tyr Phe Val Tyr  Asp Asp Phe Lys Lys  Leu Asp Ser
        995                 1000                1005

Asn Tyr  Leu Lys His Met Asp  Lys Phe Asn Phe Ile  Trp Lys Leu
    1010                1015                1020

Glu Asp  Lys Lys Ala Glu Asp  Val Tyr Asp Lys Val  Asn Asp Glu
    1025                1030                1035

Phe Val  Leu Asn Val Pro Glu  Met Lys Glu Tyr Ile  Arg Lys Ile
    1040                1045                1050

Tyr Asn  Tyr Lys Tyr Met Leu  Val Ser Lys Glu Val  Thr Thr Lys
    1055                1060                1065

Asn Gly  Ala Phe Tyr Asp Gln  Thr Lys Tyr Asn Ala  Lys Thr Ile
    1070                1075                1080

Asn Leu  Ile Pro Ile Lys Lys  Asp Lys Pro Thr Asn  Ile Tyr Gly
    1085                1090                1095

Gly Tyr  Lys Gly Lys Val Ser  Ser Tyr Met Met Leu  Val Lys Ile
    1100                1105                1110

Gln Lys  Lys Lys Glu Val Ile  Tyr Lys Phe Val Gly  Val Pro Arg
    1115                1120                1125
```

```
Leu Trp  Thr Asp Glu Leu Asp  Arg Leu Ile Asp Thr  Asp Glu Lys
    1130                1135                1140


Lys Ala  Leu Leu Lys Lys
    1145
```

<210> 259
<211> 1314
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Sequence

<400> 259

```
Met Leu Arg Leu Tyr Cys Ala Asn Asn Leu Val Leu Asn Asn Val Gln
1               5                   10                  15


Asn Leu Trp Lys Tyr Leu Leu Leu Leu Ile Phe Asp Lys Lys Ile Ile
            20                  25                  30


Phe Leu Phe Lys Ile Lys Val Ile Leu Ile Arg Arg Tyr Met Glu Asn
        35                  40                  45


Asn Asn Lys Glu Lys Ile Val Ile Gly Phe Asp Leu Gly Val Ala Ser
    50                  55                  60


Val Gly Trp Ser Ile Val Asn Ala Glu Thr Lys Glu Val Ile Asp Leu
65                  70                  75                  80


Gly Val Arg Leu Phe Ser Glu Pro Glu Lys Ala Asp Tyr Arg Arg Ala
                85                  90                  95


Lys Arg Thr Thr Arg Arg Leu Leu Arg Arg Lys Lys Phe Lys Arg Glu
            100                 105                 110


Lys Phe His Lys Leu Ile Leu Lys Asn Ala Glu Ile Phe Gly Leu Gln
        115                 120                 125
```

```
Ser Arg Asn Glu Ile Leu Asn Val Tyr Lys Asp Gln Ser Ser Lys Tyr
    130                 135                 140

Arg Asn Ile Leu Lys Leu Lys Ile Asn Ala Leu Lys Glu Glu Ile Lys
145                 150                 155                 160

Pro Ser Glu Leu Val Trp Ile Leu Arg Asp Tyr Leu Gln Asn Arg Gly
                165                 170                 175

Tyr Phe Tyr Lys Asn Glu Lys Leu Thr Asp Glu Phe Val Ser Asn Ser
            180                 185                 190

Phe Pro Ser Lys Lys Leu His Glu His Tyr Glu Lys Tyr Gly Phe Phe
        195                 200                 205

Arg Gly Ser Val Lys Leu Asp Asn Lys Leu Asp Asn Lys Lys Asp Lys
    210                 215                 220

Ala Lys Glu Lys Asp Glu Glu Glu Glu Ser Asp Ala Lys Lys Glu Ser
225                 230                 235                 240

Glu Glu Leu Ile Phe Ser Asn Lys Gln Trp Ile Asn Glu Ile Val Lys
                245                 250                 255

Val Phe Glu Asn Gln Ser Tyr Leu Thr Glu Ser Phe Lys Glu Glu Tyr
            260                 265                 270

Leu Lys Leu Phe Asn Tyr Val Arg Pro Phe Asn Lys Gly Pro Gly Ser
        275                 280                 285

Lys Asn Ser Arg Thr Ala Tyr Gly Val Phe Ser Thr Asp Ile Asp Pro
    290                 295                 300

Glu Thr Asn Lys Phe Lys Asp Tyr Ser Asn Ile Trp Asp Lys Thr Ile
305                 310                 315                 320

Gly Lys Cys Ser Leu Phe Glu Glu Glu Ile Arg Ala Pro Lys Asn Leu
```

```
                325                 330                 335

Pro Ser Ala Leu Ile Phe Asn Leu Gln Asn Glu Ile Cys Thr Ile Lys
            340                 345                 350

Asn Glu Phe Thr Glu Phe Lys Asn Trp Trp Leu Asn Ala Glu Gln Lys
        355                 360                 365

Ser Glu Ile Leu Lys Phe Val Phe Thr Glu Leu Phe Asn Trp Lys Asp
    370                 375                 380

Lys Lys Tyr Ser Asp Lys Lys Phe Asn Lys Asn Leu Gln Asp Lys Ile
385                 390                 395                 400

Lys Lys Tyr Leu Leu Asn Phe Ala Leu Glu Asn Phe Asn Leu Asn Glu
                405                 410                 415

Glu Ile Leu Lys Asn Arg Asp Leu Glu Asn Asp Thr Val Leu Gly Leu
            420                 425                 430

Lys Gly Val Lys Tyr Tyr Glu Lys Ser Asn Ala Thr Ala Asp Ala Ala
        435                 440                 445

Leu Glu Phe Ser Ser Leu Lys Pro Leu Tyr Val Phe Ile Lys Phe Leu
    450                 455                 460

Lys Glu Lys Lys Leu Asp Leu Asn Tyr Leu Leu Gly Leu Glu Asn Thr
465                 470                 475                 480

Glu Ile Leu Tyr Phe Leu Asp Ser Ile Tyr Leu Ala Ile Ser Tyr Ser
                485                 490                 495

Ser Asp Leu Lys Glu Arg Asn Glu Trp Phe Lys Lys Leu Leu Lys Glu
            500                 505                 510

Leu Tyr Pro Lys Ile Lys Asn Asn Asn Leu Glu Ile Ile Glu Asn Val
        515                 520                 525
```

```
Glu Asp Ile Phe Glu Ile Thr Asp Gln Glu Lys Phe Glu Ser Phe Ser
    530                 535                 540

Lys Thr His Ser Leu Ser Arg Glu Ala Phe Asn His Ile Ile Pro Leu
545                 550                 555                 560

Leu Leu Ser Asn Asn Glu Gly Lys Asn Tyr Glu Ser Leu Lys His Ser
                565                 570                 575

Asn Glu Glu Leu Lys Lys Arg Thr Glu Lys Ala Glu Leu Lys Ala Gln
            580                 585                 590

Gln Asn Gln Lys Tyr Leu Lys Asp Asn Phe Leu Lys Glu Ala Leu Val
        595                 600                 605

Pro Leu Ser Val Lys Thr Ser Val Leu Gln Ala Ile Lys Ile Phe Asn
    610                 615                 620

Gln Ile Ile Lys Asn Phe Gly Lys Lys Tyr Glu Ile Ser Gln Val Val
625                 630                 635                 640

Ile Glu Met Ala Arg Glu Leu Thr Lys Pro Asn Leu Glu Lys Leu Leu
                645                 650                 655

Asn Asn Ala Thr Asn Ser Asn Ile Lys Ile Leu Lys Glu Lys Leu Asp
            660                 665                 670

Gln Thr Glu Lys Phe Asp Asp Phe Thr Lys Lys Lys Phe Ile Asp Lys
        675                 680                 685

Ile Glu Asn Ser Val Val Phe Arg Asn Lys Leu Phe Leu Trp Phe Glu
    690                 695                 700

Gln Asp Arg Lys Asp Pro Tyr Thr Gln Leu Asp Ile Lys Ile Asn Glu
705                 710                 715                 720

Ile Glu Asp Glu Thr Glu Ile Asp His Val Ile Pro Tyr Ser Lys Ser
```

```
                725                 730                 735

Ala Asp Asp Ser Trp Phe Asn Lys Leu Leu Val Lys Lys Ser Thr Asn
            740                 745                 750

Gln Leu Lys Lys Asn Lys Thr Val Trp Glu Tyr Tyr Gln Asn Glu Ser
        755                 760                 765

Asp Pro Glu Ala Lys Trp Asn Lys Phe Val Ala Trp Ala Lys Arg Ile
    770                 775                 780

Tyr Leu Val Gln Lys Ser Asp Lys Glu Ser Lys Asp Asn Ser Glu Lys
785                 790                 795                 800

Asn Ser Ile Phe Lys Asn Lys Lys Pro Asn Leu Lys Phe Lys Asn Ile
                805                 810                 815

Thr Lys Lys Leu Phe Asp Pro Tyr Lys Asp Leu Gly Phe Leu Ala Arg
            820                 825                 830

Asn Leu Asn Asp Thr Arg Tyr Ala Thr Lys Val Phe Arg Asp Gln Leu
        835                 840                 845

Asn Asn Tyr Ser Lys His His Ser Lys Asp Asp Glu Asn Lys Leu Phe
    850                 855                 860

Lys Val Val Cys Met Asn Gly Ser Ile Thr Ser Phe Leu Arg Lys Ser
865                 870                 875                 880

Met Trp Arg Lys Asn Glu Glu Gln Val Tyr Arg Phe Asn Phe Trp Lys
                885                 890                 895

Lys Asp Arg Asp Gln Phe Phe His His Ala Val Asp Ala Ser Ile Ile
            900                 905                 910

Ala Ile Phe Ser Leu Leu Thr Lys Thr Leu Tyr Asn Lys Leu Arg Val
        915                 920                 925
```

```
Tyr Glu Ser Tyr Asp Val Gln Arg Arg Glu Asp Gly Val Tyr Leu Ile
    930                 935                 940

Asn Lys Glu Thr Gly Glu Val Lys Lys Ala Asp Lys Asp Tyr Trp Lys
945                 950                 955                 960

Asp Gln His Asn Phe Leu Lys Ile Arg Glu Asn Ala Ile Glu Ile Lys
                965                 970                 975

Asn Val Leu Asn Asn Val Asp Phe Gln Asn Gln Val Arg Tyr Ser Arg
            980                 985                 990

Lys Ala Asn Thr Lys Leu Asn Thr  Gln Leu Phe Asn Glu  Thr Leu Tyr
        995                 1000                1005

Gly Val  Lys Glu Phe Glu Asn  Asn Phe Tyr Lys Leu  Glu Lys Val
    1010                1015                1020

Asn Leu  Phe Ser Arg Lys Asp  Leu Arg Lys Phe Ile  Leu Glu Asp
    1025                1030                1035

Leu Asn  Glu Glu Ser Glu Lys  Asn Lys Lys Asn Glu  Asn Gly Ser
    1040                1045                1050

Arg Lys  Arg Ile Leu Thr Glu  Lys Tyr Ile Val Asp  Glu Ile Leu
    1055                1060                1065

Gln Ile  Leu Glu Asn Glu Glu  Phe Lys Asp Ser Lys  Ser Asp Ile
    1070                1075                1080

Asn Ala  Leu Asn Lys Tyr Met  Asp Ser Leu Pro Ser  Lys Phe Ser
    1085                1090                1095

Glu Phe  Phe Ser Gln Asp Phe  Ile Asn Lys Cys Lys  Lys Glu Asn
    1100                1105                1110

Ser Leu  Ile Leu Thr Phe Asp  Ala Ile Lys His Asn  Asp Pro Lys
```

```
    1115                1120                1125

Lys Val  Ile Lys Ile Lys Asn  Leu Lys Phe Phe Arg  Glu Asp Ala
    1130                1135                1140

Thr Leu  Lys Asn Lys Gln Ala  Val His Lys Asp Ser  Lys Asn Gln
    1145                1150                1155

Ile Lys  Ser Phe Tyr Glu Ser  Tyr Lys Cys Val Gly  Phe Ile Trp
    1160                1165                1170

Leu Lys  Asn Lys Asn Asp Leu  Glu Glu Ser Ile Phe  Val Pro Ile
    1175                1180                1185

Asn Ser  Arg Val Ile His Phe  Gly Asp Lys Asp Lys  Asp Ile Phe
    1190                1195                1200

Asp Phe  Asp Ser Tyr Asn Lys  Glu Lys Leu Leu Asn  Glu Ile Asn
    1205                1210                1215

Leu Lys  Arg Pro Glu Asn Lys  Lys Phe Asn Ser Ile  Asn Glu Ile
    1220                1225                1230

Glu Phe  Val Lys Phe Val Lys  Pro Gly Ala Leu Leu  Leu Asn Phe
    1235                1240                1245

Glu Asn  Gln Gln Ile Tyr Tyr  Ile Ser Thr Leu Glu  Ser Ser Ser
    1250                1255                1260

Leu Arg  Ala Lys Ile Lys Leu  Leu Asn Lys Met Asp  Lys Gly Lys
    1265                1270                1275

Ala Val  Ser Met Lys Lys Ile  Thr Asn Pro Asp Glu  Tyr Lys Ile
    1280                1285                1290

Ile Glu  His Val Asn Pro Leu  Gly Ile Asn Leu Asn  Trp Thr Lys
    1295                1300                1305
```

Lys Leu Glu Asn Asn Asn
    1310

<210> 260
<211> 1064
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Sequence

<400> 260

Met Ser Glu Cys Val Thr Arg Arg Ile Leu Gly Ile Asp Leu Gly Ile
1   5   10   15

Ala Ser Cys Gly Trp Gly Val Ile Glu Val Gly Glu Ala Ser Gly Ser
            20   25   30

Ile Ile Ala Ser Gly Val Arg Cys Phe Asp Ala Pro Leu Ile Asp Lys
        35   40   45

Thr Gly Glu Pro Lys Ser Ala Thr Arg Arg Thr Ala Arg Gly Gln Arg
    50   55   60

Arg Ile Ile Arg Arg Arg Arg Gln Arg Met Asn Ala Val Arg Arg Leu
65   70   75   80

Leu Ala Glu Phe Gly Val Leu Thr Gly Arg Ser Pro Asp Ala Leu His
                85   90   95

Gln Ala Leu Leu Arg Leu Ser Gln Ser Val Ala Gly Ser Gln Val Thr
            100   105   110

Pro Trp Thr Leu Arg Ala Ala Ala His Glu Arg Lys Leu Thr Asn Asp
        115   120   125

Glu Leu Ala Val Val Leu Gly His Ile Ala Arg His Arg Gly Phe Arg
    130   135   140

```
Ser Asn Ser Lys Asn Asp Gly Gly Ala Asn Ala Ala Asp Glu Thr Ser
145                 150                 155                 160

Lys Met Lys Lys Ala Met Glu Thr Thr Arg Glu Gly Leu Ala Arg Tyr
                165                 170                 175

His Ser Phe Gly Ala Met Ile Ala Ser Asp Pro Lys Phe Ala Asp Arg
            180                 185                 190

Lys Arg Asn Arg Asp Lys Asp Tyr Ser His Thr Ala Lys Arg Ser Asp
        195                 200                 205

Leu Glu Asp Glu Val Arg Thr Ile Phe Arg Ser Gln Thr Arg Phe Gly
    210                 215                 220

Ser Leu Val Ala Ser Glu Lys Leu Ser Gln Ala Phe Ala Asp Ala Ala
225                 230                 235                 240

Phe Phe Gln Arg Pro Leu Gln Asp Ser Glu Asp Met Val Gly Ser Cys
                245                 250                 255

Pro Phe Glu Pro Gly Gln Lys Arg Thr Ala Arg Arg Ala Pro Ser Phe
            260                 265                 270

Glu Leu Phe Arg Phe Leu Ser Arg Leu Ala Asn Leu Lys Leu Thr Val
        275                 280                 285

Gly Arg Ala Pro Glu Arg Arg Leu Thr Pro Asp Glu Ile Ala Leu Ala
    290                 295                 300

Ala Lys Gly Phe Gly Glu Thr Lys Lys Ser Ile Thr Phe Lys Ser Leu
305                 310                 315                 320

Arg Glu Ala Leu Asp Leu Asp Pro Asn Ala Arg Phe Ser Gly Val Ala
                325                 330                 335

Lys Glu Lys Glu Ser Thr Leu Asp Val Ala Ala Arg Thr Gly Gly Ala
```

```
            340                 345                 350

Ala Tyr Gly Thr Lys Thr Leu Lys Asp Ala Leu Gly Asp Ala Pro Trp
        355                 360                 365

Arg Ser Leu Ser Arg Met Pro Glu Lys Leu Asp Arg Ile Ala Glu Ile
    370                 375                 380

Leu Ser Phe Arg Glu Asp Met Lys Ala Ile Arg Asn Gly Leu Glu Glu
385                 390                 395                 400

Val Gly Leu Asp Gly Leu Val Val Asp Ala Leu Met Gln Ala Thr Ala
                405                 410                 415

Asn Gly Asp Phe Lys Asp Phe Thr Arg Ala Ala His Ile Ser Ala Leu
            420                 425                 430

Ala Ala Arg Asn Ile Ile Pro Gly Leu Arg Glu Gly Leu Val Tyr Ser
        435                 440                 445

Asp Ala Cys Thr Arg Val Gly Tyr Asp His Ala Ala Arg Pro Ala Val
    450                 455                 460

Pro Leu Ser Gln Ile Gly Ser Pro Val Thr Arg Lys Ala Leu Ser Glu
465                 470                 475                 480

Ala Leu Lys Gln Val Arg Ala Val Ala Arg Glu Tyr Gly Pro Ile Asp
                485                 490                 495

Tyr Phe His Ile Glu Leu Ala Arg Ser Ile Gly Lys Ser Ala Glu Glu
            500                 505                 510

Arg Lys Lys Leu Thr Asp Gly Ile Glu Ala Arg Asn Val Glu Lys Glu
        515                 520                 525

Lys Arg Arg Lys Glu Ala Ala Glu His Leu Gly Arg Ala Pro Ser Asp
    530                 535                 540
```

```
Asp Glu Leu Leu Arg Tyr Glu Leu Ala Lys Glu Gln Asn Phe Lys Cys
545                 550                 555                 560

Ile Tyr Ser Gly Asp Pro Ile Asp Pro Ala Gly Ile Ser Ala Asn Asp
                565                 570                 575

Thr Arg Tyr Gln Val Asp His Ile Leu Pro Trp Ser Arg Phe Gly Asp
            580                 585                 590

Asp Ser Tyr Val Asn Lys Thr Leu Cys Thr Ala Arg Ser Asn Gln Asn
        595                 600                 605

Lys Arg Gly Arg Thr Pro Phe Glu Trp Phe Asp Ala Asp Lys Thr Glu
    610                 615                 620

Ala Glu Trp Met Glu Tyr Ser Ala Arg Val Glu Asp Leu Lys Glu Val
625                 630                 635                 640

Lys Gly Arg Lys Lys Arg Asn Tyr Ser Ile Lys Asp Ala Ala Ser Val
                645                 650                 655

Glu Asp Lys Phe Lys Ala Arg Asn Leu Thr Asp Thr Gln Trp Ala Thr
            660                 665                 670

Arg Leu Leu Ala Asp Glu Leu Lys Arg Met Phe Pro Pro Arg Glu Cys
        675                 680                 685

Glu Arg Val Val Thr Val Arg Ala Asp Gly Gly Asn Asp Gly Leu Ser
    690                 695                 700

Ile Val Glu Glu Arg Arg Val Phe Thr Arg Pro Gly Ala Ile Thr Ser
705                 710                 715                 720

Lys Leu Arg Arg Ala Trp Gly Leu Glu Gly Leu Lys Lys Gln Asp Gly
                725                 730                 735

Lys Arg Val Glu Asp Asp Arg His His Ala Val Asp Ala Leu Val Leu
```

```
            740                 745                 750

Ala Ala Thr Thr Glu Ser Leu Leu Asn Arg Leu Thr Val Glu Val Gln
        755                 760                 765

Gln Arg Glu Arg Glu Gly Arg Gln Asp Asp Ile Phe His Cys Ser Gln
    770                 775                 780

Pro Trp Pro Gly Phe Arg Val Asp Val Gln Arg Thr Val Tyr Gly Ser
785                 790                 795                 800

Glu Thr Met Pro Gly Ile Phe Val Ser Arg Ala Glu Arg Arg Arg Ala
                805                 810                 815

Arg Gly Lys Ala His Asp Ala Thr Val Lys Gln Ile Arg Asp Ile Asp
            820                 825                 830

Gly Glu Arg Ile Val Phe Glu Arg Lys Pro Ile Glu Lys Leu Thr Asp
        835                 840                 845

Lys Asp Leu Glu Arg Ile Pro Val Pro Glu Pro Tyr Gly Lys Ala Ala
    850                 855                 860

Asp Pro Lys Lys Leu Arg Asp Glu Leu Val Glu Asn Leu Arg Ala Trp
865                 870                 875                 880

Ile Ala Ala Gly Lys Pro Lys Asp Lys Pro Pro Arg Ser Pro Lys Gly
                885                 890                 895

Asp Ile Ile Arg Lys Val Arg Ile Glu Thr Lys Asp Lys Val Ala Val
            900                 905                 910

Glu Ile Asn Gly Gly Thr Val Asp Arg Gly Asp Met Ala Arg Val Asp
        915                 920                 925

Val Phe Arg Lys Lys Asn Lys Lys Gly Val Trp Glu Phe Tyr Val Ile
    930                 935                 940
```

```
Pro Ile Tyr Pro His Gln Ile Val Ala Ser Ala Leu Pro Pro Asn Arg
945                 950                 955                 960


Ala Val Ile Ala Tyr Lys Ala Glu Ser Glu Trp Thr Ala Ile Asp Gly
                965                 970                 975


Cys Phe Glu Phe Ala Trp Ser Leu Asn Pro Met Ser Tyr Leu Glu Leu
            980                 985                 990


Val Lys Ser Asn Gly Glu Leu Ile  Glu Gly Tyr Phe Arg  Ser Met Asp
        995                 1000                1005


Arg Thr  Thr Gly Ala Ile Asn  Leu Ser Pro Met Ser  Thr Asn Ser
    1010                1015                1020


Glu Thr  Ile Arg Ser Ile Gly  Val Lys Thr Leu Ser  Ser Phe Arg
    1025                1030                1035


Lys Phe  Thr Val Asp Arg Leu  Gly Arg Lys Phe Glu  Ile Pro Arg
    1040                1045                1050


Glu Val  Arg Thr Trp Arg Gly  Glu Ala Cys Thr
    1055                1060


<210>  261
<211>  1401
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Sequence

<400>  261

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30
```

```
Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
```

```
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430
```

```
Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
```

625 630 635 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
645 650 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
660 665 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
675 680 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
690 695 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705 710 715 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
725 730 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
740 745 750

Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
755 760 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
770 775 780

Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro
785 790 795 800

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
805 810 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
820 825 830

```
Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser
945                 950                 955                 960

Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020

Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
```

```
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050

Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080

Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155

Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170

Phe Glu  Lys Asn Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Lys Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215
```

```
Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230

Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245

Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260

His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275

Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290

Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                1300                1305

Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
    1310                1315                1320

Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1325                1330                1335

Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1340                1345                1350

Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                1360                1365

Ala Tyr  Pro Tyr Asp Val Pro  Asp Tyr Ala Ser Leu  Gly Ser Gly
    1370                1375                1380

Ser Pro  Lys Lys Lys Arg Lys  Val Glu Asp Pro Lys  Lys Lys Arg
    1385                1390                1395

Lys Val  Asp
```

1400

<210> 262
<211> 1368
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Sequence

<400> 262

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Leu
            20                  25                  30


Lys Gly Leu Gly Asn Thr Asp Arg His Gly Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110


His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125


His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140


Ser Thr Asp Lys Val Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
```

```
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Arg Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Thr Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350
```

```
Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
```

```
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750
```

```
Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

Glu Glu Gly Ile Lys Glu Leu Gly Ser Asp Ile Leu Lys Glu Tyr Pro
785                 790                 795                 800

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Val Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Arg Val Ile Thr Leu Lys Ser
```

```
945                 950                 955                 960

Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020

Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050

Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080

Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140
```

```
Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155

Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170

Phe Glu  Lys Asp Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Arg Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215

Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230

Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245

Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260

His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275

Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290

Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                1300                1305

Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
    1310                1315                1320

Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Arg  Tyr Thr Ser
```

```
    1325                1330                1335

Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1340                1345                1350

Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                1360                1365
```

<210> 263
<211> 1368
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Sequence

<400> 263

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Leu
            20                  25                  30

Lys Gly Leu Gly Asn Thr Asp Arg His Gly Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
```

```
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Val Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Arg Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Thr Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320
```

```
Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
```

```
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720
```

```
His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
               725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

Glu Glu Gly Ile Lys Glu Leu Gly Ser Asp Ile Leu Lys Glu Tyr Pro
785                 790                 795                 800

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
               805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp Ala Ile Val Pro Gln Ser Phe Leu Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
               885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Val Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
```

```
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Arg Val Ile Thr Leu Lys Ser
945                 950                 955                 960

Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020

Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050

Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080

Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110
```

```
Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155

Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170

Phe Glu  Lys Asp Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Arg Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215

Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230

Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245

Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260

His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275

Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290

Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
```

```
    1295                1300                1305

Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
    1310                1315                1320

Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1325                1330                1335

Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1340                1345                1350

Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                1360                1365
```

<210> 264
<211> 1368
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Sequence

<400> 264

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Leu
            20                  25                  30

Lys Gly Leu Gly Asn Thr Asp Arg His Gly Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
```

```
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Val Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Arg Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285
```

```
Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Thr Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
```

```
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685
```

```
Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

Glu Glu Gly Ile Lys Glu Leu Gly Ser Asp Ile Leu Lys Glu Tyr Pro
785                 790                 795                 800

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp Ala Ile Val Pro Gln Ser Phe Leu Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
```

```
               885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Val Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Arg Val Ile Thr Leu Lys Ser
945                 950                 955                 960

Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
               965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020

Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050

Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080
```

```
Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155

Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170

Phe Glu  Lys Asp Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Arg Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215

Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230

Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245

Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260

His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
```

```
    1265                1270                1275

Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290

Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                1300                1305

Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
    1310                1315                1320

Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1325                1330                1335

Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1340                1345                1350

Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                1360                1365
```

<210> 265
<211> 240
<212> PRT
<213> Acetobacter aceti

<400> 265

```
Met Ala Asn Ile Ala Glu Asn Leu Val Phe Gly Ile Asp Leu Gly Ile
1               5                   10                  15

Gly Ser Cys Gly Trp Ala Val Leu Asn Gln Lys Ala Lys Asp Glu Asn
            20                  25                  30

Ile Val Ala Leu Gly Ser Trp Cys Phe Asp Val Pro Glu Thr Asp Lys
        35                  40                  45

Glu Arg Ile Pro Thr Asn Gln Ile Arg Arg Ala Asn Arg Leu Leu Arg
    50                  55                  60
```

```
Arg Val Ile Arg Arg Arg Arg Asn Arg Met Ala Glu Ile Arg Arg Leu
65                  70                  75                  80


Phe Ala Ser Lys Gly Met Leu Asp Thr Ala Asp Pro Asp Ala Leu Ala
                85                  90                  95


Lys Ile Ser Ala Asp Pro Trp Glu Met Arg Ala Lys Gly Leu Asp Tyr
            100                 105                 110


Gln Leu Thr Pro Gln Glu Phe Ala Val Ala Leu Gly His Ile Ala Lys
        115                 120                 125


Arg Arg Gly Phe Lys Ser Ala Ala Lys Arg Val Ser Thr Asn Ala Pro
    130                 135                 140


Ser Glu Asp Ser Lys Met Leu Ala Ala Leu Glu Lys Thr Lys Glu Gln
145                 150                 155                 160


Ser Ala Gln Tyr Arg Thr Ile Gly Glu Met Phe Ala Arg Asp Pro Ala
                165                 170                 175


Tyr Ala Asp Arg Arg Arg Asn Arg Asp Gly Cys Phe Asp Arg Thr Met
            180                 185                 190


Ser Arg Glu Asp Leu Phe Lys Glu Thr Gln Ile Leu Phe Glu Ser Gln
        195                 200                 205


Arg Arg Leu Gly Asn Phe Ser Ala Thr Ser Glu Thr Glu Gln Ala Phe
    210                 215                 220


Ile Asp Ile Ala Phe Arg Gln Lys Pro Met Gln Asp Ser Glu Arg Leu
225                 230                 235                 240


<210>  266
<211>  400
<212>  PRT
<213>  Acetobacter aceti

<400>  266
```

```
Ser Phe Glu Arg Phe Arg Leu Leu Cys Arg Leu Val Asn Leu Arg Val
1               5                  10                  15

Thr Asp Gly Leu Glu Asp Arg Pro Leu Thr Pro Glu Glu Leu Arg Leu
            20                  25                  30

Ala Cys Glu Asp Ala Gly Lys Thr Arg Lys Leu Ser Val Lys Lys Val
        35                  40                  45

Arg Ser Leu Ile Gly Leu Arg Asp Asp Gln Arg Phe Thr Thr Ile Pro
    50                  55                  60

Pro Asp Gln Glu Gln His Asp Ile Ala Ala Arg Thr Gly Asp Ala Leu
65                  70                  75                  80

Thr Gly Thr Ala Thr Phe Arg Ala Ile Leu Gly Glu Ser Phe Trp Arg
                85                  90                  95

Gln Leu Leu Pro His Pro Glu Gln Leu Asp Arg Ala Ala Trp Ile Ile
            100                 105                 110

Ser Phe His Glu Leu Thr Asp Thr Ile Ile Ser Lys Leu Ala Thr Ile
        115                 120                 125

Gly Leu Pro Ser Glu Val Met Glu Leu Ile Arg Lys Ala Leu Glu Asp
    130                 135                 140

Gly Lys Phe Ser Lys Phe Lys Gly Ala Ala Ser Leu Ser Asp Lys Ala
145                 150                 155                 160

Ala Arg Lys Leu Ile Pro Phe Leu Gln Glu Gly Leu Thr Tyr Asp Lys
                165                 170                 175

Ala Cys Gln Lys Ala Gly Tyr Asn His Ala Ala Ser Lys Phe Thr His
            180                 185                 190

Tyr Asp Ser Ile Asp Thr Lys Ala Lys Phe Asn Ser Leu Met Asp Asp
```

```
        195                 200                 205

Val Arg Asp Ser Ile Thr Asn Pro Val Ala Arg Lys Ala Ile Ser Glu
    210                 215                 220

Gly Met Lys Gln Val Trp Ala Met Arg Asn Gln Trp Gly Leu Pro Gly
225                 230                 235                 240

Ala Ile Cys Ile Glu Leu Ala Arg Asp Val Gly Asn Ser Ala Glu Lys
                245                 250                 255

Arg Arg Glu Ile Glu Ser Gly Ile Lys Lys Asn Thr Ala Gln Arg Glu
            260                 265                 270

Arg Glu Arg Gln Glu Ala Lys Glu His Leu Asn Gln Ser Asp Ile Ser
        275                 280                 285

Ser Glu Thr Leu Leu Arg Tyr Arg Leu Trp Lys Glu Gln Gly Gly Arg
    290                 295                 300

Cys Cys Tyr Thr Asp Gln Pro Ile Thr Pro Ser Gln Leu Ile Ala Ser
305                 310                 315                 320

Asp Asn Ser Val Gln Val Asp His Ile Leu Pro Trp Ser Arg Phe Gly
                325                 330                 335

Asp Asp Ser Tyr Leu Asn Lys Ala Leu Cys Thr Ala Lys Ala Asn Gln
            340                 345                 350

Glu Lys Lys Asn Arg Thr Pro Trp Glu Trp Ile His Asn Gln Lys Gly
        355                 360                 365

Val Glu Ala Trp Asn His Phe Thr Ala Ala Val Glu Ser Arg Lys Glu
    370                 375                 380

Thr Arg Gly Leu Lys Lys Arg Asn Phe Leu Leu Lys Ser Ser Lys Glu
385                 390                 395                 400
```

<210> 267
<211> 376
<212> PRT
<213> Acetobacter aceti

<400> 267

```
Tyr Ala Ala Arg Val Met Ala Glu Ala Val Arg Leu Leu Tyr Pro Ser
1               5                  10                  15


Gly Asn Arg Ala Glu Lys Gly Gly Val Lys Arg Val Phe Thr Arg Pro
            20                  25                  30


Gly Ala Leu Thr Ala Ala Leu Arg His Ala Trp Gly Val Glu Ser Leu
        35                  40                  45


Lys Lys Ile Asn Gly Lys Arg Leu Asn Asp Asp Arg His His Ala Leu
    50                  55                  60


Asp Ala Ala Val Val Ala Ala Val Ser Glu Lys Glu Ile Gln Lys Leu
65                  70                  75                  80


Thr Lys Ser Phe Gln Ile Cys Glu Gln Lys Gly Leu Ala Arg Pro Met
                85                  90                  95


Arg Asp Val Pro Met Pro Trp Glu Gly Phe Arg His Gln Leu Glu Thr
            100                 105                 110


Ala Tyr Ala Asp Ile Arg Val Ala Arg Pro Glu Arg Arg Arg Ala Arg
        115                 120                 125


Gly Lys Gly His Asp Ala Thr Ile Arg Gln Leu Arg Glu Glu Lys Asp
    130                 135                 140


Gly Pro Val Val Tyr Glu Arg Arg Ala Ile Ser Asp Leu Lys Leu Thr
145                 150                 155                 160


Asp Leu Glu Arg Ile Lys Asp Pro Glu Arg Asn Ser Ala Ile Ile Ser
                165                 170                 175
```

```
Ser Leu Arg Thr Trp Ile Glu Lys Gly Lys Pro Ala Asp Tyr Pro Pro
            180                 185                 190

Gln Ser Pro Lys Gly Asp Glu Ile Arg Lys Ile Arg Val Met Ser Arg
        195                 200                 205

Asn Lys Pro Ala Val Ser Val Arg Gly Gly Thr Ala Asp Arg Gly Glu
    210                 215                 220

Met Thr Arg Val Asp Val Phe Thr Lys Met Gly Lys Lys Gly Lys Pro
225                 230                 235                 240

Glu Trp Phe Leu Val Pro Ile Tyr Arg His Gln Val Ile Asp Arg Ile
                245                 250                 255

Gln Trp Pro Gln Pro Pro Asn Gln Ala Ala Ala Asn Gly Lys Ser Glu
            260                 265                 270

Lys Asn Trp Pro Thr Met Gly Leu Glu His Glu Phe Arg Phe Ser Leu
        275                 280                 285

Tyr Pro Arg Ser Tyr Val Gln Ile Val Lys Arg Asp Gly Glu Ile Ile
    290                 295                 300

Glu Gly Tyr Phe Ala Gly Leu Asp Arg Thr Val Ala Ala Phe Ser Leu
305                 310                 315                 320

Leu Ser Ser Ser Asp Pro Thr Ser Ile Gln Arg Gly Ile Gly Ala Lys
                325                 330                 335

Thr Leu Glu Ser Ile Arg Lys Tyr Asn Val Asn Arg Phe Gly Asp Ile
            340                 345                 350

Ser Met Val Glu Gln Glu Thr Arg Thr Trp His Gly Asp Val Cys Ile
        355                 360                 365
```

Ser Pro Asp Gln Pro Asp Ser Ala
370 375

<210> 268
<211> 1054
<212> PRT
<213> Actinobacillus suis

<400> 268

Met Lys Leu Thr Pro Leu Asn Tyr Ile Leu Gly Leu Asp Leu Gly Ile
1 5 10 15

Ala Ser Val Gly Trp Ala Val Val Glu Ile Asp Glu Gln Glu Asn Pro
20 25 30

Leu Gly Leu Ile Asp Val Gly Val Arg Thr Phe Asp Arg Ala Glu Val
35 40 45

Pro Lys Thr Gly Glu Ser Leu Ala Leu Ala Arg Arg Leu Ala Arg Ser
50 55 60

Ala Arg Arg Leu Val Lys Arg Arg Ala Asp Arg Ile Lys Lys Ala Lys
65 70 75 80

Arg Leu Leu Lys Ala Glu Asn Ile Leu Leu Ser Ala Asp Glu His Leu
85 90 95

Pro Asn Asp Val Trp Gln Leu Arg Val Lys Gly Leu Asp Gln Lys Leu
100 105 110

Glu Arg Gln Glu Trp Ala Ala Val Leu Leu His Leu Leu Lys His Arg
115 120 125

Gly Tyr Leu Ser Gln Arg Lys Asn Glu Ser Lys Ser Glu Asn Lys Glu
130 135 140

Leu Gly Ala Leu Leu Ser Gly Val Glu Thr Asn His Gln Ile Leu Gln
145 150 155 160

```
Ser Ala Glu Tyr Arg Thr Pro Ala Glu Ile Ala Val Lys Lys Phe His
               165                 170                 175

Val Glu Asp Gly His Ile Arg Asn Gln Arg Gly Ala Tyr Thr His Thr
            180                 185                 190

Phe Ser Arg Leu Asp Leu Leu Ala Glu Met Glu Leu Leu Phe Gln Arg
        195                 200                 205

Gln Thr Asp Leu Gly Asn Pro His Thr Ser Ala Lys Leu Leu Glu Asn
    210                 215                 220

Leu Thr Ala Leu Leu Met Trp Gln Lys Pro Ala Leu Ala Gly Glu Ala
225                 230                 235                 240

Ile Leu Lys Met Leu Gly Lys Cys Thr Phe Glu Pro Thr Glu Tyr Lys
               245                 250                 255

Ala Ala Lys Asn Ser Tyr Ser Ala Glu Arg Phe Val Trp Leu Thr Lys
            260                 265                 270

Leu Asn Asn Leu Arg Ile Leu Glu Gln Gly Ala Glu Arg Ala Leu Thr
        275                 280                 285

Asp Asn Glu Arg Phe Ala Leu Leu Asp Gln Pro Tyr Glu Lys Ala Lys
    290                 295                 300

Phe Thr Tyr Ala Gln Ala Arg Thr Met Leu Ala Leu Pro Asp Glu Ala
305                 310                 315                 320

Ile Phe Lys Gly Val Arg Tyr Gln Gly Glu Asp Lys Lys Ala Val Glu
               325                 330                 335

Thr Lys Thr Ile Leu Met Glu Met Lys Ala Tyr His Gln Ile Arg Lys
            340                 345                 350

Ala Leu Glu Asn Ala Asp Leu Lys Ala Glu Trp Asn Glu Leu Lys Asn
```

```
        355                 360                 365

Asn Ser Glu Leu Leu Asp Asp Ile Gly Thr Ala Phe Ser Leu His Lys
    370                 375                 380

Thr Asp Glu Asp Ile Cys Arg Tyr Leu Asp Gly Lys Leu Ser Glu Ser
385                 390                 395                 400

Ile Leu Asn Ala Leu Leu Glu Asn Leu Asn Phe Asp Lys Phe Ile Gln
                405                 410                 415

Leu Ser Leu Lys Ala Leu Gln Gln Ile Leu Pro Leu Met Leu Gln Gly
            420                 425                 430

Gln Arg Tyr Asp Glu Ala Val Ser Ala Ile Tyr Gly Asp His Tyr Gly
        435                 440                 445

Lys Lys Ser Ala Glu Ile Asn Arg Leu Leu Pro Thr Ile Pro Ala Asp
    450                 455                 460

Glu Ile Arg Asn Pro Val Val Leu Arg Thr Leu Thr Gln Ala Arg Lys
465                 470                 475                 480

Val Ile Asn Ala Val Val Arg Leu Tyr Gly Ser Pro Ala Arg Ile His
                485                 490                 495

Ile Glu Thr Gly Arg Glu Val Gly Lys Ser Tyr Gln Asp Arg Lys Lys
            500                 505                 510

Leu Glu Lys Gln Gln Glu Asp Asn Arg Lys Gln Arg Glu Ser Ala Val
        515                 520                 525

Lys Lys Phe Lys Glu Tyr Phe Pro Asn Phe Val Gly Glu Pro Lys Gly
    530                 535                 540

Lys Asp Ile Leu Lys Met Arg Leu Tyr Glu Leu Gln Gln Ala Lys Cys
545                 550                 555                 560
```

```
Leu Tyr Ser Gly Lys Ser Leu Glu Leu His Arg Leu Leu Glu Lys Gly
                565                 570                 575

Tyr Val Glu Val Asp His Ala Leu Pro Phe Ser Arg Thr Trp Asp Asp
            580                 585                 590

Ser Phe Asn Asn Lys Val Leu Val Leu Ala Asn Glu Asn Gln Asn Lys
        595                 600                 605

Gly Asn Leu Thr Pro Tyr Glu Trp Leu Asp Gly Lys Asn Asn Ser Glu
    610                 615                 620

His Trp Gln Asn Phe Val Ala Arg Val Gln Thr Ser Gly Phe Ser His
625                 630                 635                 640

Thr Lys Lys Gln Arg Ile Leu Ser His Lys Leu Asp Glu Lys Gly Phe
                645                 650                 655

Ile Glu Arg Asn Leu Asn Asp Thr Arg Tyr Val Ala Arg Phe Leu Cys
            660                 665                 670

Asn Phe Ile Ala Asp Asn Met Leu Leu Thr Gly Lys Gly Lys Arg Lys
        675                 680                 685

Val Phe Ala Ser Asn Gly Gln Ile Thr Ala Leu Leu Arg Gly Arg Trp
    690                 695                 700

Gly Leu Gln Lys Val Arg Asp Asp Asn Asp Arg His His Ala Leu Asp
705                 710                 715                 720

Ala Val Val Val Ala Cys Ser Thr Val Val Met Gln Gln Lys Ile Thr
                725                 730                 735

Arg Phe Val Arg Tyr Glu Glu Gly Asn Val Phe Ser Gly Glu Arg Ile
            740                 745                 750

Asp Arg Glu Thr Gly Glu Ile Ile Pro Leu His Phe Pro Ser Pro Trp
```

```
        755                 760                 765

Ala Phe Phe Arg Glu Asn Val Glu Ile Arg Ile Phe Ser Glu Asn Pro
    770                 775                 780

Lys Leu Glu Leu Glu Asn Arg Leu Pro Asp Tyr Pro Gln Tyr Asn His
785                 790                 795                 800

Glu Phe Val Gln Pro Leu Phe Val Ser Arg Met Pro Thr Arg Lys Met
                805                 810                 815

Thr Gly Gln Gly His Met Glu Thr Val Lys Ser Ala Lys Arg Leu Asp
            820                 825                 830

Glu Gly Leu Ser Val Leu Lys Val Pro Leu Thr Gln Leu Lys Leu Ser
        835                 840                 845

Asp Leu Glu Arg Met Val Asn Arg Glu Arg Glu Val Thr Leu Tyr Glu
    850                 855                 860

Ser Leu Lys Ala Arg Leu Glu Gln Phe Gly Asn Asp Pro Ala Lys Ala
865                 870                 875                 880

Phe Ala Glu Pro Phe His Lys Lys Gly Gly Ala Val Val Lys Ala Val
                885                 890                 895

Arg Val Glu Gln Thr Gln Lys Ser Gly Val Leu Val Arg Asp Gly Asn
            900                 905                 910

Gly Val Ala Asp Asn Ala Ser Met Val Arg Val Asp Val Phe Thr Lys
        915                 920                 925

Gly Gly Lys Tyr Phe Leu Val Pro Ile Tyr Thr Trp Gln Val Ala Lys
    930                 935                 940

Gly Ile Leu Pro Asn Lys Ala Val Thr Ala Asn Val Asp Glu Ile Asp
945                 950                 955                 960
```

```
Trp Leu Glu Met Asp Glu Ser Tyr Gln Phe Ile Phe Thr Met Tyr Pro
                965                 970                 975


Asn Asp Leu Val Lys Val Lys Leu Lys Lys Glu Glu Phe Phe Gly Tyr
            980                 985                 990


Tyr Gly Gly Leu Asp Arg Ala Thr  Gly Ala Ile Val Ile  Lys Glu His
        995                 1000                1005


Asp Leu  Glu Lys Ser Lys Gly  Lys Gln Gly Ile Tyr  Arg Ile Gly
    1010                1015                1020


Val Lys  Leu Ala Leu Ser Phe  Glu Lys Tyr Gln Val  Asp Glu Leu
    1025                1030                1035


Gly Lys  Asn Ile Arg Pro Cys  Arg Pro Thr Lys Arg  Gln His Val
    1040                1045                1050


Arg
```

<210> 269
<211> 239
<212> PRT
<213> Actinobacillus ureae

<400> 269

```
Met Glu Ile Arg Ile Phe Ser Glu Asn Pro Lys Leu Gly Leu Glu Asn
1               5                   10                  15


Arg Leu Pro Gly Tyr Pro Gln Tyr Asn His Glu Phe Val Gln Pro Leu
            20                  25                  30


Phe Val Ser Arg Met Pro Thr Arg Lys Met Thr Gly Lys Gly His Met
        35                  40                  45


Glu Thr Val Lys Ser Ala Lys Arg Leu Asp Glu Gly Leu Ser Val Leu
    50                  55                  60
```

```
Lys Val Pro Leu Thr Gln Leu Lys Leu Ser Asp Leu Glu Arg Met Val
65                  70                  75                  80

Asn Arg Glu Arg Glu Asp Ala Leu Tyr Gln Ser Leu Lys Ala His Leu
                85                  90                  95

Glu Gln Phe Gly Asn Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe His
            100                 105                 110

Lys Lys Gly Gly Thr Val Val Lys Ala Val Arg Val Glu Gln Thr Gln
        115                 120                 125

Lys Ser Gly Val Leu Val Arg Asp Gly Asn Gly Val Ala Asp Asn Thr
    130                 135                 140

Ser Met Val Arg Val Asp Val Phe Thr Lys Ala Gly Lys Tyr Phe Leu
145                 150                 155                 160

Val Pro Ile Tyr Lys Trp Gln Val Ala Lys Arg Ile Leu Pro Asn Lys
                165                 170                 175

Ala Val Thr Ala Gly Val Asp Glu Ile Asp Trp Leu Glu Met Asp Ser
            180                 185                 190

Ser Tyr Gln Phe Ile Phe Thr Met Tyr Ala Asn Asp Leu Val Lys Val
        195                 200                 205

Lys Leu Lys Lys Arg Ser Ile Leu Gly Leu Leu Arg Trp Phe Arg Ser
    210                 215                 220

Cys Asn Trp Gly Tyr Cys Tyr Gln Arg Thr Arg Phe Arg Glu Ile
225                 230                 235
```

<210> 270
<211> 400
<212> PRT
<213> Actinobacillus ureae

<400> 270

```
Met Lys Leu Thr Pro Leu Asn Tyr Ile Leu Gly Leu Asp Leu Gly Ile
1               5                  10                  15

Ala Ser Val Gly Trp Ala Val Val Glu Ile Asp Glu Gln Glu Asn Pro
            20                  25                  30

Leu Gly Leu Ile Asp Val Gly Val Arg Thr Phe Asp Arg Ala Glu Val
        35                  40                  45

Ala Lys Thr Gly Glu Ser Leu Ala Leu Ala Arg Arg Leu Ala Arg Ser
    50                  55                  60

Ser Arg Arg Leu Val Lys Arg Arg Ala Asp Arg Ile Lys Lys Ala Lys
65                  70                  75                  80

Arg Leu Leu Lys Ala Glu Asn Leu Leu Leu Ser Ala Asp Glu Ile Leu
                85                  90                  95

Pro Asn Asp Val Trp Gln Leu Arg Val Lys Gly Leu Asp Gln Lys Leu
            100                 105                 110

Glu Arg Gln Glu Trp Ala Ala Val Leu Leu His Ile Leu Lys His Arg
        115                 120                 125

Gly Tyr Leu Ser Gln Arg Lys Asn Glu Ser Lys Ser Glu Asn Lys Glu
    130                 135                 140

Leu Gly Ala Leu Leu Ser Gly Val Ala Thr Asn His Gln Leu Leu Gln
145                 150                 155                 160

Thr Ala Glu Tyr Arg Thr Pro Ala Glu Ile Thr Val Lys Lys Phe Gln
                165                 170                 175

Ala Glu Glu Asn Gly His Gly His Ile Arg Asn Gln Arg Gly Asp Tyr
            180                 185                 190
```

```
Ser His Thr Phe Asp Arg Lys Asp Leu Leu Ala Glu Met Lys Leu Leu
        195                 200                 205

Phe Gln Arg Gln Ala Glu Leu Gly Asn Pro His Thr Ser Glu Lys Leu
    210                 215                 220

Leu Glu Asn Leu Thr Thr Leu Leu Leu Trp Gln Lys Pro Ala Leu Ala
225                 230                 235                 240

Gly Glu Ala Ile Leu Lys Met Leu Gly Lys Cys Thr Phe Glu Pro Ala
                245                 250                 255

Glu Tyr Lys Ala Ala Lys Asn Ser Tyr Ser Ala Glu Arg Phe Val Trp
            260                 265                 270

Leu Thr Lys Leu Asn Asn Leu Arg Ile Leu Glu Asn Gly Ile Glu Arg
        275                 280                 285

Ala Leu Thr Asp Asn Glu Arg Phe Thr Leu Leu Asp Gln Pro Tyr Glu
    290                 295                 300

Lys Ala Lys Leu Thr Tyr Ala Gln Ala Arg Thr Met Leu Ala Leu Ser
305                 310                 315                 320

Asp Glu Ala Ile Phe Lys Gly Val Arg Tyr Gln Gly Glu Asp Lys Lys
                325                 330                 335

Ala Ala Glu Lys Val Ala Leu Ile Glu Met Lys Gly Tyr Gln His Ile
            340                 345                 350

Arg Lys Ala Leu Glu Gly Ala Gly Leu Lys Ala Glu Trp Asn Glu Leu
        355                 360                 365

Lys Asn Asn Ser Glu Leu Leu Asp Asp Ile Gly Thr Ala Phe Ser Leu
    370                 375                 380

Tyr Phe Ser Ile Ser Asn Leu Pro Thr Glu Ile Ala Tyr Phe Thr Pro
```

385 390 395 400

<210> 271
<211> 1113
<212> PRT
<213> Actinomyces georgiae

<400> 271

Met Ser Ala Ser Ser Gln Asn Val Glu Arg Ile Arg Tyr Lys Val Gly
1 5 10 15

Ile Asp Val Gly Leu Arg Ser Ile Gly Phe Cys Ala Val Gln Val Asp
20 25 30

Ala Asp Asp Arg Pro Val Lys Leu Leu Asn Thr Val Val His Val His
35 40 45

Asp Ala Gly Val Ser Pro Ala Asp Ala Lys Lys Ala Asp Thr Arg Lys
50 55 60

Leu Val Ser Gly Val Ala Arg Arg Thr Arg Arg Leu Tyr Arg Thr Arg
65 70 75 80

Lys Arg Arg Leu Val Asp Leu Asp Arg Gln Leu Asp Gly Leu Gly Trp
85 90 95

Pro Leu Val Asp Pro Ala Arg Phe Ala Asp Pro Arg Glu Pro Trp Phe
100 105 110

Ala Arg Glu Lys Leu Val Ser Gly Arg Val Asp Asp Ala Asp Glu Arg
115 120 125

Lys Glu Leu Leu Ser Val Ala Leu Arg His Ile Ala His His Arg Gly
130 135 140

Trp Arg Asn Pro Tyr Ser Thr Val Glu Ser Leu Gln Ala Asp Ala Pro
145 150 155 160

```
Pro Ser Glu Phe Leu Gln Gly Leu Asn Gln Arg Val Ser Glu Lys Leu
                165                 170                 175

Gly Thr Glu Leu Asp Pro Gly Leu Thr Gln Gly Gln Leu Val Ala Lys
            180                 185                 190

Leu Leu His Arg Phe Pro Asn Ala Lys Ile Arg Gly Pro Glu Gly Ile
        195                 200                 205

Leu Arg Gly Lys Leu His Gln Ser Asp Asn Ala Gly Glu Leu Arg Leu
    210                 215                 220

Ile Cys Arg Thr Gln Gly Leu Asp Cys His Ile Thr Glu Glu Leu Val
225                 230                 235                 240

Arg Leu Val Phe Gln Ala Lys Ser Pro Lys Ala Asn Lys Glu Met Arg
                245                 250                 255

Lys Arg Ile Gly Arg Asp Gln Leu Pro Gly Gln Gly Ala His Ile Arg
            260                 265                 270

Ala Glu Lys Ala His Pro Val Phe Gln Arg Phe Arg Ile Val Ala Val
        275                 280                 285

Leu Ala Asn Leu Arg Ile Arg Glu Ala His Val Asp Arg Arg Leu Thr
    290                 295                 300

Ala Glu Glu Met Arg Thr Leu Thr Asp Phe Leu Leu Gly Leu Ala Gly
305                 310                 315                 320

Ser Glu Gln Pro Thr Trp Glu Glu Leu Ala Asp Asn Leu Asn Ile Glu
                325                 330                 335

Arg His Gln Leu Arg Gly Thr Ala Lys Ala Ser Val Asp Gly Ala Pro
            340                 345                 350

Ala Leu Arg Phe Pro Pro Ile Asp Ala Thr Thr Asp Arg Ile Tyr Ala
        355                 360                 365
```

```
Ser Lys Leu Lys Trp Leu Ala Glu Trp Trp Arg Gln Ala Asp Glu Glu
    370                 375                 380

Arg Arg Gly Tyr Met Val Asp Ala Leu Ser Asn Ser Gly Gly Ser Glu
385                 390                 395                 400

Asp Glu Pro Tyr Leu Asp Asp Glu Ile Ala Glu Met Leu Glu Gln Ala
                405                 410                 415

Ser Glu Glu Asp Gln Ala Lys Leu Asp Ser Leu His Leu Pro Gly Gly
            420                 425                 430

Arg Ala Ser Tyr Cys Leu Asp Thr Leu Arg Arg Leu Thr Asp Ala Met
        435                 440                 445

Leu Gly Gly Gly Leu Asp Leu Phe Glu Ala Arg Lys Ala Val Phe His
    450                 455                 460

Val Asp Asp Asp Trp Ala Pro Pro Thr Asp Pro Ile Gly Ala Pro Val
465                 470                 475                 480

Gly Asn Pro Pro Val Asp Arg Val Leu Lys His Val Ala Arg Trp Leu
                485                 490                 495

Glu Ala Ala Thr Gly Arg Trp Gly Ala Pro Gln Thr Ile Asn Ile Glu
            500                 505                 510

His Val Arg Glu Gly Leu Gly Ser Glu Lys Ala Ala Arg Glu Leu Thr
        515                 520                 525

Arg Met Asn Asp Arg Arg Arg Arg Asn Asn Gln Lys Leu Val Glu Glu
    530                 535                 540

Met Gly Glu Lys Leu Gly Met Ser Gly Arg Ile Arg Arg Ser Asp Arg
545                 550                 555                 560
```

```
Met Arg Tyr Glu Ala Ile Arg Arg Gln Asn Cys Glu Cys Leu Tyr Cys
                565                 570                 575

Gly Gln Pro Ile Thr Tyr Gln Thr Met Glu Met Asp His Ile Val Pro
            580                 585                 590

Arg Ala Gly Ala Ala Ser Thr Asn Ser Arg Ser Asn Leu Ala Ala Val
        595                 600                 605

Cys Arg Arg Cys Asn His Gln Lys Gly Lys Leu Pro Phe Ala Val Trp
    610                 615                 620

Ala Glu Ser Gln Asp Ser Pro Ala Glu Val Arg Leu Gln Asp Ala Val
625                 630                 635                 640

Gln Arg Val Arg His Trp Leu Arg Asp Ala Gly Met Gly Gln Lys Glu
                645                 650                 655

Leu Gln Ala Leu Arg Val Gln Val Ile Ala Arg Leu Lys Ser Lys Arg
            660                 665                 670

Pro Asp Glu Glu Phe Asp Gly Arg Ser Met Glu Ser Ile Ala Trp Met
        675                 680                 685

Ala Asn Glu Leu Arg Ala Arg Val Glu Ala Gln Tyr Arg Gly Ser Gly
    690                 695                 700

Thr Thr Val Arg Val Tyr Arg Gly Ala Leu Thr Ala Glu Ala Arg Lys
705                 710                 715                 720

Ala Ser Gly Phe Glu Gly Arg Val Asn Leu Ile Gly Gly Arg Gly Lys
                725                 730                 735

Asp Arg Phe Asp Arg Arg His His Ala Met Asp Ala Leu Val Ile Ala
            740                 745                 750

Leu Met Asn Gln Ser Val Ala Gln Thr Leu Ala Leu Arg Leu Asn Met
        755                 760                 765
```

```
Arg Asp Ser Gln Trp Leu Thr Gln Ser Glu Gln Thr Trp Arg Gln Phe
    770                 775                 780

His Gly Ala Pro Gly Glu Ala Ala Arg Lys Trp Glu Ala Trp Asp Arg
785                 790                 795                 800

Asp Met Arg Asp Ala Ser Asp Leu Phe Asn Leu Ala Leu Asp Gly Gly
                805                 810                 815

Arg Ile Pro Ile Thr Glu Asn Val Arg Leu Arg Val Gly Asn Gly Arg
            820                 825                 830

Val His Glu Asp Gly Val Ile Arg Phe Lys Pro Glu Tyr Glu Val Lys
        835                 840                 845

Gly Lys Thr Ile Lys Gly Gly Glu Ala Arg Leu Leu Gly Asp Ser Leu
    850                 855                 860

Pro Ser Glu Gln Ile Asp Arg Ala Glu Thr Pro Ala Leu Trp Thr Ala
865                 870                 875                 880

Leu Thr Arg Leu Pro Glu Tyr Asp Arg Lys Ser Gly Leu Pro Glu Asn
                885                 890                 895

Pro Asp Arg Val Ile Arg Val Asn Gly Ala Val Val Gln Ala Thr Asp
            900                 905                 910

Arg Ile Arg Phe Phe Gly Thr Pro Ala Ser Val Ala Val Arg Gly Gly
        915                 920                 925

Tyr Ala Lys Leu Gly Glu Ser Ile His His Ala Arg Ile Tyr Arg Ile
    930                 935                 940

Asn Gly Lys Thr Pro Lys Tyr Ala Met Ile Arg Val Tyr Thr Ile Asp
945                 950                 955                 960
```

```
Leu Met Arg Leu Asn His Glu Asp Ile Phe Thr Ala Val Leu Lys Pro
                965                 970                 975


Ser Thr Ile Ser Met Arg Cys Ala Glu Lys Lys Leu Lys Tyr Ala Ile
            980                 985                 990


Ala Glu Gly Asn Ala Glu Gln Ile  Gly Trp Leu Val Glu  Gly Asp Gln
        995                 1000                1005


Leu Glu  Leu Asp Ala Ala Ala  Tyr Ala Lys Gly Val  Gly Ala Asp
    1010                1015                1020


Leu Met  Arg Glu Tyr Pro Met  Ala Thr Cys Trp Arg  Val Ala Gly
    1025                1030                1035


Phe Pro  Asp Glu Ala Lys Leu  Arg Leu Arg Pro Val  Leu Leu Ala
    1040                1045                1050


Ala Glu  Gly Met Gly Glu Asp  Ala Pro Lys Phe Met  Arg Glu Val
    1055                1060                1065


Leu Glu  Asn Gln Gly Trp Arg  Pro Ala Val Asn Ala  Leu Leu Ser
    1070                1075                1080


Pro Gly  Ser Val Arg Val Val  Arg Arg Asn Val Leu  Gly Glu Pro
    1085                1090                1095


Arg Phe  Lys Ser Ser Gly His  Leu Pro Thr Thr Val  Asp Leu Val
    1100                1105                1110


<210>  272
<211>  1101
<212>  PRT
<213>  Actinomyces naeslundii

<400>  272

Met Trp Tyr Ala Ser Leu Met Ser Ala His His Leu Arg Val Gly Ile
1               5                   10                  15
```

```
Asp Val Gly Thr His Ser Val Gly Leu Ala Thr Leu Arg Val Asp Asp
            20                  25                  30

His Gly Thr Pro Ile Glu Leu Leu Ser Ala Leu Ser His Ile His Asp
        35                  40                  45

Ser Gly Val Gly Lys Glu Gly Lys Lys Asp His Asp Thr Arg Lys Lys
    50                  55                  60

Leu Ser Gly Ile Ala Arg Arg Ala Arg Arg Leu Leu His His Arg Arg
65                  70                  75                  80

Thr Gln Leu Gln Gln Leu Asp Glu Val Leu Arg Asp Leu Gly Phe Pro
                85                  90                  95

Ile Pro Thr Pro Gly Glu Phe Leu Asp Leu Asn Glu Gln Thr Asp Pro
            100                 105                 110

Tyr Arg Val Trp Arg Val Arg Ala Arg Leu Val Glu Glu Lys Leu Pro
        115                 120                 125

Glu Glu Leu Arg Gly Pro Ala Ile Ser Met Ala Val Arg His Ile Ala
    130                 135                 140

Arg His Arg Gly Trp Arg Asn Pro Tyr Ser Lys Val Glu Ser Leu Leu
145                 150                 155                 160

Ser Pro Ala Glu Glu Ser Pro Phe Met Lys Ala Leu Arg Glu Arg Ile
                165                 170                 175

Leu Ala Thr Thr Gly Glu Val Leu Asp Asp Gly Ile Thr Pro Gly Gln
            180                 185                 190

Ala Met Ala Gln Val Ala Leu Thr His Asn Ile Ser Met Arg Gly Pro
        195                 200                 205

Glu Gly Ile Leu Gly Lys Leu His Gln Ser Asp Asn Ala Asn Glu Ile
```

```
    210                 215                 220

Arg Lys Ile Cys Ala Arg Gln Gly Val Ser Pro Asp Val Cys Lys Gln
225                 230                 235                 240

Leu Leu Arg Ala Val Phe Lys Ala Asp Ser Pro Arg Gly Ser Ala Val
                245                 250                 255

Ser Arg Val Ala Pro Asp Pro Leu Pro Gly Gln Gly Ser Phe Arg Arg
            260                 265                 270

Ala Pro Lys Cys Asp Pro Glu Phe Gln Arg Phe Arg Ile Ile Ser Ile
        275                 280                 285

Val Ala Asn Leu Arg Ile Ser Glu Thr Lys Gly Glu Asn Arg Pro Leu
    290                 295                 300

Thr Ala Asp Glu Arg Arg His Val Val Thr Phe Leu Thr Glu Asp Ser
305                 310                 315                 320

Gln Ala Asp Leu Thr Trp Val Asp Val Ala Glu Lys Leu Gly Val His
                325                 330                 335

Arg Arg Asp Leu Arg Gly Thr Ala Val His Thr Asp Asp Gly Glu Arg
            340                 345                 350

Ser Ala Ala Arg Pro Pro Ile Asp Ala Thr Asp Arg Ile Met Arg Gln
        355                 360                 365

Thr Lys Ile Ser Ser Leu Lys Thr Trp Trp Glu Glu Ala Asp Ser Glu
    370                 375                 380

Gln Arg Gly Ala Met Ile Arg Tyr Leu Tyr Glu Asp Pro Thr Asp Ser
385                 390                 395                 400

Glu Cys Ala Glu Ile Ile Ala Glu Leu Pro Glu Glu Asp Gln Ala Lys
                405                 410                 415
```

```
Leu Asp Ser Leu His Leu Pro Ala Gly Arg Ala Ala Tyr Ser Arg Glu
            420                 425                 430

Ser Leu Thr Ala Leu Ser Asp His Met Leu Ala Thr Thr Asp Asp Leu
        435                 440                 445

His Glu Ala Arg Lys Arg Leu Phe Gly Val Asp Asp Ser Trp Ala Pro
    450                 455                 460

Pro Ala Glu Ala Ile Asn Ala Pro Val Gly Asn Pro Ser Val Asp Arg
465                 470                 475                 480

Thr Leu Lys Ile Val Gly Arg Tyr Leu Ser Ala Val Glu Ser Met Trp
                485                 490                 495

Gly Thr Pro Glu Val Ile His Val Glu His Val Arg Asp Gly Phe Thr
            500                 505                 510

Ser Glu Arg Met Ala Asp Glu Arg Asp Lys Ala Asn Arg Arg Arg Tyr
        515                 520                 525

Asn Asp Asn Gln Glu Ala Met Lys Lys Ile Gln Arg Asp Tyr Gly Lys
    530                 535                 540

Glu Gly Tyr Ile Ser Arg Gly Asp Ile Val Arg Leu Asp Ala Leu Glu
545                 550                 555                 560

Leu Gln Gly Cys Ala Cys Leu Tyr Cys Gly Thr Thr Ile Gly Tyr His
                565                 570                 575

Thr Cys Gln Leu Asp His Ile Val Pro Gln Ala Gly Pro Gly Ser Asn
            580                 585                 590

Asn Arg Arg Gly Asn Leu Val Ala Val Cys Glu Arg Cys Asn Arg Ser
        595                 600                 605

Lys Ser Asn Thr Pro Phe Ala Val Trp Ala Gln Lys Cys Gly Ile Pro
```

```
    610                 615                 620

His Val Gly Val Lys Glu Ala Ile Gly Arg Val Arg Gly Trp Arg Lys
625                 630                 635                 640

Gln Thr Pro Asn Thr Ser Ser Glu Asp Leu Thr Arg Leu Lys Lys Glu
                645                 650                 655

Val Ile Ala Arg Leu Arg Arg Thr Gln Glu Asp Pro Glu Ile Asp Glu
            660                 665                 670

Arg Ser Met Glu Ser Val Ala Trp Met Ala Asn Glu Leu His His Arg
        675                 680                 685

Ile Ala Ala Ala Tyr Pro Glu Thr Thr Val Met Val Tyr Arg Gly Ser
    690                 695                 700

Ile Thr Ala Ala Ala Arg Lys Ala Ala Gly Ile Asp Ser Arg Ile Asn
705                 710                 715                 720

Leu Ile Gly Glu Lys Gly Arg Lys Asp Arg Ile Asp Arg Arg His His
                725                 730                 735

Ala Val Asp Ala Ser Val Val Ala Leu Met Glu Ala Ser Val Ala Lys
            740                 745                 750

Thr Leu Ala Glu Arg Ser Ser Leu Arg Gly Glu Gln Arg Leu Thr Gly
        755                 760                 765

Lys Glu Gln Thr Trp Lys Gln Tyr Thr Gly Ser Thr Val Gly Ala Arg
    770                 775                 780

Glu His Phe Glu Met Trp Arg Gly His Met Leu His Leu Thr Glu Leu
785                 790                 795                 800

Phe Asn Glu Arg Leu Ala Glu Asp Lys Val Tyr Val Thr Gln Asn Ile
                805                 810                 815
```

```
Arg Leu Arg Leu Ser Asp Gly Asn Ala His Thr Val Asn Pro Ser Lys
            820                 825                 830

Leu Val Ser His Arg Leu Gly Asp Gly Leu Thr Val Gln Gln Ile Asp
        835                 840                 845

Arg Ala Cys Thr Pro Ala Leu Trp Cys Ala Leu Thr Arg Glu Lys Asp
    850                 855                 860

Phe Asp Glu Lys Asn Gly Leu Pro Ala Arg Glu Asp Arg Ala Ile Arg
865                 870                 875                 880

Val His Gly His Glu Ile Lys Ser Ser Asp Tyr Ile Gln Val Phe Ser
                885                 890                 895

Lys Arg Lys Lys Thr Asp Ser Asp Arg Asp Glu Thr Pro Phe Gly Ala
            900                 905                 910

Ile Ala Val Arg Gly Gly Phe Val Glu Ile Gly Pro Ser Ile His His
        915                 920                 925

Ala Arg Ile Tyr Arg Val Glu Gly Lys Lys Pro Val Tyr Ala Met Leu
    930                 935                 940

Arg Val Phe Thr His Asp Leu Leu Ser Gln Arg His Gly Asp Leu Phe
945                 950                 955                 960

Ser Ala Val Ile Pro Pro Gln Ser Ile Ser Met Arg Cys Ala Glu Pro
                965                 970                 975

Lys Leu Arg Lys Ala Ile Thr Thr Gly Asn Ala Thr Tyr Leu Gly Trp
            980                 985                 990

Val Val Val Gly Asp Glu Leu Glu  Ile Asn Val Asp Ser  Phe Thr Lys
        995                 1000                1005

Tyr Ala  Ile Gly Arg Phe Leu  Glu Asp Phe Pro Asn  Thr Thr Arg
```

```
    1010                1015                1020

Trp Arg  Ile Cys Gly Tyr Asp  Thr Asn Ser Lys Leu  Thr Leu Lys
    1025                1030                1035

Pro Ile  Val Leu Ala Ala Glu  Gly Leu Glu Asn Pro  Ser Ser Ala
    1040                1045                1050

Val Asn  Glu Ile Val Glu Leu  Lys Gly Trp Arg Val  Ala Ile Asn
    1055                1060                1065

Val Leu  Thr Lys Val His Pro  Thr Val Val Arg Arg  Asp Ala Leu
    1070                1075                1080

Gly Arg  Pro Arg Tyr Ser Ser  Arg Ser Asn Leu Pro  Thr Ser Trp
    1085                1090                1095

Thr Ile  Glu
    1100
```

<210> 273
<211> 1181
<212> PRT
<213> Actinomyces sp.

<400> 273

```
Met Leu His Cys Ile Ala Val Ile Arg Val Pro Pro Ser Glu Glu Pro
1               5                   10                  15

Gly Phe Phe Glu Thr His Ala Asp Ser Cys Ala Leu Cys His His Gly
            20                  25                  30

Cys Met Thr Tyr Ala Ala Asn Asp Lys Ala Ile Arg Tyr Arg Val Gly
        35                  40                  45

Ile Asp Val Gly Leu Arg Ser Ile Gly Phe Cys Ala Val Glu Val Asp
    50                  55                  60
```

```
Asp Glu Asp His Pro Ile Arg Ile Leu Asn Ser Val Val His Val His
65                  70                  75                  80

Asp Ala Gly Thr Gly Gly Pro Gly Glu Thr Glu Ser Leu Arg Lys Arg
                85                  90                  95

Ser Gly Val Ala Ala Arg Ala Arg Arg Arg Gly Arg Ala Glu Lys Gln
            100                 105                 110

Arg Leu Lys Lys Leu Asp Val Leu Leu Glu Glu Leu Gly Trp Gly Val
        115                 120                 125

Ser Ser Asn Glu Leu Leu Asp Ser His Ala Pro Trp His Ile Arg Lys
    130                 135                 140

Arg Leu Val Ser Glu Tyr Ile Glu Asp Glu Thr Glu Arg Arg Gln Cys
145                 150                 155                 160

Leu Ser Val Ala Met Ala His Ile Ala Arg His Arg Gly Trp Arg Asn
                165                 170                 175

Ser Phe Ser Lys Val Asp Thr Leu Leu Leu Glu Gln Ala Pro Ser Asp
            180                 185                 190

Arg Met Gln Gly Leu Lys Glu Arg Val Glu Asp Arg Thr Gly Leu Gln
        195                 200                 205

Phe Ser Glu Glu Val Thr Gln Gly Glu Leu Val Ala Thr Leu Leu Glu
    210                 215                 220

His Asp Gly Asp Val Thr Ile Arg Gly Phe Val Arg Lys Gly Gly Lys
225                 230                 235                 240

Ala Thr Lys Val His Gly Val Leu Glu Gly Lys Tyr Met Gln Ser Asp
                245                 250                 255

Leu Val Ala Glu Leu Arg Gln Ile Cys Arg Thr Gln Arg Val Ser Glu
            260                 265                 270
```

```
Thr Thr Phe Glu Lys Leu Val Leu Ser Ile Phe His Ser Lys Glu Pro
        275                 280                 285

Ala Pro Ser Ala Ala Arg Gln Arg Glu Arg Val Gly Leu Asp Glu Leu
    290                 295                 300

Gln Leu Ala Leu Asp Pro Ala Ala Lys Gln Pro Arg Ala Glu Arg Ala
305                 310                 315                 320

His Pro Ala Phe Gln Lys Phe Lys Val Val Ala Thr Leu Ala Asn Met
                325                 330                 335

Arg Ile Arg Glu Gln Ser Ala Gly Glu Arg Ser Leu Thr Ser Glu Glu
            340                 345                 350

Leu Asn Arg Val Ala Arg Tyr Leu Leu Asn His Thr Glu Ser Glu Ser
        355                 360                 365

Pro Thr Trp Asp Asp Val Ala Arg Lys Leu Glu Val Pro Arg His Arg
    370                 375                 380

Leu Arg Gly Ser Ser Arg Ala Ser Leu Glu Thr Gly Gly Gly Leu Thr
385                 390                 395                 400

Tyr Pro Pro Val Asp Asp Thr Thr Val Arg Val Met Ser Ala Glu Val
                405                 410                 415

Asp Trp Leu Ala Asp Trp Trp Asp Cys Ala Asn Asp Glu Ser Arg Gly
            420                 425                 430

His Met Ile Asp Ala Ile Ser Asn Gly Cys Gly Ser Glu Pro Asp Asp
        435                 440                 445

Val Glu Asp Glu Glu Val Asn Glu Leu Ile Ser Ser Ala Thr Ala Glu
    450                 455                 460
```

```
Asp Met Leu Lys Leu Glu Leu Leu Ala Lys Lys Leu Pro Ser Gly Arg
465                 470                 475                 480

Val Ala Tyr Ser Leu Lys Thr Leu Arg Glu Val Thr Ala Ala Ile Leu
                485                 490                 495

Glu Thr Gly Asp Asp Leu Ser Gln Ala Ile Thr Arg Leu Tyr Gly Val
            500                 505                 510

Asp Pro Gly Trp Val Pro Thr Pro Ala Pro Ile Glu Ala Pro Val Gly
        515                 520                 525

Asn Pro Ser Val Asp Arg Val Leu Lys Gln Val Ala Arg Trp Leu Lys
    530                 535                 540

Phe Ala Ser Lys Arg Trp Gly Val Pro Gln Thr Val Asn Ile Glu His
545                 550                 555                 560

Thr Arg Glu Gly Leu Lys Ser Ala Ser Leu Leu Glu Glu Glu Arg Glu
                565                 570                 575

Arg Trp Glu Arg Phe Glu Ala Arg Arg Glu Ile Arg Gln Lys Glu Met
            580                 585                 590

Tyr Lys Arg Leu Gly Ile Ser Gly Pro Phe Arg Arg Ser Asp Gln Val
        595                 600                 605

Arg Tyr Glu Ile Leu Asp Leu Gln Asp Cys Ala Cys Leu Tyr Cys Gly
    610                 615                 620

Asn Glu Ile Asn Phe Gln Thr Phe Glu Val Asp His Ile Ile Pro Arg
625                 630                 635                 640

Val Asp Ala Ser Ser Asp Ser Arg Arg Thr Asn Leu Ala Ala Val Cys
                645                 650                 655

His Ser Cys Asn Ser Ala Lys Gly Gly Leu Ala Phe Gly Gln Trp Val
            660                 665                 670
```

```
Lys Arg Gly Asp Cys Pro Ser Gly Val Ser Leu Glu Asn Ala Ile Lys
        675                 680                 685

Arg Val Arg Ser Trp Ser Lys Asp Arg Leu Gly Leu Thr Glu Lys Ala
    690                 695                 700

Met Gly Lys Arg Lys Ser Glu Val Ile Ser Arg Leu Lys Thr Glu Met
705                 710                 715                 720

Pro Tyr Glu Glu Phe Asp Gly Arg Ser Met Glu Ser Val Ala Trp Met
                725                 730                 735

Ala Ile Glu Leu Lys Lys Arg Ile Glu Gly Tyr Phe Asn Ser Asp Arg
            740                 745                 750

Pro Glu Gly Cys Ala Ala Val Gln Val Asn Ala Tyr Ser Gly Arg Leu
        755                 760                 765

Thr Ala Cys Ala Arg Arg Ala Ala His Val Asp Lys Arg Val Arg Leu
    770                 775                 780

Ile Arg Leu Lys Gly Asp Asp Gly His His Lys Asn Arg Phe Asp Arg
785                 790                 795                 800

Arg Asn His Ala Met Asp Ala Leu Val Ile Ala Leu Met Thr Pro Ala
                805                 810                 815

Ile Ala Arg Thr Ile Ala Val Arg Glu Asp Arg Arg Glu Ala Gln Gln
            820                 825                 830

Leu Thr Arg Ala Phe Glu Ser Trp Lys Asn Phe Leu Gly Ser Glu Glu
        835                 840                 845

Arg Met Gln Asp Arg Trp Glu Ser Trp Ile Gly Asp Val Glu Tyr Ala
    850                 855                 860
```

```
Cys Asp Arg Leu Asn Glu Leu Ile Asp Ala Asp Lys Ile Pro Val Thr
865                 870                 875                 880


Glu Asn Leu Arg Leu Arg Asn Ser Gly Lys Leu His Ala Asp Gln Pro
                885                 890                 895


Glu Ser Leu Lys Lys Ala Arg Arg Gly Ser Lys Arg Pro Arg Pro Gln
            900                 905                 910


Arg Tyr Val Leu Gly Asp Ala Leu Pro Ala Asp Val Ile Asn Arg Val
        915                 920                 925


Thr Asp Pro Gly Leu Trp Thr Ala Leu Val Arg Ala Pro Gly Phe Asp
    930                 935                 940


Ser Gln Leu Gly Leu Pro Ala Asp Leu Asn Arg Gly Leu Lys Leu Arg
945                 950                 955                 960


Gly Lys Arg Ile Ser Ala Asp Phe Pro Ile Asp Tyr Phe Pro Thr Asp
                965                 970                 975


Ser Pro Ala Leu Ala Val Gln Gly Gly Tyr Val Gly Leu Glu Phe His
            980                 985                 990


His Ala Arg Leu Tyr Arg Ile Ile  Gly Pro Lys Glu Lys  Val Lys Tyr
        995                 1000                1005


Ala Leu  Leu Arg Val Cys Ala  Ile Asp Leu Cys Gly  Ile Asp Cys
    1010                1015                1020


Asp Asp  Leu Phe Glu Val Glu  Leu Lys Pro Ser Ser  Ile Ser Met
    1025                1030                1035


Arg Thr  Ala Asp Ala Lys Leu  Lys Glu Ala Met Gly  Asn Gly Ser
    1040                1045                1050


Ala Lys  Gln Ile Gly Trp Leu  Val Leu Gly Asp Glu  Ile Gln Ile
    1055                1060                1065
```

```
Asp Pro  Thr Lys Phe Pro Lys  Gln Ser Ile Gly Lys  Phe Leu Lys
    1070                1075                1080


Glu Cys  Gly Pro Val Ser Ser  Trp Arg Val Ser Ala  Leu Asp Thr
    1085                1090                1095


Pro Ser  Lys Ile Thr Leu Lys  Pro Arg Leu Leu Ser  Asn Glu Pro
    1100                1105                1110


Leu Leu  Lys Thr Ser Arg Val  Gly Gly His Glu Ser  Asp Leu Val
    1115                1120                1125


Val Ala  Glu Cys Val Glu Lys  Ile Met Lys Lys Thr  Gly Trp Val
    1130                1135                1140


Val Glu  Ile Asn Ala Leu Cys  Gln Ser Gly Leu Ile  Arg Val Ile
    1145                1150                1155


Arg Arg  Asn Ala Leu Gly Glu  Val Arg Thr Ser Pro  Lys Ser Gly
    1160                1165                1170


Leu Pro  Ile Ser Leu Asn Leu  Arg
    1175                1180
```

<210> 274
<211> 1120
<212> PRT
<213> Actinomyces sp.

<400> 274

```
Met Asn Ala Met Lys Gln Tyr Asn Ala Gly Ile Asp Val Gly Ile Asn
1               5                  10                  15


Ser Val Gly Phe Ala Ala Ile Glu Val Asp Ser Lys Gly Leu Pro Leu
            20                  25                  30


Asn Ile Leu Asn Asn Met Val Val Leu His Asp Ser Gly Val Asp Pro
```

```
        35                  40                  45

Gly Thr Ala Lys Thr Gly Ala Thr Arg Leu Ala Asn Ser Gly Thr Ala
    50                  55                  60

Arg Arg Thr Arg Lys Leu Ile Ala Arg Arg Arg Lys Arg Leu Gln Lys
65                  70                  75                  80

Leu Asp Arg Tyr Ile Glu Val Gln Gly Trp Pro Leu Val Asp Phe Ser
                85                  90                  95

Ser Leu Pro Asp Pro Tyr Thr Pro Trp Lys Ile Arg Ala Lys Leu Thr
            100                 105                 110

Gln Asp Arg Leu Glu Gly Glu Glu Gln Gly Arg Gly Leu Ser Ile Ala
        115                 120                 125

Leu Arg His Met Ala Arg His Arg Gly Trp Arg Asn Pro Tyr Glu Gly
    130                 135                 140

Val Glu Ser Leu His Ser Pro Lys Glu Ala Ser Lys Gln Phe Lys Asp
145                 150                 155                 160

Leu Lys Asp Arg Val Thr Lys Val Ser Gly Val Ile Phe Asp Glu Asp
                165                 170                 175

Ala Thr Pro Ala Glu Val Val Cys Asp Ile Gly Leu Ser Pro Lys Gln
            180                 185                 190

Arg Leu Arg Ser Ala Pro Ser Ala Lys Tyr Lys Glu Gly Ala Thr Leu
        195                 200                 205

Ala Asp Glu Pro Val Gly Gly Lys Ser Lys Glu Gly Leu Leu Gly Gly
    210                 215                 220

Lys Leu Met Gln Ser Asp Asn Ala Asn Glu Leu Arg Lys Ile Gly Ile
225                 230                 235                 240
```

```
Val Gln Gly Leu Ser Asn Glu Lys Val Asn Glu Ile Ile Asp Gln Val
                245                 250                 255

Phe Ala Ser Glu Ser Pro Lys Gly Gln Ala Gly Lys Arg Ala Lys Lys
            260                 265                 270

Asp Glu Leu Pro Gly Gln Glu Gln Tyr Val Arg Ala Leu Arg Ala His
        275                 280                 285

Leu Ala Phe Gln Arg Phe Arg Ile Val Ala Ala Val Ala Asn Leu Arg
    290                 295                 300

Ile Leu Glu Ala Glu Pro Lys His Glu Arg Leu Leu Ser Gln Ser Glu
305                 310                 315                 320

Lys Asp Lys Val Ile Glu Phe Leu Met Ser Ala Asp Gly Asp Asp Gly
                325                 330                 335

Val Thr Trp Ser Asp Val Ala Glu Glu Leu Gly Ile Glu Arg Glu Cys
            340                 345                 350

Leu Ser Gly Thr Ala Lys Arg Gly Ala Asp Gly Glu Arg Pro Ser Ser
        355                 360                 365

Phe Pro Pro Thr Asn Ser Thr Asn Ile Ser Ile Val Arg Ser Lys Val
    370                 375                 380

Lys Pro Leu Ile Glu Trp Trp Arg Lys Ala Ser Asp Asp Glu Gln Ala
385                 390                 395                 400

Thr Leu Val Thr Ala Leu Ser Asn Ala Asp Glu Leu Thr Asp Asp Gln
                405                 410                 415

Pro Ser Ala Glu Thr Val Arg Gln Phe Leu Ser Ser Pro Asp Glu Gln
            420                 425                 430

Ser Gln Glu Lys Ile Asp Lys Ile Ser Leu Pro Lys Gly Arg Ala Ala
```

```
        435                 440                 445

Tyr Ser Val Asn Ser Leu Glu Arg Leu Thr Arg Arg Met Leu Lys Asp
    450                 455                 460

Ser Val Asp Leu Phe Glu Ala Arg Lys Arg Glu Phe Gly Val Asp Asn
465                 470                 475                 480

Asn Trp Thr Pro Thr Pro Asp Ser Ile Gly Glu Pro Val Gly Asn Pro
                485                 490                 495

Ala Val Asp Arg Val Leu Lys Ile Val Asn Arg Trp Leu Leu Ala Val
            500                 505                 510

Thr Arg Lys Trp Gly Pro Pro Lys Val Val Asn Ile Glu His Val Arg
        515                 520                 525

Val Gly Phe Thr Ser Ala Ala Gln Thr Arg Lys Tyr Glu Glu Glu Asn
    530                 535                 540

Lys Thr Asn Arg Glu Arg Asn Leu Ala Ile Leu Glu Glu Leu Arg Asp
545                 550                 555                 560

Lys Phe Gly Thr Ser Gly Lys Ile Arg Arg Glu Asp Ile Thr Arg Phe
                565                 570                 575

Ala Ala Leu Arg Arg Gln Asn Cys Gln Cys Ala Tyr Cys Gly Glu Ala
            580                 585                 590

Ile Thr Phe Phe Asp Cys Glu Met Asp His Ile Val Pro Arg Lys Gly
        595                 600                 605

Pro Gly Ser Thr Asn Thr Arg Asn Asn Leu Val Ala Ile Cys Glu Arg
    610                 615                 620

Cys Asn Lys Ser Lys Ser Asn Met Pro Phe Ser Leu Trp Ala Gln Asn
625                 630                 635                 640
```

```
Cys Asp Ile Pro Gly Val Ser Val Glu Ala Val Ile Asp Arg Val Arg
                645                 650                 655

Thr Trp Ile Lys Asp Pro Glu Leu Asn Pro Lys Gln Tyr Asn Asn Phe
            660                 665                 670

Lys Lys Asp Val Ile Glu Arg Leu Arg Lys Thr Val Asp Asp Asp Ala
        675                 680                 685

Ile Asp Asn Arg Ser Ile Glu Ser Val Ala Trp Met Ala Thr Glu Leu
    690                 695                 700

Ala Asp Arg Ile Gly Ser His Phe Arg Thr Ala Gly Ala Asn Thr Lys
705                 710                 715                 720

Val Arg Val Tyr Arg Gly Trp Leu Thr Ser Glu Ala Arg Lys Ala Ser
                725                 730                 735

Gly Phe Glu Gly Lys Ile Asn Leu Ile Gly Gly Arg Gly Lys Thr Arg
            740                 745                 750

Leu Asp Arg Arg His His Ala Met Asp Ala Ala Thr Ile Ala Leu Met
        755                 760                 765

Arg Gln Ser Val Ala Gln Thr Leu Val Glu Arg Ala Ser Ile Arg Glu
    770                 775                 780

Ser Asp Arg Leu Arg Arg Val Val Ser Ser Ser Trp Lys Asp Tyr Arg
785                 790                 795                 800

Gly Ala Asp Arg Asp Lys Gln Phe Ser Tyr Gly Ser Trp Leu Asn Ser
                805                 810                 815

Met Asn Ala Leu Ala Glu Leu Phe Asn Arg Ala Ile Asp Ala Asp Gly
            820                 825                 830

Ile Pro Val Thr Gln Asn Leu Arg Leu Arg Leu Gly Asn Gly Glu Ala
```

```
        835                 840                 845

His Asp Ala Thr Ile Arg Ser Leu Glu Lys Lys Arg Val Gly Ala Ser
    850                 855                 860

Trp Thr Ile Gly Glu Ile Asp Arg Ala Ser Thr Pro Gln Leu Trp Leu
865                 870                 875                 880

Ala Leu Thr Arg Gln Glu Asp Phe Asp Gln Asn Asp Gly Leu Pro Ala
                885                 890                 895

Asn Ala Ser Arg Glu Leu Arg Val Lys Asn His Trp Phe His Ala Glu
            900                 905                 910

Glu Asn Val Thr Leu Phe Pro Thr Lys Ser Ala Ala Ile Ala Val Arg
        915                 920                 925

Gly Gly Tyr Ala Glu Ile Gly Asn Thr Ile His His Ala Arg Leu Tyr
    930                 935                 940

Lys Leu Pro Gly Lys Lys Leu Thr Tyr Gly Met Ile Arg Val Phe Ala
945                 950                 955                 960

Ile Asp Leu Leu Cys Ala Trp His Thr Asp Leu Phe Ser Ser Pro Leu
                965                 970                 975

Leu Pro Glu Ser Ile Ser Leu Arg Thr Ala Glu Thr Lys Val Arg Arg
            980                 985                 990

Ala Val Glu Asp Gly Ala Ala Met  Tyr Ile Gly Trp Leu  Val Asp Gly
        995                 1000                1005

Asp Glu  Ile Val Leu Asp Pro  Glu Thr Lys Ala Phe  Lys Ser Asn
    1010                1015                1020

Lys Ile  Gly Glu Tyr Leu Cys  Glu Phe Pro Gly Thr  Lys Arg Trp
    1025                1030                1035
```

```
Lys Val  Asp Gly Phe Pro Asp  Lys Glu Lys Leu Arg  Leu Arg Pro
    1040                1045                1050


Leu Gln  Leu Ala Gly Glu Gly  Leu Pro Glu Asp Val  Ser Ala Gly
    1055                1060                1065


Thr Glu  Glu Ile Leu Gly Pro  Lys Gly Asn Gly Trp  Arg Val Ala
    1070                1075                1080


Ile Asn  Ala Leu Phe Lys Ser  Ser Gln Leu Val Val  Val Arg Arg
    1085                1090                1095


Thr Ala  Leu Gly Met Val Arg  Lys Leu Ser Arg Arg  His Leu Pro
    1100                1105                1110


Leu Thr  Thr Arg Leu Arg Gly
    1115                1120
```

<210> 275
<211> 1095
<212> PRT
<213> Actinomyces sp.

<400> 275

```
Met Pro Ala His His Leu Arg Val Gly Ile Asp Val Gly Thr His Ser
1               5                   10                  15


Val Gly Leu Ala Thr Leu Arg Val Asp Asp Gln Gly Thr Pro Ile Glu
            20                  25                  30


Leu Leu Ser Ala Leu Ser His Ile His Asp Ser Gly Ile Gly Lys Glu
        35                  40                  45


Gly Gln Lys Asp His Asp Thr Arg Lys Lys Leu Ser Gly Val Ala Arg
    50                  55                  60


Arg Thr Arg His Leu Leu Arg Asn Arg Arg Glu Arg Leu Gln Gln Leu
65                  70                  75                  80
```

```
Asp Lys Val Leu Val Asp Leu Gly Phe Pro Ile Pro Lys Pro Glu Glu
                85                  90                  95

Tyr Pro Asp Leu Ser Glu Arg Thr Asp Pro Tyr Arg Val Trp Arg Val
            100                 105                 110

Arg Ala Arg Leu Val Glu Glu Thr Leu Pro Glu Glu Leu Arg Gly Pro
        115                 120                 125

Ala Ile Ser Met Ala Val Arg His Ile Ala Arg His Arg Gly Trp Arg
    130                 135                 140

Asn Pro Tyr Ser Lys Val Glu Ser Leu Leu Ser Pro Ala Glu Glu Ser
145                 150                 155                 160

Ser Phe Met Lys Ala Leu Arg Lys Arg Ile Met Thr Lys Thr Gly Glu
                165                 170                 175

Val Leu Asp Asp Asp Ile Thr Pro Gly Gln Ala Met Ala Gln Val Ala
            180                 185                 190

Leu Thr His Lys Ile Tyr Met Arg Gly Pro Glu Gly Ile Leu Gly Lys
        195                 200                 205

Leu His Gln Ser Asp Asn Ala Asn Glu Ile Arg Lys Ile Cys Ala Arg
    210                 215                 220

Gln Gly Ile Ser Ser Asp Val Cys Lys Gln Leu Leu Arg Ala Val Phe
225                 230                 235                 240

Lys Ala Glu Ser Pro Arg Gly Ser Ala Val Ser Arg Val Ala Pro Asp
                245                 250                 255

Pro Leu Pro Gly Gln Gly Ser Phe Arg Arg Ala Pro Lys Cys Asp Pro
            260                 265                 270
```

```
Glu Phe Gln Arg Phe Arg Ile Ile Ser Ile Val Ala Asn Leu Arg Ile
        275                 280                 285

Ser Glu Thr Lys Gly Glu Asn Arg Pro Leu Thr Val Asp Glu Arg Arg
    290                 295                 300

Gln Val Val Ala Phe Leu Met Glu Asp Ser Gln Ala Asp Leu Thr Trp
305                 310                 315                 320

Val Asp Val Ala Glu Lys Leu Arg Val Ser Arg Gln Ala Leu Arg Gly
                325                 330                 335

Thr Ala Met Leu Thr Ala Asp Gly Glu Arg Ser Ala Ala Gln Pro Pro
            340                 345                 350

Ile Asp Val Thr Asp Gln Ile Met Arg Lys Thr Lys Ile Ser Ala Leu
        355                 360                 365

Lys Thr Trp Trp Asp Lys Ala Asp Ala Glu Arg Arg Gly Ala Met Val
    370                 375                 380

Arg Tyr Leu Tyr Glu Gly Leu Glu Asp Ser Glu Cys Ala Glu Val Ile
385                 390                 395                 400

Ala Lys Leu Pro Glu Lys Asp His Ala Lys Leu Asp Ser Leu His Leu
                405                 410                 415

Pro Ala Gly Arg Ala Ala Tyr Ser Arg Glu Ser Leu Thr Ala Leu Ser
            420                 425                 430

Asp His Met Leu Glu Thr Thr Asn Asp Leu His Glu Ala Arg Lys Arg
        435                 440                 445

Leu Phe Gly Val Asp Asp Ser Trp Ala Pro Pro Ala Glu Pro Val Gly
    450                 455                 460

Ala Pro Val Gly Asn Pro Ser Val Asp Arg Thr Leu Lys Ile Val Ala
465                 470                 475                 480
```

```
Arg Tyr Leu Ser Ala Val Glu Ser Ile Trp Gly Thr Pro Glu Val Ile
                485                 490                 495

His Val Glu His Val Arg Asp Gly Phe Thr Ser Glu Arg Thr Ala Glu
            500                 505                 510

Glu Arg Asp Lys Ala Asn Arg Ser Arg His Asn Asp Asn Gln Lys Ala
        515                 520                 525

Ile Glu Lys Ile Gln His Asp Tyr Gly Lys Glu Gly Tyr Ile Ser Arg
    530                 535                 540

Gly Asp Ile Val Arg Phe His Ala Leu Lys Leu Gln Gly Ser Ala Cys
545                 550                 555                 560

Leu Tyr Cys Gly Thr Thr Ile Gly Tyr His Thr Cys Gln Leu Asp His
                565                 570                 575

Ile Val Pro Gln Ala Gly Pro Gly Ser Asn Asn Arg Arg Gly Asn Leu
            580                 585                 590

Val Ala Val Cys Glu Arg Cys Asn His Ser Lys Ser Asn Thr Pro Phe
        595                 600                 605

Ala Val Trp Ala Gln Lys Cys Gly Ile Pro His Val Gly Val Lys Glu
    610                 615                 620

Ala Ile Ser Arg Val Asn Gly Trp Val Glu His Asn His Ser Thr Ser
625                 630                 635                 640

Ser Gly Asp Leu Thr Arg Leu Lys Lys Glu Val Ile Ala Arg Leu Arg
                645                 650                 655

Arg Thr Gln Lys Asp Pro Glu Ile Asp Glu Arg Ser Met Glu Ser Val
            660                 665                 670
```

```
Ala Trp Met Ala Asn Glu Leu His His Arg Ile Ala Ala Ala Tyr Pro
        675                 680                 685

Glu Thr Thr Val Met Val Tyr Arg Gly Ser Ile Thr Ala Ala Ala Arg
    690                 695                 700

Lys Ala Ala Ser Ile Glu Ser Arg Ile Asn Leu Ile Gly Glu Lys Gly
705                 710                 715                 720

Arg Lys Asp Arg Leu Asp Arg Arg His His Ala Val Asp Ala Ser Val
                725                 730                 735

Val Ala Leu Met Glu Pro Ser Val Ala Lys Thr Leu Ala Glu Arg Ser
            740                 745                 750

Ser Leu Arg Gly Glu Gln Arg Leu Thr Gly Gln Glu Gln Thr Trp Lys
        755                 760                 765

Gln Tyr Thr Gly Leu Thr Val Gly Ala Arg Glu Arg Phe Glu Ala Trp
    770                 775                 780

Arg Gly His Met His Arg Leu Thr Glu Leu Phe Asn Glu Ser Leu Ala
785                 790                 795                 800

Ala Asp Glu Val Tyr Val Thr Gln Asn Ile Arg Leu Arg Leu Ser Asp
                805                 810                 815

Gly Ser Ala His Thr Val Lys Ala Ser Lys Leu Val Ser His Arg Leu
            820                 825                 830

Gly Asp Gly Leu Thr Val Gln Gln Ile Asp Arg Ala Cys Thr Pro Ala
        835                 840                 845

Leu Trp Cys Ala Leu Thr Arg Glu Ile Asp Phe Asp Glu Lys Asn Gly
    850                 855                 860

Leu Pro Ala Arg Glu Asp Arg Val Ile Arg Val His Gly Gln Glu Ile
865                 870                 875                 880
```

```
Ser Ser Ala Asp Cys Ile Gln Val Phe Ser Lys Arg Lys Lys Thr Lys
               885                 890                 895


Ser Asp Arg Asp Glu Ala Pro Phe Gly Ala Ile Ala Val Arg Gly Gly
            900                 905                 910


Phe Val Glu Ile Gly Ser Ser Ile His His Ala Arg Ile Tyr Arg Ile
        915                 920                 925


Glu Gly Glu Lys Pro Ala Tyr Ala Met Leu Arg Val Phe Thr His Asp
    930                 935                 940


Leu Leu Ser Gln Arg His Gly Asp Leu Phe Ser Ala Val Ile Pro Pro
945                 950                 955                 960


Gln Ser Ile Ser Met Arg Cys Ala Ala Thr Glu Leu Arg Gln Ala Ile
               965                 970                 975


Ser Glu Gly Arg Ala Thr Tyr Leu Gly Trp Ile Val Ser Gly Asp Glu
            980                 985                 990


Leu His Ile Pro Val Glu Thr Phe  Thr Thr His Lys Ile  Gly Ser Phe
        995                 1000                1005


Leu Lys  Asp Tyr Pro Asn Thr  Thr Arg Trp Arg Ile  Cys Gly Tyr
    1010                1015                1020


Asp Ser  Glu Thr Met Leu Ile  Leu Lys Pro Arg Ile  Leu Ser Ala
    1025                1030                1035


Glu Gly  Leu Asn Asn Ser Ser  Asp Ile Ala Glu Tyr  Val Ile Lys
    1040                1045                1050


Asn Lys  Gly Trp Arg Val Ala  Ile Asn Lys Leu Ala  Lys Val His
    1055                1060                1065
```

```
Pro Thr  Val Val Arg Arg Asp  Ala Leu Gly Arg Pro  Arg His Ser
    1070                1075                1080


Ser Arg  Ser Asn Leu Pro Val  Thr Trp Ser Ile Glu
    1085                1090                1095
```

<210> 276
<211> 1144
<212> PRT
<213> Actinomyces sp.

<400> 276

```
Met Ser Met Ile Asp Ser Ser Glu Asn Val Pro Gly Ile Arg Tyr Arg
1               5                   10                  15


Val Gly Ile Asp Val Gly Leu Lys Ser Ile Gly Phe Cys Ala Val Glu
            20                  25                  30


Val Asp Arg Asn Asp Gln Pro Val Arg Met Leu Asn Ser Met Val Phe
        35                  40                  45


Ile His Asp Ala Gly Val Asp Pro Asn Glu Asn Lys Ala Ala Lys Ser
    50                  55                  60


Arg Lys Leu Thr Ala Gly Val Ala Arg Arg Thr Arg Arg Leu Tyr Arg
65                  70                  75                  80


Thr Arg His Gln Arg Leu Val Asn Leu Asp Arg Val Leu Ser Lys Glu
                85                  90                  95


Phe Gly Trp Pro Leu Pro Asp Leu Thr Ser Phe Lys Asp Pro Arg Glu
            100                 105                 110


Pro Trp His Val Arg Ala Gly Leu Leu Glu Gly Tyr Ile Ala Asp Asp
        115                 120                 125


Glu Lys Arg Lys Glu Ala Leu Ser Ile Ala Leu Arg His Ile Ala Arg
    130                 135                 140
```

```
His Arg Gly Trp Arg Asn Pro Tyr Ala Lys Val Glu Thr Leu Leu Gln
145                 150                 155                 160

Pro Ser Glu Pro Ser Asp Phe Leu Lys Gly Leu Asn Asp Arg Ile Ser
                165                 170                 175

Glu Glu Leu Gly Arg Ala Phe Pro Ala Asp Ala Thr Pro Gly Gln Leu
            180                 185                 190

Val Asp Thr Tyr Leu Ala His Pro Asp Tyr Val Gly Arg Ala Gly Thr
        195                 200                 205

Pro Lys Leu Arg Gly Pro Gln Gly Ile Leu Ala Gly Lys Leu His Gln
    210                 215                 220

Ser Asp Asn Ala Gln Glu Ile Arg Gly Ile Cys Asp Val Gln Arg Ile
225                 230                 235                 240

Glu Pro Ala Glu Arg Asp Arg Leu Ile Arg Val Val Phe Glu Ala Lys
                245                 250                 255

Ser Pro Lys Gly Ser Ala Lys Glu Arg Gly Leu Val Gly Tyr Asp Glu
            260                 265                 270

Leu Pro Gly Gln Gly Arg His Val Arg Ala Glu Lys Ala His Pro Ala
        275                 280                 285

Phe Gln Leu Phe Arg Met Val Ser Val Leu Ala Asn Leu Arg Ile Arg
    290                 295                 300

Glu Gly Arg Glu Glu Arg Pro Leu Thr Pro Asp Glu Leu Glu Asp Leu
305                 310                 315                 320

Val Asp Phe Ile Asn Gln Val Ser Leu Lys Gln Glu Val Thr Trp Gln
                325                 330                 335

Asp Leu Ala Asp Lys Leu Arg Ile Glu Arg Ala Asp Leu Arg Gly Thr
```

```
            340                 345                 350

Ala Lys Ala Ser Phe Asp Gly Ser Pro Val Leu Arg Asn Pro Pro Thr
        355                 360                 365

Asp Val Thr Thr Glu Lys Ile Met Ala Cys Lys Val Lys Trp Leu Lys
    370                 375                 380

Glu Trp Trp Lys Glu Ala Asp Asp Glu Gln Arg Gly Tyr Met Val Asp
385                 390                 395                 400

Ala Phe Ser Asn Ser Gly Gly Ser Glu Asp Gly Thr Asp Val Asn Asp
                405                 410                 415

Glu Val Ala Glu Leu Leu Glu Gln Ala Thr Glu Asp Asp Gln Leu Glu
            420                 425                 430

Phe Glu Lys Ile Ser Leu Pro Gln Gly Arg Ala Ala Tyr Ser Leu Asp
        435                 440                 445

Ser Leu Arg Arg Leu Thr Asp Arg Met Leu Arg Asp Gly Val Asp Leu
    450                 455                 460

His Thr Ala Arg Arg Leu Glu Phe Asn Val Gly Asp Asp Trp Lys Pro
465                 470                 475                 480

Ala Val Glu Pro Ile Gly Ala Pro Thr Gly Asn Pro Ala Val Asp Arg
                485                 490                 495

Val Leu Lys Gln Val Ser Arg Trp Leu His Ala Ala Thr Glu Arg Trp
            500                 505                 510

Gly Glu Pro Thr Val Ile Asn Ile Glu His Ala Arg Asp Gly Leu Gly
        515                 520                 525

Ser Glu Arg Val Ala Arg Glu Leu Met Arg Glu Asn Glu Lys Arg Arg
    530                 535                 540
```

```
Lys Ala Asn Ala Ser Ala Val Ala Glu Met Ala Ala Lys Leu Lys Leu
545                 550                 555                 560


Ser Gly Lys Val His Arg Ser Asp Gln Ile Arg Tyr Phe Ala Leu Gln
                565                 570                 575


Arg Gln Asn Cys Gln Cys Leu Tyr Cys Gly Ala Pro Ile Thr Tyr Thr
            580                 585                 590


Thr Ala Glu Met Asp His Ile Val Pro Arg Ala Asp Gly Ser Ser Thr
        595                 600                 605


Asn Asp Arg Ser Asn Leu Ala Ala Val Cys Arg Thr Cys Asn His Met
    610                 615                 620


Lys Gly Lys Ile Pro Phe Ala Val Trp Ala Ser Ser Asp Lys Ala Asn
625                 630                 635                 640


Gln Gly Val Ser Leu Thr Gly Ala Leu Glu Arg Val Asn Met Trp Gln
                645                 650                 655


Arg Asp Ser Gly Met Ser Pro Arg Gln Leu Lys Gln Leu Gln Arg Glu
            660                 665                 670


Val Cys Ala Arg Leu Lys Ser Lys Lys Pro Asp Gln Glu Phe Asp Gly
        675                 680                 685


Arg Ser Met Glu Ser Val Ala Trp Met Ala Val Glu Leu Arg Thr Arg
    690                 695                 700


Ile Glu Gly Phe Tyr Arg Ser Arg Asp Glu Glu Ser Val Pro Ser Val
705                 710                 715                 720


Gly Val Tyr Arg Gly Gln Leu Thr Ala Glu Ala Arg Arg Ala Ser Gly
                725                 730                 735


Phe Glu Ser Arg Val Asn Leu Ile Gly Gly Arg Gly Lys Thr Arg Phe
```

```
            740                 745                 750

Asp Arg Arg His His Ala Met Asp Ala Leu Val Ile Ala Leu Met Asn
        755                 760                 765

Pro Ser Val Ser Arg Thr Leu Ala Leu Arg Leu Asn Met Arg Asp Ala
    770                 775                 780

Gln Arg Leu Thr Gly Val Glu Glu Thr Trp Lys His Phe Tyr Gly Lys
785                 790                 795                 800

Pro Gly Glu Ala Ser Lys Arg Phe Glu Ser Trp Arg Glu Ser Met Leu
                805                 810                 815

Arg Gly Val Glu Leu Phe Asn Ile Ala Leu Ser Asp Asn Ala Ile Pro
            820                 825                 830

Phe Val Glu Asn Ile Arg Leu Arg Val Gly Ser Ser Val Ile His Asp
        835                 840                 845

Ala Thr Val His Ser Phe Cys Pro Pro Lys Thr Pro Asp Gly Lys Gln
    850                 855                 860

Ile Ile Thr Lys Gly Tyr Gly Glu Gln His Ser Leu Gly Ser Ala Met
865                 870                 875                 880

Pro Val Glu Leu Ile Asp Arg Ala Glu Thr Pro Ala Leu Trp Thr Ala
                885                 890                 895

Leu Thr Arg Cys Pro Asp Phe Asp Pro Lys Lys Gly Leu Pro Glu Asn
            900                 905                 910

Pro Gln Arg Thr Ile Ser Val Asn Gly Thr Arg Val Gly Pro Thr Glu
        915                 920                 925

Leu Val Asn Phe Phe Glu Phe Ser Lys Ser Gly Pro Lys Ala Cys Leu
    930                 935                 940
```

```
Lys Val Arg Gly Gly Tyr Val Asp Leu Ser Gly Ala Ile His His Ala
945                 950                 955                 960


Arg Ile Tyr Arg Ile Ala Gly Lys Lys Thr Ala Tyr Ala Met Ile Arg
                965                 970                 975


Val Phe Gln Val Asp Leu Leu Arg Leu Lys Asp His Asp Val Phe Thr
            980                 985                 990


Thr Pro Leu Lys Pro Ser Thr Ile  Ser Met Arg Thr Ala  Glu Pro Lys
        995                 1000                1005


Ile Arg  Glu Ala Leu Ala Asn  Gly Thr Ala Thr Gln  Ile Gly Trp
    1010                1015                1020


Leu Val  Glu Gly Asp Glu Leu  Val Ile Asp Thr Ser  Lys Tyr Ser
    1025                1030                1035


Gly Gly  Phe Ile Gly Glu Val  Leu Ala Arg Tyr Pro  Glu Ala Thr
    1040                1045                1050


Ser Trp  Arg Val Ala Gly Phe  Met Thr Pro Ala Lys  Leu Arg Ile
    1055                1060                1065


Lys Pro  Ile Leu Leu Ser Lys  Glu Gly Phe Val Asp  Glu Thr Gln
    1070                1075                1080


Ala Ala  Leu Leu Gly Val Glu  Val Thr Ser Glu Ala  Ile Gln Lys
    1085                1090                1095


Thr Val  Asp Arg Pro Gly Trp  Leu Pro Ala Val Asn  Val Leu Phe
    1100                1105                1110


Gly Ala  Gly Gly Val Arg Val  Ile Arg Arg Asn Cys  Leu Gly Glu
    1115                1120                1125


Glu Arg  Tyr His Ser Ser Ala  Ser Leu Pro Val Ser  Met Thr Leu
```

1130 1135 1140

Glu

<210> 277
<211> 1103
<212> PRT
<213> Actinomyces sp.

<400> 277

Met Thr Lys Ile Asn Asp Asp Leu Arg Tyr Arg Val Gly Ile Asp Val
1 5 10 15

Gly Leu Lys Ser Ile Gly Phe Cys Ala Val Glu Val Asp Glu Asn Asp
20 25 30

Gln Pro Leu Arg Leu Leu Asn Ser Met Val Phe Val His Asp Ala Gly
35 40 45

Val Asp Pro Asn Glu Asn Lys Ala Ala Lys Ser Arg Lys Leu Thr Ala
50 55 60

Gly Val Ala Arg Arg Thr Gln Arg Gly Thr Ala Gln Asn Arg Arg Arg
65 70 75 80

Leu Ala Glu Leu Asp Arg Ala Leu Ser Glu Glu Leu Asn Trp Pro Leu
85 90 95

Pro Asn Leu Glu Asp Phe Glu Asp Ser Tyr Glu Pro Trp His Thr Arg
100 105 110

Ala Glu Leu Val Glu His Tyr Ile Lys Asp Asp Ala Glu Arg Ala Glu
115 120 125

Ala Leu Ala Ile Ala Ile Arg His Ile Ala Arg His Arg Gly Trp Arg
130 135 140

```
Asn Pro Tyr Leu Ser Val Asp Ser Leu Leu Thr Pro Gln Glu Pro Ser
145                 150                 155                 160

Lys Phe Leu Arg Gly Leu Asn Glu Arg Val Thr Gln Ala Leu Gly Arg
                165                 170                 175

Glu Phe Pro Ala Asp Ala Thr Pro Gly Gln Leu Ile Cys Ala Tyr Ile
            180                 185                 190

Asp Ser Pro Lys Tyr Ala Glu Thr Gln Gly Ile Arg Gly Asp Ser Gly
        195                 200                 205

Ile Leu Ser Gly Lys Leu His Gln Phe Asp Asn Val Gly Glu Ile Arg
    210                 215                 220

Lys Ile Cys Glu Val Gln Arg Leu Asp His Asp Val Phe Lys Leu Leu
225                 230                 235                 240

Val Arg Lys Val Phe Phe Ala Lys Ser Pro Arg Gly Ser Ala Ala Gly
                245                 250                 255

Leu Val Gly His Asp Gln Ile Pro Gly Gln Gly Lys Tyr Ile Arg Ala
            260                 265                 270

Glu Lys Ala His Pro Asp Phe Gln Leu Phe Arg Ile Val Ala Val Leu
        275                 280                 285

Thr Asn Leu Arg Ile Arg Glu Gly Lys Ala Glu Arg Cys Leu Thr Pro
    290                 295                 300

Asp Glu Leu Arg Gly Leu Val Asp Tyr Ile Leu Glu Val Gln Leu Lys
305                 310                 315                 320

Gln Gln Val Thr Trp Ala Asp Leu Ala Asp Asn Leu Gly Ile Glu Arg
                325                 330                 335

Thr Asp Leu Arg Gly Thr Ala Arg Ala Ser Phe Asp Gly Ser Pro Ala
            340                 345                 350
```

```
Leu Arg Phe Pro Pro Thr Asp Val Thr Ala Glu Lys Ile Met Ala Ser
        355                 360                 365

Lys Val Lys Trp Leu Lys Asp Trp Trp Asp Lys Ala Asp Ser Glu Arg
    370                 375                 380

Arg Gly Phe Met Val Asp Ala Leu Ser Asn Ser Gly Gly Ser Thr Gly
385                 390                 395                 400

Asp Asn Asp Ile Asp Asp Glu Val Ala Ala Leu Leu Glu Ala Ala Thr
                405                 410                 415

Glu Asp Glu Gln Ala Glu Leu Glu Lys Ile Gln Leu Pro Gln Gly Arg
            420                 425                 430

Ala Ala Tyr Ser Leu Asp Ser Leu Arg Arg Leu Thr Lys Arg Met Leu
        435                 440                 445

Glu Glu Gly Val Asp Leu His Thr Ala Arg Lys Glu Glu Phe Asn Val
    450                 455                 460

Asp Asp Asp Trp Arg Pro Glu Pro Glu Pro Ile Glu Ala Pro Val Gly
465                 470                 475                 480

Asn Pro Ala Val Asp Arg Val Leu Lys Gln Val Ala Arg Trp Leu Asn
                485                 490                 495

Met Ala Thr Asp Arg Trp Gly Val Pro Asp Val Ile Asn Ile Glu His
            500                 505                 510

Thr Arg Asp Gly Leu Gly Ser Glu Lys Val Ala Arg Glu Leu Leu Arg
        515                 520                 525

Glu Ser Gln Lys Arg Gln Asp Leu Asn Gln Lys Asp Met Asp Lys Met
    530                 535                 540
```

```
Ile Arg Glu Leu Gly Ile Ser Gly Lys Ala Arg Arg Ser Ser Leu Ile
545                 550                 555                 560

Lys Tyr Gln Ala Ile Gln Arg Gln Asn Ser Met Cys Leu Tyr Cys Gly
                565                 570                 575

Thr Glu Ile Gly Phe Glu Thr Ala Glu Met Asp His Ile Val Pro Arg
            580                 585                 590

Ala Leu Ser Gly Ser Thr Asn Asp Arg Ser Asn Leu Ala Ala Val Cys
        595                 600                 605

Arg Ala Cys Asn His Gln Lys Gly Ala Val Pro Phe Ala Val Trp Ala
    610                 615                 620

Thr Ser Gly Glu Ala His Ala Gly Val Ser Leu Glu Asp Ala Ile Lys
625                 630                 635                 640

Arg Val Arg Leu Trp Gln Lys Gly Pro Gly Met Ser Pro Lys Gln His
                645                 650                 655

Lys Ala Phe Gln Asn Glu Val Ile Ser Arg Leu Lys Ser Arg Lys Pro
            660                 665                 670

Asp Glu Glu Phe Asp Gly Arg Ser Met Glu Ser Val Ala Trp Met Ala
        675                 680                 685

Val Glu Leu Arg Thr Arg Ile Asp Gly Tyr Tyr Arg Lys Val Asn Ser
    690                 695                 700

Asp Ser Val Pro Lys Val Gly Ile Tyr Arg Gly Gln Leu Thr Ala Glu
705                 710                 715                 720

Ala Arg Lys Ala Ser Gly Phe Glu Asn Arg Val Asn Leu Ile Gly Gly
                725                 730                 735

Lys Gly Lys Thr Arg Phe Asp Arg Arg His His Ala Met Asp Ala Leu
            740                 745                 750
```

```
Val Ile Ala Met Met Asn Gln Ser Val Ser Gln Thr Leu Ala Leu Arg
        755                 760                 765

Val Asn Met Arg Glu Ser Gln Arg Ile Thr Gly Gln Glu Glu Thr Trp
    770                 775                 780

Lys Asn Phe Tyr Gly Lys Pro Gly Gln Ala Ser Glu Arg Phe Glu Lys
785                 790                 795                 800

Trp Arg Glu Gly Met Leu Arg Ala Val Glu Leu Phe Asn Ile Glu Leu
                805                 810                 815

Ala Lys Asn Ala Ile Pro Phe His Glu Asn Val Arg Leu Arg Val Gly
            820                 825                 830

Ser Ser Lys Val His Asp Asp Thr Val Arg Lys Phe Ile His Ala Lys
        835                 840                 845

Leu Gly Glu Ala Leu Ser Val Ala Met Ile Asp Cys Ala Glu Thr Pro
    850                 855                 860

Ala Leu Trp Thr Ala Leu Thr Arg Leu Pro Asp Phe Asp Pro Lys Asp
865                 870                 875                 880

Gly Leu Pro Glu Asp Leu Ser Arg Glu Ile Tyr Ile His Ser Arg Lys
                885                 890                 895

Ile Thr Ala Asp Glu Gln Leu Asn Phe Phe Asn Ser Pro Ser Ala Cys
            900                 905                 910

Leu Lys Val Arg Gly Gly Tyr Val Glu Ile Gly Ser Ser Ile His His
        915                 920                 925

Ala Arg Val Tyr Arg Ile Asp Gly Lys Lys Thr Thr Tyr Ser Met Val
    930                 935                 940
```

```
Arg Val Phe Ala Thr Asp Leu Val Lys Met Thr His Glu Asp Val Phe
945                 950                 955                 960


Thr Thr Pro Leu Lys Pro Ser Thr Ile Ser Met Arg Thr Ala Asp Pro
                965                 970                 975


Lys Ile Arg Lys Ala Leu Ala Asp Gly Thr Ala Thr Gln Ile Gly Trp
            980                 985                 990


Leu Val Glu Gly Asp Glu Leu Gln  Leu Glu Thr Asp Lys  Tyr Ser Gly
        995                 1000                1005


Gly Leu  Ile Gly Glu Val Leu  Ala Glu Tyr Pro Gln  Leu Thr Ser
    1010                1015                1020


Trp Arg  Val Ala Gly Phe Tyr  Gly Val Thr Gln Leu  Arg Leu Arg
    1025                1030                1035


Pro Tyr  Met Leu Ala Ala Glu  Gly Ile Pro Ser Asp  Ala Ser Glu
    1040                1045                1050


Ser Leu  Arg Lys Val Ile Glu  Gly Lys Gly Trp Leu  Pro Ala Ile
    1055                1060                1065


Asn Ala  Leu Leu Ser Ser Gly  Cys Val Lys Val Val  Arg Arg Asn
    1070                1075                1080


Cys Leu  Gly Glu Pro Arg Phe  Asn Ala Lys Ser Ser  Leu Pro Val
    1085                1090                1095


Ser Gln  Leu Leu Arg
    1100
```

<210> 278
<211> 1114
<212> PRT
<213> Actinomyces turicensis

<400> 278

```
Met Gln Phe His Phe Tyr Met Val Tyr Val Thr Met Lys Gly Met Asn
1               5                  10                  15

Asp Lys Asp Ala Ser Gln Gln Leu Arg Tyr Arg Val Gly Ile Asp Val
            20                  25                  30

Gly Thr His Ser Ile Gly Phe Cys Ala Val Glu Val Asp Glu Ser Gly
        35                  40                  45

Met Pro Ile Gln Leu Leu Asn Ser Met Val His Lys His Asp Ser Gly
    50                  55                  60

Ile Asp Pro Gly Gly Asn Asp Thr Ala Thr Thr Arg Leu Ala Glu Ala
65                  70                  75                  80

Gly Val Ala Arg Arg Thr Arg Arg Leu Ile Arg Arg Arg Lys Lys Arg
                85                  90                  95

Leu Gln Glu Leu Asp Ala Phe Ile Glu Glu Cys Gly Trp Pro Leu Val
            100                 105                 110

Asp Leu Ala Thr Ile Thr Asp Ala Arg Ser Pro Trp Arg Ile Arg Ala
        115                 120                 125

His Leu Ala Thr Glu His Ile Asp Asp Glu Ala Glu Gln Gly Lys Leu
    130                 135                 140

Leu Ser Ile Ala Leu Arg His Met Ala Arg His Arg Gly Trp Arg Ser
145                 150                 155                 160

Pro Tyr Ala Arg Ile Ser Ser Leu His Ile Gln Ala Asp Pro Ser Glu
                165                 170                 175

Gln Leu Lys Ala Leu Ala Gln Arg Val Ser Glu Lys Thr Gly Ile Ser
            180                 185                 190

Leu Thr Ala Asp Gln Thr Pro Ala Gln Leu Ile Ser Val Tyr Leu Asp
```

```
        195                 200                 205

Val Phe Glu Thr Gly Lys Leu Arg Gly Pro Glu Gly Ile Leu Gly Gly
    210                 215                 220

Lys Leu Met Gln Ser Asp Asn Ala Asn Glu Leu Arg Arg Ile Ala Thr
225                 230                 235                 240

Val Gln Gly Leu Asp Asn Asp Leu Leu Lys Lys Ile Ile Gly Phe Val
                245                 250                 255

Phe Ala Ala Glu Ser Pro Lys Gly Ser Ala Ala Lys Arg Val Gly Lys
            260                 265                 270

Asp Val Leu Pro Gly Ala His Gly Leu Arg Ala Glu Lys Ala His Pro
        275                 280                 285

Ala Phe Gln Gln Phe Arg Ile Val Ser Ile Val Gln Asn Leu Arg Ile
    290                 295                 300

Lys Glu Gly Thr Gly Leu Arg Ala Leu Thr Ser Glu Glu Thr Glu Ile
305                 310                 315                 320

Val Val Asp Phe Leu Asn Gln Ala Gly Leu Thr Glu Ala Pro Thr Trp
                325                 330                 335

Glu Glu Val Ala Asp Asn Leu Glu Ile Pro Arg Ser His Leu Lys Gly
            340                 345                 350

Thr Ala Thr Glu Gly Phe Asp Gly Ile Ala Pro Ser Thr Arg Pro Pro
        355                 360                 365

Phe Asp Val Thr Ser Gln Lys Ile Leu Asn Gly Lys Leu Lys Lys Leu
    370                 375                 380

Ser Ala Trp Trp Lys Asp Ala Asp Tyr Asp His Arg Cys Ala Met Val
385                 390                 395                 400
```

```
Asn Ala Leu Ser Asn Val Gly Ser Asp Asp Glu Gly Ser Leu Ala Asp
                405                 410                 415

Asp Asp Val Arg Glu Phe Leu Ser Asp Phe Thr Asp Glu Glu Leu Glu
            420                 425                 430

Ala Leu Asp Lys Val Glu Leu Pro Gly Gly Arg Ala Ala Tyr Ser Val
        435                 440                 445

Asp Ser Leu Glu Lys Leu Thr Asn Thr Met Leu Ser Glu Gly Cys Asp
    450                 455                 460

Leu His Ser Ala Arg Lys Ile Ala Phe Gly Val Asp Asp Ser Trp Thr
465                 470                 475                 480

Pro Pro Ala Glu Pro Ile Gly Gln Pro Val Gly Asn Pro Ala Val Asp
                485                 490                 495

Arg Val Leu Lys Gln Val Ala Arg Trp Ile Ser Ala Ala Thr Asn Gln
            500                 505                 510

Trp Gly Thr Pro Glu Ser Val Asn Ile Glu His Val Arg Asp Ala Leu
        515                 520                 525

Gly Ser Glu Lys Ala Ser Arg Glu Tyr Gln Arg Ser Leu Gln Thr Arg
    530                 535                 540

Arg Ile Arg Asn Glu Lys Leu Phe Ala Glu Met Arg Glu Arg Leu Asp
545                 550                 555                 560

Ile Gly Gly Lys Pro Arg Arg Ser Glu Leu Thr Arg Tyr Leu Ala Leu
                565                 570                 575

Gln Arg Gln Asn Cys Gln Cys Leu Tyr Cys Gly Met Pro Ile Thr Tyr
            580                 585                 590

Thr Asp Ala Glu Met Asp His Ile Val Pro Arg Lys Gly Ala Ala Ser
```

```
        595                 600                 605

Thr Asn Thr Arg Glu Asn Phe Ala Ala Val Cys Arg Ala Cys Asn His
    610                 615                 620

Gln Lys Ser Asn Leu Pro Phe Ala Val Trp Ala Glu Lys Thr Glu Arg
625                 630                 635                 640

Pro Gly Val Ser Val Lys Glu Ala Tyr Lys Arg Val Ser Asp Met Arg
                645                 650                 655

Ile Glu Pro Gly Met Asn Gly Arg Gln Met Asn Glu Phe Arg Lys Ala
            660                 665                 670

Ile Arg Leu Arg Leu Thr Thr Lys His Ala Asp Ala Glu Ile Asp Gly
        675                 680                 685

Arg Ser Leu Glu Ser Val Ala Trp Met Ala Asn Glu Leu Arg His Arg
    690                 695                 700

Ile Glu Gly Phe Tyr Arg Ser Ala Glu Asn Asp Val Thr Val Arg Val
705                 710                 715                 720

Phe Arg Gly Ala Val Thr Ala Glu Gly Arg Arg Ala Ser Gly Phe Glu
                725                 730                 735

Ser Arg Val Asn Leu Ile Gly Gly Lys Gly Lys Thr Arg Leu Asp Arg
            740                 745                 750

Arg His His Ala Met Asp Ala Leu Thr Ile Ala Leu Met Glu Pro Gly
        755                 760                 765

Ile Ala Gln Thr Ile Ala Leu Arg Met Asn Met Arg Glu Ser Gln Arg
    770                 775                 780

Val Leu Gly Glu Gln Glu Thr Trp Lys Ser Phe Thr Gly Gly Ser Asp
785                 790                 795                 800
```

```
Thr Ala Arg Lys Arg Trp Glu His Trp Cys Glu Glu Met Leu Arg Ala
                805                 810                 815

Ser Glu Leu Phe Asn Val Phe Leu Ala Glu Asp Arg Ile Pro Ile Cys
            820                 825                 830

Gln Asn Lys Arg Leu Arg Leu Gly Ser Ser Ala Val His Lys Ala Ile
        835                 840                 845

Val Gln Pro Phe Glu Ala Ser Asp Lys Arg Ile Val Ser Asp Ala Met
    850                 855                 860

Pro Val Glu Leu Ile Asp Arg Ala Ser Thr Pro Ala Leu Trp Thr Ala
865                 870                 875                 880

Leu Thr Arg Asp Pro Asp Phe Asp Pro Lys Glu Gly Leu Pro Ala Asn
                885                 890                 895

Pro Ser Arg Thr Ile Arg Leu His Asp Lys Arg Leu Gly Pro Asn Glu
            900                 905                 910

Thr Val Glu Phe Phe Pro Thr Ala Ala Ala Cys Leu Ala Ile Arg Gly
        915                 920                 925

Gly Tyr Cys Glu Ile Gly Ala Gly Ile His His Ala Arg Ile Phe Arg
    930                 935                 940

Ile Ser Gly Lys Lys Thr Thr Tyr Ala Met Leu Arg Val Tyr Gln Cys
945                 950                 955                 960

Asp Leu Val Arg Phe Gln Lys Glu Asn Leu Leu Thr Val Glu Leu Pro
                965                 970                 975

Ala Asn Thr Ile Ser Val Arg Thr Ala Val Pro Lys Leu Arg Glu Ala
            980                 985                 990

Leu Ala His Gly Thr Ala Glu Gln  Ile Gly Trp Leu Val  Val Gly Asp
```

995 1000 1005

Glu Leu Lys Ile Asp Leu Ser Gly Phe Thr Thr Gly Gln Ile Glu
1010 1015 1020

Thr Phe Asn Glu Thr Tyr Pro Gln Ala Thr Arg Trp Glu Val Thr
1025 1030 1035

Gly Phe Pro Thr Lys Thr Gln Leu Arg Leu Lys Pro Leu Leu Ile
1040 1045 1050

Ala Ser Glu Gly Leu Ala Asp Asp Val Pro Asp Asp Ile Val Lys
1055 1060 1065

Ile Val Lys Gly Pro Gly Trp Trp Pro Ala Ile Asp Lys Leu Leu
1070 1075 1080

Lys Ile Gly Asn Val Val Leu Tyr Arg Arg Asp Thr His Gly Lys
1085 1090 1095

Pro Arg Val Val Ser His Arg Ser Leu Pro Leu Ser Ser Lys Leu
1100 1105 1110

Gln

<210> 279
<211> 1113
<212> PRT
<213> Alcanivorax sp.

<400> 279

Met Arg Tyr Arg Val Gly Leu Asp Leu Gly Thr Ala Ser Val Gly Ala
1 5 10 15

Ala Val Phe Ser Met Asp Glu Gln Gly Asn Pro Met Glu Leu Ile Trp
20 25 30

```
His Tyr Glu Arg Leu Phe Ser Glu Pro Leu Val Pro Asp Met Gly Gln
        35                  40                  45

Leu Lys Pro Lys Lys Ala Ala Arg Arg Leu Ala Arg Gln Gln Arg Arg
    50                  55                  60

Gln Ile Asp Arg Arg Ala Ser Arg Leu Arg Arg Ile Ala Ile Val Ser
65                  70                  75                  80

Arg Arg Leu Gly Ile Ala Pro Gly Arg Asn Asp Ser Gly Val His Gly
                85                  90                  95

Asn Asp Val Pro Thr Leu Arg Ala Met Ala Val Asn Glu Arg Ile Glu
            100                 105                 110

Leu Gly Gln Leu Arg Ala Val Leu Leu Arg Met Gly Lys Lys Arg Gly
        115                 120                 125

Tyr Gly Gly Thr Phe Lys Ala Val Arg Lys Val Gly Glu Ala Gly Glu
    130                 135                 140

Val Ala Ser Gly Ala Ser Arg Leu Glu Glu Glu Met Val Ala Leu Ala
145                 150                 155                 160

Ser Val Gln Asn Lys Asp Ser Val Thr Val Gly Glu Tyr Leu Ala Ala
                165                 170                 175

Arg Val Glu His Gly Leu Pro Ser Lys Leu Lys Val Ala Ala Asn Asn
            180                 185                 190

Glu Tyr Tyr Ala Pro Glu Tyr Ala Leu Phe Arg Gln Tyr Leu Gly Leu
        195                 200                 205

Pro Ala Ile Lys Gly Arg Pro Asp Cys Leu Pro Asn Met Tyr Ala Leu
    210                 215                 220

Arg His Gln Ile Glu His Glu Phe Glu Arg Ile Trp Ala Thr Gln Ser
225                 230                 235                 240
```

```
Gln Phe His Asp Val Met Lys Asp His Gly Val Lys Glu Glu Ile Arg
                245                 250                 255

Asn Ala Ile Phe Phe Gln Arg Pro Leu Lys Ser Pro Ala Asp Lys Val
            260                 265                 270

Gly Arg Cys Ser Leu Gln Thr Asn Leu Pro Arg Ala Pro Arg Ala Gln
        275                 280                 285

Ile Ala Ala Gln Asn Phe Arg Ile Glu Lys Gln Met Ala Asp Leu Arg
    290                 295                 300

Trp Gly Met Gly Arg Arg Ala Glu Met Leu Asn Asp His Gln Lys Ala
305                 310                 315                 320

Val Ile Arg Glu Leu Leu Asn Gln Gln Lys Glu Leu Ser Phe Arg Lys
                325                 330                 335

Ile Tyr Lys Glu Leu Glu Arg Ala Gly Cys Pro Gly Pro Glu Gly Lys
            340                 345                 350

Gly Leu Asn Met Asp Arg Ala Ala Leu Gly Gly Arg Asp Asp Leu Ser
        355                 360                 365

Gly Asn Thr Thr Leu Ala Ala Trp Arg Lys Leu Gly Leu Glu Asp Arg
    370                 375                 380

Trp Gln Glu Leu Asp Glu Val Thr Gln Ile Gln Val Ile Asn Phe Leu
385                 390                 395                 400

Ala Asp Leu Gly Ser Pro Glu Gln Leu Asp Thr Asp Asp Trp Ser Cys
                405                 410                 415

Arg Phe Met Gly Lys Asn Gly Arg Pro Arg Asn Phe Ser Asp Glu Phe
            420                 425                 430
```

```
Val Ala Phe Met Asn Glu Leu Arg Met Thr Asp Gly Phe Asp Arg Leu
        435                 440                 445

Ser Lys Met Gly Phe Glu Gly Gly Arg Ser Ser Tyr Ser Ile Lys Ala
    450                 455                 460

Leu Lys Ala Leu Thr Glu Trp Met Ile Ala Pro His Trp Arg Glu Thr
465                 470                 475                 480

Pro Glu Thr His Arg Val Asp Glu Glu Ala Ala Ile Arg Glu Cys Tyr
                485                 490                 495

Pro Glu Ser Leu Ala Thr Pro Ala Gln Gly Gly Arg Gln Ser Lys Leu
            500                 505                 510

Glu Pro Pro Pro Leu Thr Gly Asn Glu Val Val Asp Val Ala Leu Arg
        515                 520                 525

Gln Val Arg His Thr Ile Asn Met Met Ile Asp Asp Leu Gly Ser Val
    530                 535                 540

Pro Ala Gln Ile Val Val Glu Met Ala Arg Glu Met Lys Gly Gly Val
545                 550                 555                 560

Thr Arg Arg Asn Asp Ile Glu Lys Gln Asn Lys Arg Phe Ala Ser Glu
                565                 570                 575

Arg Lys Lys Ala Ala Gln Ser Ile Glu Glu Asn Gly Lys Thr Pro Thr
            580                 585                 590

Pro Ala Arg Ile Leu Arg Tyr Gln Leu Trp Ile Glu Gln Gly His Gln
        595                 600                 605

Cys Pro Tyr Cys Glu Ser Asn Ile Ser Leu Glu Gln Ala Leu Ser Gly
    610                 615                 620

Ala Tyr Thr Asn Phe Glu His Ile Leu Pro Arg Thr Leu Thr Gln Ile
625                 630                 635                 640
```

```
Gly Arg Lys Arg Ser Glu Leu Val Leu Ala His Arg Glu Cys Asn Asp
               645                 650                 655

Glu Lys Gly Asn Arg Thr Pro Tyr Gln Ala Phe Gly His Asp Asp Arg
            660                 665                 670

Arg Trp Arg Ile Val Glu Gln Arg Ala Asn Ala Leu Pro Lys Lys Ser
        675                 680                 685

Ser Arg Lys Thr Arg Leu Leu Leu Leu Lys Asp Phe Glu Gly Glu Ala
    690                 695                 700

Leu Thr Asp Glu Ser Ile Asp Glu Phe Ala Asp Arg Gln Leu His Glu
705                 710                 715                 720

Ser Ser Trp Leu Ala Lys Val Thr Thr Gln Trp Leu Ser Ser Leu Gly
               725                 730                 735

Ser Asp Val Tyr Val Ser Arg Gly Ser Leu Thr Ala Glu Leu Arg Arg
            740                 745                 750

Arg Trp Gly Leu Asp Thr Val Ile Pro Gln Val Arg Phe Glu Ser Gly
        755                 760                 765

Met Pro Val Val Asp Glu Glu Gly Ala Glu Ile Thr Pro Glu Glu Phe
    770                 775                 780

Glu Lys Phe Arg Leu Gln Trp Glu Gly His Arg Val Thr Arg Glu Met
785                 790                 795                 800

Arg Thr Asp Arg Arg Pro Asp Lys Arg Ile Asp His Arg His His Leu
               805                 810                 815

Val Asp Ala Ile Val Thr Ala Leu Thr Ser Arg Ser Leu Tyr Gln Gln
            820                 825                 830
```

```
Tyr Ala Lys Ala Trp Lys Val Ala Asp Glu Lys Gln Arg His Gly Arg
        835                 840                 845

Val Asp Val Lys Val Glu Leu Pro Met Pro Ile Leu Thr Ile Arg Asp
    850                 855                 860

Ile Ala Leu Glu Ala Val Arg Ser Val Arg Ile Ser His Lys Pro Asp
865                 870                 875                 880

Arg Tyr Pro Asp Gly Arg Phe Phe Glu Ala Thr Ala Tyr Gly Ile Ala
                885                 890                 895

Gln Arg Leu Asp Glu Arg Ser Gly Glu Lys Val Asp Trp Leu Val Ser
            900                 905                 910

Arg Lys Ser Leu Thr Asp Leu Ala Pro Glu Lys Lys Ser Ile Asp Val
        915                 920                 925

Asp Lys Val Arg Ala Asn Ile Ser Arg Ile Val Gly Glu Ala Ile Arg
    930                 935                 940

Leu His Ile Ser Asn Ile Phe Glu Lys Arg Val Ser Lys Gly Met Thr
945                 950                 955                 960

Pro Gln Gln Ala Leu Arg Glu Pro Ile Glu Phe Gln Gly Asn Ile Leu
                965                 970                 975

Arg Lys Val Arg Cys Phe Tyr Ser Lys Ala Asp Asp Cys Val Arg Ile
            980                 985                 990

Glu His Ser Ser Arg Arg Gly His  His Tyr Lys Met Leu  Leu Asn Asp
        995                 1000                1005

Gly Phe  Ala Tyr Met Glu Val  Pro Cys Lys Glu Gly  Ile Leu Tyr
    1010                1015                1020

Gly Val  Pro Asn Leu Val Arg  Pro Ser Glu Ala Val  Gly Ile Lys
    1025                1030                1035
```

```
Arg Ala  Pro Glu Ser Gly Asp  Phe Ile Arg Phe Tyr  Lys Gly Asp
    1040                1045                1050


Thr Val  Lys Asn Ile Lys Thr  Gly Arg Val Tyr Thr  Ile Lys Gln
    1055                1060                1065


Ile Leu  Gly Asp Gly Gly Gly  Lys Leu Ile Leu Thr  Pro Val Thr
    1070                1075                1080


Glu Thr  Lys Pro Ala Asp Leu  Leu Ser Ala Lys Trp  Gly Arg Leu
    1085                1090                1095


Lys Val  Gly Gly Arg Asn Ile  His Leu Leu Arg Leu  Cys Ala Glu
    1100                1105                1110


<210>  280
<211>  1146
<212>  PRT
<213>  Alicyclobacillus hesperidum

<400>  280

Met Ala Tyr Arg Leu Gly Leu Asp Ile Gly Ile Thr Ser Val Gly Trp
1               5                   10                  15


Ala Val Val Ala Leu Glu Lys Asp Glu Ser Gly Leu Lys Pro Val Arg
            20                  25                  30


Ile Gln Asp Leu Gly Val Arg Ile Phe Asp Lys Ala Glu Asp Ser Lys
        35                  40                  45


Thr Gly Ala Ser Leu Ala Leu Pro Arg Arg Glu Ala Arg Ser Ala Arg
    50                  55                  60


Arg Arg Thr Arg Arg Arg Arg Arg His Arg Leu Trp Arg Val Lys Arg Leu
65                  70                  75                  80


Leu Glu Gln His Gly Ile Leu Ser Met Glu Gln Ile Glu Ala Leu Tyr
```

```
                85                  90                  95

Ala Gln Arg Thr Ser Ser Pro Asp Val Tyr Ala Leu Arg Val Ala Gly
            100                 105                 110

Leu Asp Arg Cys Leu Ile Ala Glu Glu Ile Ala Arg Val Leu Ile His
        115                 120                 125

Ile Ala His Arg Arg Gly Phe Gln Ser Asn Arg Lys Ser Glu Ile Lys
    130                 135                 140

Asp Ser Asp Ala Gly Lys Leu Leu Lys Ala Val Gln Glu Asn Glu Asn
145                 150                 155                 160

Leu Met Gln Ser Lys Gly Tyr Arg Thr Val Ala Glu Met Leu Val Ser
                165                 170                 175

Glu Ala Thr Lys Thr Asp Ala Glu Gly Lys Leu Val His Gly Lys Lys
            180                 185                 190

His Gly Tyr Val Ser Asn Val Arg Asn Lys Ala Gly Glu Tyr Arg His
        195                 200                 205

Thr Val Ser Arg Gln Ala Ile Val Asp Glu Val Arg Lys Ile Phe Ala
    210                 215                 220

Ala Gln Arg Ala Leu Gly Asn Asp Val Met Ser Glu Glu Leu Glu Asp
225                 230                 235                 240

Ser Tyr Leu Lys Ile Leu Cys Ser Gln Arg Asn Phe Asp Asp Gly Pro
                245                 250                 255

Gly Gly Asp Ser Pro Tyr Gly His Gly Ser Val Ser Pro Asp Gly Val
            260                 265                 270

Arg Gln Ser Ile Tyr Glu Arg Met Val Gly Ser Cys Thr Phe Glu Thr
        275                 280                 285
```

```
Gly Glu Lys Arg Ala Pro Arg Ser Ser Tyr Ser Phe Glu Arg Phe Gln
    290                 295                 300

Leu Leu Thr Lys Val Val Asn Leu Arg Ile Tyr Arg Gln Gln Glu Asp
305                 310                 315                 320

Gly Gly Arg Tyr Pro Cys Glu Leu Thr Gln Thr Glu Arg Ala Arg Val
                325                 330                 335

Ile Asp Cys Ala Tyr Glu Gln Thr Lys Ile Thr Tyr Gly Lys Leu Arg
            340                 345                 350

Lys Leu Leu Asp Met Lys Asp Thr Glu Ser Phe Ala Gly Leu Thr Tyr
        355                 360                 365

Gly Leu Asn Arg Ser Arg Asn Lys Thr Glu Asp Thr Val Phe Val Glu
    370                 375                 380

Met Lys Phe Tyr His Glu Val Arg Lys Ala Leu Gln Arg Ala Gly Val
385                 390                 395                 400

Phe Ile Gln Asp Leu Ser Ile Glu Thr Leu Asp Gln Ile Gly Trp Ile
                405                 410                 415

Leu Ser Val Trp Lys Ser Asp Asp Asn Arg Arg Lys Lys Leu Ser Thr
            420                 425                 430

Leu Gly Leu Ser Asp Asn Val Ile Glu Glu Leu Leu Pro Leu Asn Gly
        435                 440                 445

Ser Lys Phe Gly His Leu Ser Leu Lys Ala Ile Arg Lys Ile Leu Pro
    450                 455                 460

Phe Leu Glu Asp Gly Tyr Ser Tyr Asp Val Ala Cys Glu Leu Ala Gly
465                 470                 475                 480

Tyr Gln Phe Gln Gly Lys Thr Glu Tyr Val Lys Gln Arg Leu Leu Pro
```

```
                485                 490                 495

Pro Leu Gly Glu Gly Glu Val Thr Asn Pro Val Val Arg Arg Ala Leu
            500                 505                 510

Ser Gln Ala Ile Lys Val Val Asn Ala Val Ile Arg Lys His Gly Ser
        515                 520                 525

Pro Glu Ser Ile His Ile Glu Leu Ala Arg Glu Leu Ser Lys Asn Leu
    530                 535                 540

Asp Glu Arg Arg Lys Ile Glu Lys Ala Gln Lys Glu Asn Gln Lys Asn
545                 550                 555                 560

Asn Glu Gln Ile Lys Asp Glu Ile Arg Glu Ile Leu Gly Ser Ala His
                565                 570                 575

Val Thr Gly Arg Asp Ile Val Lys Tyr Lys Leu Phe Lys Gln Gln Gln
            580                 585                 590

Glu Phe Cys Met Tyr Ser Gly Glu Lys Leu Asp Val Thr Arg Leu Phe
        595                 600                 605

Glu Pro Gly Tyr Ala Glu Val Asp His Ile Ile Pro Tyr Gly Ile Ser
    610                 615                 620

Phe Asp Asp Ser Tyr Asp Asn Lys Val Leu Val Lys Thr Glu Gln Asn
625                 630                 635                 640

Arg Gln Lys Gly Asn Arg Thr Pro Leu Glu Tyr Leu Arg Asp Lys Pro
                645                 650                 655

Glu Gln Lys Ala Lys Phe Ile Ala Leu Val Glu Ser Ile Pro Leu Ser
            660                 665                 670

Gln Lys Lys Lys Asn His Leu Leu Met Asp Lys Arg Ala Ile Asp Leu
        675                 680                 685
```

```
Glu Gln Glu Gly Phe Arg Glu Arg Asn Leu Ser Asp Thr Arg Tyr Ile
    690                 695                 700

Thr Arg Ala Leu Met Asn His Ile Gln Ala Trp Leu Leu Phe Asp Glu
705                 710                 715                 720

Thr Ala Ser Thr Arg Ser Lys Arg Val Val Cys Val Asn Gly Ala Val
                725                 730                 735

Thr Ala Tyr Met Arg Ala Arg Trp Gly Leu Thr Lys Asp Arg Asp Ala
            740                 745                 750

Gly Asp Lys His His Ala Ala Asp Ala Val Val Val Ala Cys Ile Gly
        755                 760                 765

Asp Ser Leu Ile Gln Arg Val Thr Lys Tyr Asp Lys Phe Lys Arg Asn
    770                 775                 780

Ala Leu Ala Asp Arg Asn Arg Tyr Val Gln Gln Val Ser Lys Ser Glu
785                 790                 795                 800

Gly Ile Thr Gln Tyr Val Asp Lys Glu Thr Gly Glu Val Phe Thr Trp
                805                 810                 815

Glu Ser Phe Asp Glu Arg Lys Phe Leu Pro Asn Glu Pro Leu Glu Pro
            820                 825                 830

Trp Pro Phe Phe Arg Asp Glu Leu Leu Ala Arg Leu Ser Asp Asp Pro
        835                 840                 845

Ser Lys Asn Ile Arg Ala Ile Gly Leu Leu Thr Tyr Ser Glu Thr Glu
    850                 855                 860

Gln Ile Asp Pro Ile Phe Val Ser Arg Met Pro Thr Arg Lys Val Thr
865                 870                 875                 880

Gly Ala Ala His Lys Glu Thr Ile Arg Ser Pro Arg Ile Val Lys Val
```

```
               885                 890                 895

Asp Asp Asn Lys Gly Thr Glu Ile Gln Val Val Val Ser Lys Val Ala
            900                 905                 910

Leu Thr Glu Leu Lys Leu Thr Lys Asp Gly Glu Ile Lys Asp Tyr Phe
        915                 920                 925

Arg Pro Glu Asp Asp Pro Arg Leu Tyr Asn Thr Leu Arg Glu Arg Leu
    930                 935                 940

Val Gln Phe Gly Gly Asp Ala Lys Ala Ala Phe Lys Glu Pro Val Tyr
945                 950                 955                 960

Lys Ile Ser Lys Asp Gly Ser Val Arg Thr Pro Val Arg Lys Val Lys
               965                 970                 975

Ile Gln Glu Lys Leu Thr Leu Gly Val Pro Val His Gly Gly Arg Gly
            980                 985                 990

Ile Ala Glu Asn Gly Gly Met Val  Arg Ile Asp Val Phe  Ala Lys Gly
        995                 1000                1005

Gly Lys  Tyr Tyr Phe Val Pro  Ile Tyr Val Ala Asp  Val Leu Lys
    1010                1015                1020

Arg Glu  Leu Pro Asn Arg Leu  Ala Thr Ala His Lys  Pro Tyr Ser
    1025                1030                1035

Glu Trp  Arg Val Val Asp Asp  Ser Tyr Gln Phe Lys  Phe Ser Leu
    1040                1045                1050

Tyr Pro  Asn Asp Ala Val Met  Ile Lys Pro Ser Arg  Glu Val Asp
    1055                1060                1065

Ile Thr  Tyr Lys Asp Arg Lys  Glu Pro Val Gly Cys  Arg Ile Met
    1070                1075                1080
```

```
Tyr Phe  Val Ser Ala Asn Ile  Ala Ser Ala Ser Ile  Ser Leu Arg
    1085                1090                1095


Thr His  Asp Asn Ser Gly Glu  Leu Glu Gly Leu Gly  Ile Gln Gly
    1100                1105                1110


Leu Glu  Val Phe Glu Lys Tyr  Val Val Gly Pro Leu  Gly Asp Thr
    1115                1120                1125


His Pro  Val Tyr Lys Glu Arg  Arg Met Pro Phe Arg  Val Glu Arg
    1130                1135                1140


Lys Met  Asn
    1145
```

<210> 281
<211> 1552
<212> PRT
<213> Anaerophaga sp.

<400> 281

```
Met Phe Ser Gln Arg Asn Asn Pro Tyr Cys Glu Leu Leu Gln Asn Val
1               5                   10                  15


Lys Gln Leu Tyr Lys Glu Lys Phe Gly Lys Thr Asn Gln Val Asp Asn
            20                  25                  30


Ser Ile Ile Tyr Gly Phe Met Lys Arg Ile Leu Gly Leu Asp Leu Gly
        35                  40                  45


Thr Asn Ser Ile Gly Trp Ala Leu Val Glu Asn Asp Glu Asn Asp Arg
    50                  55                  60


Lys Gly Lys Ile Ile Gly Met Gly Ser Arg Ile Ile Pro Met Asp Met
65                  70                  75                  80


Ser Glu Leu Asp Asn Phe Asn Lys Gly Ala Ser Ile Ser Lys Thr Ala
                85                  90                  95
```

```
Glu Arg Thr Arg Leu Arg Met Thr Arg Arg Leu Arg Glu Arg His Leu
            100                 105                 110

Leu Arg Arg Ala Arg Leu His Arg Ile Leu Asn Ile Met Gly Phe Leu
        115                 120                 125

Pro Glu His Tyr Arg Asn Ser Ile Asp Phe Ile Asp Lys Lys Gly Cys
    130                 135                 140

Phe Phe Glu Gly Gln Glu Pro Lys Ile Ala Tyr Lys Pro Asp Lys Asn
145                 150                 155                 160

Ser Glu Gln Phe Cys Phe Leu Phe Thr Ser Ser Phe His Glu Met Leu
                165                 170                 175

Glu Asp Phe Arg Lys Phe Gln Pro Glu Leu Ile Gln Asn Arg Lys Lys
            180                 185                 190

Val Pro Tyr Asp Trp Thr Ile Tyr Tyr Leu Arg Lys Lys Ala Leu Thr
        195                 200                 205

Gln Lys Ile Ser Lys Glu Glu Leu Ala Trp Ile Ile Leu Asn Phe Asn
    210                 215                 220

Thr Lys Arg Gly Tyr Tyr His Leu Arg Gly Glu Asp Glu Asp Asn Gln
225                 230                 235                 240

Asp Asn Lys Lys Ile Lys Glu Phe Arg Ala Leu Lys Val Val Asn Val
                245                 250                 255

Thr Glu Arg Glu Gly Ala Asn Ser Ser Gly Lys Lys Trp Tyr Asp Met
            260                 265                 270

Glu Leu Glu Asn Gly Trp Val Tyr Ser Arg Gln Ser Asn Leu Pro Pro
        275                 280                 285
```

```
Asn Leu Glu Gly Lys Thr Ile Glu Leu Ile Val Ser Tyr Thr Leu Asp
    290                 295                 300

Asn Asn Gly Asn Ile Lys Lys Asp Lys Asn Gly Lys Glu Lys Tyr Ser
305                 310                 315                 320

Leu Ser Met Pro Gly Glu Glu Asp Trp Asn Leu Val Lys Ile Lys Thr
                325                 330                 335

Glu Asn Asp Leu Lys Thr Ser Lys Lys Ser Val Gly Glu Tyr Ile Tyr
            340                 345                 350

Asp His Leu Leu Lys Asn Pro Asp Gln Lys Ile Arg Gly Lys Leu Ile
        355                 360                 365

Ser Thr Ile Glu Arg Lys Phe Tyr Lys Glu Glu Leu Ser Arg Ile Leu
    370                 375                 380

Lys Thr Gln Met Asn Phe Tyr Glu Glu Leu Lys Asn Arg Glu Leu Tyr
385                 390                 395                 400

Gln Lys Cys Val Glu Glu Leu Tyr Pro Asn Asn Lys Ser His Gln Gln
                405                 410                 415

Thr Leu Leu Gln Lys Asp Phe Ile His Leu Ile Val Glu Asp Ile Ile
            420                 425                 430

Phe Tyr Gln Arg Pro Leu Lys Ser Lys Arg Ala Phe Val Asn Asn Cys
        435                 440                 445

Pro Leu Glu Tyr Arg Val Tyr Val Asp Lys Lys Ser Gly Glu Leu Ile
    450                 455                 460

Lys Ser Gly Val Lys Cys Ile Pro Lys Ser His Pro Leu Phe Gln Glu
465                 470                 475                 480

Phe Arg Leu Trp Gln Tyr Val Arg Asn Leu Arg Ile Tyr Glu Arg Glu
                485                 490                 495
```

```
Arg Met Val Asn Gly Arg Leu Met Val Asn Val Asp Val Thr Asn Glu
            500                 505                 510

Leu Leu Pro Asp Glu Glu His Ile Val Arg Leu Phe Asp Leu Leu Asn
        515                 520                 525

Asp Arg Lys Ser Phe Lys Gln Asp Asp Val Leu Arg Phe Val Gly Ile
    530                 535                 540

Lys Ser Pro Lys Asp Arg Lys Arg Tyr Ser Trp Asn Tyr Pro Glu Asp
545                 550                 555                 560

Lys Glu Leu Pro Gly Asn Glu Thr Arg His Leu Ile Leu Ala Trp Leu
                565                 570                 575

Lys Lys Val Asp Gly Val Pro Glu Asp Trp Leu Asp Pro Glu Lys Leu
            580                 585                 590

Lys Ala Leu Trp His Leu Leu Tyr Ser Val Thr Asp Arg Glu Glu Ile
        595                 600                 605

Ile Lys Gly Leu His Ser Phe Ala Lys Lys Tyr Glu Leu Pro Asp Thr
    610                 615                 620

Phe Val Glu His Phe Lys Lys Ile Pro Arg Leu Glu Arg Glu Tyr Gly
625                 630                 635                 640

Ser Phe Ser Glu Lys Ala Ile Lys Lys Leu Leu Pro Leu Met Arg Met
                645                 650                 655

Gly Lys Tyr Trp Lys Ala Glu Glu Ile Pro Ala Asp Leu Leu Glu Lys
            660                 665                 670

Ala Gln Lys Ile Ile Asp Ala Glu Ala Asp Asp Arg Ile Ser Asp Glu
        675                 680                 685
```

```
Val Arg Glu Lys Leu Leu His Leu Lys Asp Ile Ser Gln Leu Lys Gly
    690                 695                 700

Leu Pro Leu Trp Gln Ala Ser Tyr Leu Val Tyr Gly Arg His Ser Glu
705                 710                 715                 720

Thr Gly Glu Val Val Lys Trp Arg Thr Ser Glu Asp Leu Glu Lys Tyr
                725                 730                 735

Ile Leu Gln Phe Lys Gln His Ser Leu Arg Asn Pro Val Val Glu Gln
            740                 745                 750

Val Ile Leu Glu Ala Leu Arg Val Val Lys Asp Ile Trp Glu His Tyr
        755                 760                 765

Gly Glu Gly Lys Glu Gly Phe Phe Asn Glu Ile His Val Glu Ile Gly
    770                 775                 780

Arg Glu Leu Lys Asn Pro Ala Asp Lys Arg Lys Lys Ile Thr Ser Gln
785                 790                 795                 800

Ile Gln Glu Asn Glu Asn Thr Asn Leu Arg Ile Lys Ala Leu Leu Glu
                805                 810                 815

Glu Leu Phe Asn Asp Pro Ser Val Lys Asn Val Arg Pro Tyr Ser Pro
            820                 825                 830

Ala Gln Gln Glu Ile Leu Arg Ile Tyr Glu Asp Gly Val Leu Asn Gly
        835                 840                 845

Gln Lys Glu Ile Pro Asp Asp Ile Leu Lys Ile Ser Lys Met Ala Arg
    850                 855                 860

Pro Ser Lys Ser Gln Leu Val Lys Tyr Lys Leu Trp Leu Glu Gln Lys
865                 870                 875                 880

Tyr Arg Ser Pro Tyr Thr Gly Glu Ile Ile Pro Leu Ser Gln Leu Phe
                885                 890                 895
```

```
Thr Ser Ala Tyr Glu Ile Glu His Ile Ile Pro Gln Ala Arg Tyr Phe
            900                 905                 910

Asp Asp Ser Phe Ser Asn Lys Val Ile Cys Glu Ala Glu Val Asn Arg
        915                 920                 925

Glu Lys Gly His Gln Leu Ala Phe Glu Phe Ile Thr Lys Arg Gly Gly
    930                 935                 940

Asp Glu Ile Glu Leu Asn Phe Gly Lys Lys Val Thr Ile Leu Asn Val
945                 950                 955                 960

Glu Glu Tyr Gln Lys Phe Val Lys Asp His Tyr Gly Arg Ser Leu Arg
                965                 970                 975

Ser Leu Ser Lys Met Arg Lys Leu Leu Met Glu Asp Ile Pro Asp Asp
            980                 985                 990

Phe Ile Asp Arg Gln Leu Asn Asp  Ser Arg Tyr Ile Ser  Lys Val Val
        995                 1000                1005

Arg Asn  Leu Leu Ser Asn Ile  Val Arg Ala Glu Asp  Glu Asn Ser
    1010                1015                1020

Leu Val  Ser Lys His Leu Ile  Thr Cys Thr Gly Gly  Val Thr Thr
    1025                1030                1035

Arg Leu  Lys His Glu Trp Gly  Leu Asn Asp Val Trp  Asn Glu Leu
    1040                1045                1050

Ile Thr  Pro Arg Phe Val Arg  Leu Asn Lys Met Gly  Lys Glu Lys
    1055                1060                1065

Phe Gly  Glu Trp Ile Asn Lys  Lys Gly Lys Gln Val  Phe Gln Ile
    1070                1075                1080
```

```
Gln Met  Pro Leu Glu Leu Gln  Lys Gly Phe Asn Lys  Lys Arg Ile
    1085                1090                1095

Asp His  Arg His His Ala Leu  Asp Ala Leu Val Val  Ala Cys Ala
    1100                1105                1110

Ser Arg  Ser His Val Asn Tyr  Leu Asn Asn Asp Ser  Ala Arg Ala
    1115                1120                1125

Asn Ala  Ser Glu Thr Arg Tyr  Asp Leu Arg Asn Lys  Leu Cys Tyr
    1130                1135                1140

Lys Asp  Lys Thr Asp Ser Asn  Gly Asn Tyr Arg Trp  Lys Phe Tyr
    1145                1150                1155

Lys Pro  Trp Glu Ser Phe Thr  Glu Glu Ala Lys Asn  Arg Leu Ala
    1160                1165                1170

Gly Thr  Val Val Ser Phe Lys  Ser Asn Arg Arg Ile  Met Thr Arg
    1175                1180                1185

Ser Ser  Asn Arg Tyr Phe Lys  Trp Val Asp Thr Ser  Glu Gly Lys
    1190                1195                1200

Lys Lys  Lys Leu Val Arg Gln  Ile Lys Gly Asp Asn  Gln Ala Ile
    1205                1210                1215

Arg Lys  Pro Leu His Lys Asp  Thr Val Leu Gly Lys  Val Ser Leu
    1220                1225                1230

Arg Lys  Glu Lys Lys Val Ser  Leu Ser Lys Ala Ile  Asp Leu Trp
    1235                1240                1245

Glu Ser  Ile Val Asp Lys Pro  Leu Lys Lys Arg Ile  Gln Ser Leu
    1250                1255                1260

Arg Glu  Gln Gly Tyr Asp Lys  Lys Leu Leu Leu Lys  Tyr Phe Lys
    1265                1270                1275
```

```
Asp Arg  Asn Asn Gln Phe Asn  Gly Gln Asp Ile Ser  Arg Val Asn
    1280                1285                1290

Ile Tyr  Phe Phe Asp Asn Asn  Leu Ala Ala Arg Arg  Val Thr Leu
    1295                1300                1305

Asp Ala  Ser Phe Asn Ser Glu  Lys Arg Ile Asp Gly  Ile Thr Asp
    1310                1315                1320

Ser Gly  Ile Lys Lys Ile Leu  Tyr Ala His Leu Gln  Asn Glu Lys
    1325                1330                1335

Tyr His  Gly Lys Lys Asp Glu  Lys Gly Asn Glu Ile  Ser Pro Tyr
    1340                1345                1350

Glu Leu  Ala Phe Ser Pro Glu  Gly Leu Glu Glu Met  Asn Ala Asn
    1355                1360                1365

Ile Lys  Lys Leu Asn Gly Gly  Lys Pro His Cys Pro  Ile Tyr Lys
    1370                1375                1380

Val Arg  Leu Ala Glu Thr Ile  Gly Glu Lys Phe Lys  Leu Gly Glu
    1385                1390                1395

Lys Gly  Asn Lys Asn Lys Lys  Tyr Val Glu Ala Ala  Lys Gly Thr
    1400                1405                1410

Asn Leu  Phe Phe Ala Val Tyr  Val Asp Glu Lys Gly  Val Arg Ser
    1415                1420                1425

Phe Glu  Thr Ile Pro Phe Ser  Val Ala Leu Glu Arg  Arg Lys Gln
    1430                1435                1440

Lys Leu  Ala Val Val Pro Glu  Glu Asn Glu Asn Lys  Glu Lys Leu
    1445                1450                1455
```

```
Leu Phe  Tyr Leu Ser Pro Asn  Asp Leu Val Tyr Val  Pro Asp Glu
    1460                1465                1470


Asp Glu  Lys Leu Ile Asp Tyr  Arg Gln Leu Ser Ile  Asn Pro Thr
    1475                1480                1485


Arg Ile  Tyr Lys Met Val Ser  Ser Ser Gly Thr Gln  Cys Phe Phe
    1490                1495                1500


Ile Pro  His Phe Val Ala Ser  Pro Ile Val Gln Thr  Met Glu Leu
    1505                1510                1515


Gly Pro  Asn Asn Lys Ser Glu  Arg Ala Trp Asp Gly  Gln Met Ile
    1520                1525                1530


Lys Asn  Val Cys Tyr Lys Leu  Ser Val Asp Arg Leu  Gly Asn Val
    1535                1540                1545


Lys Ile  Glu Lys
    1550
```

<210> 282
<211> 1515
<212> PRT
<213> Anaerophaga thermohalophila

<400> 282

```
Met Lys Arg Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Leu Val Glu Ser Asp Glu Glu Gln Lys Ser Gly Lys Ile Gln Gly
            20                  25                  30


Ile Gly Ser Arg Ile Ile Pro Met Asp Gln Asn Glu Leu Asp Asn Phe
        35                  40                  45


Asn Lys Gly Asn Thr Val Ser Gln Thr Ala Glu Arg Thr Arg Leu Arg
    50                  55                  60
```

```
Met Val Arg Arg Leu Arg Glu Arg His Leu Leu Arg Arg Glu Arg Leu
65                  70                  75                  80

His Arg Val Leu Lys Glu Ile Gly Phe Leu Pro Glu His Tyr Leu Glu
                85                  90                  95

Gln Ile Asp Phe Thr Glu Lys Pro Gly Gly Phe Leu Pro Gly Lys Glu
            100                 105                 110

Pro Lys Ile Ala Tyr Lys Pro Asp Asn Phe Lys Asp Lys Tyr Asp Phe
        115                 120                 125

Leu Phe Gln Asp Ser Tyr His Glu Met Leu Ser Asp Phe Gln Asp Lys
    130                 135                 140

Asn Pro Glu Phe Ile Gln Lys Arg Lys Lys Val Pro Gln Asp Trp Thr
145                 150                 155                 160

Ile Tyr Tyr Leu Arg Lys Lys Ala Leu Thr Ala Lys Ile Thr Lys Glu
                165                 170                 175

Glu Leu Ala Trp Ile Ile Leu Asn Phe Asn Gln Lys Arg Gly Tyr Tyr
            180                 185                 190

Gln Leu Arg Gly Glu Asp Glu Asp Val Ala Lys Asn Thr Lys Lys Glu
        195                 200                 205

Glu Phe His Ala Leu Lys Val Val Lys Val Lys Glu Arg Glu Asp Ser
    210                 215                 220

Glu Gly Ala Ser Gly Lys Trp Tyr Asp Ile Glu Leu Glu Asn Gly Trp
225                 230                 235                 240

Val Tyr Pro Arg Gln Ser Asn Ile Arg Pro Asp Trp Glu Gly Lys Ile
                245                 250                 255

Leu Glu Leu Ile Val Thr Tyr Asn Leu Asp Lys Asp Gly Asn Ile Lys
```

```
            260                 265                 270

Thr Asp Lys Glu Gly Asn Glu Lys Arg Ser Phe Arg Met Pro Asn Lys
        275                 280                 285

Asp Asp Trp Thr Leu Arg Lys Lys Arg Thr Glu Asn Glu Ile Glu Lys
    290                 295                 300

Ser Gly Lys Thr Val Gly Glu Tyr Ile Tyr Asp Asn Leu Leu Asp Ala
305                 310                 315                 320

Pro Asp Leu Lys Ile Arg Gly Lys Leu Val Ser Thr Ile Glu Arg Lys
                325                 330                 335

Tyr Tyr Arg Ser Glu Leu Glu Gln Ile Leu Thr Ala Gln Lys Lys Tyr
            340                 345                 350

His Pro Glu Leu Ser Asn Ser Glu Leu Phe Asn Lys Cys Ile Ser Asn
        355                 360                 365

Leu Tyr Pro Asn Asn Asp Ile His Arg Lys Ala Leu Leu Ser Lys Asp
    370                 375                 380

Phe Val His Leu Ile Ile Asn Asp Ile Ile Phe Tyr Gln Arg Pro Leu
385                 390                 395                 400

Lys Ser Lys Arg Ser Thr Val Ser Asn Cys Pro Leu Glu Tyr Arg Val
                405                 410                 415

Tyr Val Asp Lys Val Thr Gly Glu Lys Lys Lys Val Pro Leu Lys Cys
            420                 425                 430

Ile Pro Lys Ser His Pro Leu Tyr Gln Glu Phe Arg Leu Trp Gln Tyr
        435                 440                 445

Val Lys Asn Leu Arg Leu Phe Glu Lys Glu Arg Phe Glu Asn Gly Arg
    450                 455                 460
```

```
Leu Leu Thr Asn Val Asp Val Thr Glu Gln Phe Leu Pro Asp Glu Asp
465                 470                 475                 480

Lys Tyr Val Glu Leu Phe Glu Phe Leu Asn Gly Arg Lys Thr Phe Lys
                485                 490                 495

Gln Asp Asp Ile Leu Lys Phe Ala Gly Ile Lys Ser Ala Lys Asp Arg
            500                 505                 510

Val Lys Tyr Tyr Trp Asn Tyr Pro Gln Glu Lys Glu Tyr Pro Gly Asn
        515                 520                 525

Glu Thr Arg Tyr Leu Ile Glu Ser Arg Leu Lys Lys Ile Glu Asn Val
    530                 535                 540

Pro Asp Glu Trp Leu Asn Tyr Glu Lys Ile Glu Glu Leu Trp His Leu
545                 550                 555                 560

Leu Tyr Ser Val Thr Asp Lys Val Glu Ile Glu Lys Gly Leu Gln Ser
                565                 570                 575

Phe Ala Ala Lys Tyr Gln Leu Pro Asp Leu Phe Val Glu Val Phe Lys
            580                 585                 590

Gly Phe Pro Arg Met Glu Arg Glu Tyr Gly Ala Phe Ser Lys Lys Ala
        595                 600                 605

Ile Lys Lys Leu Leu Pro Leu Met Arg Met Gly Lys Tyr Trp Lys Leu
    610                 615                 620

Glu Asn Ile Asn Pro Asp Leu Ile Glu Lys Val Gln Lys Ile Ile Asp
625                 630                 635                 640

Gly Glu Ala Asp Asp Asn Ile Asn Asp Gly Ile Arg Glu Arg Phe Ser
                645                 650                 655

Glu Ile Asn Glu Met Ser Asp Leu Arg Gly Met Pro Leu Trp Lys Ala
```

```
            660                 665                 670

Ser Tyr Leu Val Tyr Gly Arg His Ser Glu Ala Ala Glu Val Ile Arg
        675                 680                 685

Trp Arg Thr Ser Ala Asp Leu Asp Gln Tyr Ile Lys Asp Phe Lys Gln
    690                 695                 700

His Ala Leu Arg Asn Pro Ile Val Glu Gln Val Val Leu Glu Ala Leu
705                 710                 715                 720

Arg Val Val Lys Asp Val Trp Asn Tyr Phe Gly Glu Gly Arg Glu Lys
                725                 730                 735

Phe Phe Asp Glu Ile His Val Glu Ile Gly Arg Asp Leu Lys Asn Pro
            740                 745                 750

Ala Asp Lys Arg Gln Lys Ile Ala Asn Gln Ile Gln Glu Asn Glu Asn
        755                 760                 765

Thr Asn Leu Arg Ile Lys Ala Leu Leu Val Glu Leu Phe Asn Asp Pro
    770                 775                 780

Glu Val Gln Asn Val Arg Pro Tyr Ser Pro Val Gln Gln Gln Leu Leu
785                 790                 795                 800

Lys Ile Tyr Glu Asp Gly Val Leu Asn Ala Glu Arg Asp Ile Pro Asp
                805                 810                 815

Asp Ile Gln Lys Ile Ser Arg Met Ala Asn Pro Thr Arg Asn Gln Leu
            820                 825                 830

Ile Arg Tyr Lys Leu Trp Leu Glu Gln Lys Tyr Arg Ser Pro Tyr Thr
        835                 840                 845

Gly Glu Ile Ile Pro Leu Asn Lys Leu Phe Thr Ser Glu Tyr Glu Val
    850                 855                 860
```

```
Glu His Ile Ile Pro Arg Ala Arg Tyr Phe Asp Asp Ser Phe Ser Asn
865                 870                 875                 880


Lys Ile Ile Ser Glu Ala Glu Val Asn Arg Lys Lys Asp Arg Met Leu
                885                 890                 895


Ala Phe Glu Phe Ile Lys Lys Leu Gly Gly Ser Thr Ile Asp Leu Asn
            900                 905                 910


Tyr Gly Lys Lys Val Ser Val Leu Thr Val Glu Glu Tyr Gln Gln Phe
        915                 920                 925


Val Lys Asp His Tyr Gly Ile Asn Pro His Ser Arg Leu Lys Met Gln
    930                 935                 940


Lys Leu Leu Met Asp Glu Ile Pro Glu Ser Phe Ile Glu Arg Gln Leu
945                 950                 955                 960


Asn Asp Ser Arg Tyr Ile Ser Lys Met Val Arg Asn Leu Leu Ser Asn
                965                 970                 975


Ile Val Arg Glu Glu Asn Glu Asn Ser Pro Val Ala Lys Gln Leu Ile
            980                 985                 990


Thr Cys Ser Gly Ser Ile Thr Asn  Thr Leu Lys Gln Glu  Trp Gly Leu
        995                 1000                1005


Asn Asp  Val Trp Asn Thr Ile  Ile Thr Pro Arg Phe  Glu Arg Leu
    1010                1015                1020


Asn Lys  Met Gly Glu Gln Lys  Tyr Gly Glu Trp Val  Asn Lys Glu
    1025                1030                1035


Gly Lys  Pro Val Phe Gln Ile  Gln Met Pro Leu Glu  Leu Gln Lys
    1040                1045                1050


Gly Phe  Asn Lys Lys Arg Ile  Asp His Arg His His  Ala Leu Asp
```

```
    1055                1060                1065

Ala Leu  Ile Val Ala Ser Ala  Thr Arg Ser His Val  Asn Tyr Leu
    1070                1075                1080

Ser Asn  Glu Ala Ala Lys Thr  Asn Ala Lys Asp Thr  Arg Phe Asp
    1085                1090                1095

Leu Arg  Asn Arg Leu Cys Tyr  Lys Glu Lys Arg Gly  Gln Asn Arg
    1100                1105                1110

Asn Phe  Thr Trp Arg Phe Tyr  Lys Pro Trp Asn Thr  Phe Thr Glu
    1115                1120                1125

Asp Ala  Lys Asn Ala Leu Asn  Asp Ile Val Val Ser  Phe Lys Ser
    1130                1135                1140

Asn His  Arg Val Ile Asn Lys  Ser Thr Asn Arg Tyr  Phe Lys Trp
    1145                1150                1155

Glu Asn  Leu Pro Gly Gly Met  Lys Lys Lys Arg Leu  Val Arg Gln
    1160                1165                1170

Glu Lys  Gly Asp Asn Trp Ala  Ile Arg Gln Ser Leu  His Lys Asp
    1175                1180                1185

Thr Val  Leu Gly Lys Val Ser  Leu Arg Lys Val Lys  Pro Val Ser
    1190                1195                1200

Leu Ser  Val Ala Leu Asp Ser  Trp Asn Asn Ile Val  Asp Lys Ala
    1205                1210                1215

Leu Lys  Lys Lys Ile Arg Ser  Leu Lys Asp Gln Gly  Tyr Asp Lys
    1220                1225                1230

Lys Leu  Met Leu Lys Tyr Phe  Lys Asp Arg Arg Asn  Glu Tyr Asn
    1235                1240                1245
```

```
Gly Glu  Asn Ile Ser Arg Val  Asn Val Tyr Tyr Phe  Asp Glu Glu
    1250                1255                1260

Met Ala  Ala Arg Arg Val Asp  Leu Asp Thr Ser Phe  Asn Ser Glu
    1265                1270                1275

Lys Arg  Ile Glu Gly Ile Thr  Asp Ser Gly Ile Lys  Lys Ile Ile
    1280                1285                1290

Tyr Ala  His Leu Lys Asn Glu  Lys Tyr His Gly Gln  Lys Asp Asp
    1295                1300                1305

Lys Gly  Lys Asp Ile Ser Pro  Tyr Glu Leu Ala Phe  Ser Pro Glu
    1310                1315                1320

Gly Ile  Ala Glu Met Asn Ala  Asn Ile Lys Gln Leu  Asn Gly Gly
    1325                1330                1335

Lys Pro  His Cys Pro Ile Tyr  Lys Val Arg Leu Ala  Glu Pro Val
    1340                1345                1350

Gly Glu  Lys Phe Gln Leu Gly  Glu Thr Gly Asn Lys  Thr Glu Lys
    1355                1360                1365

Leu Val  Glu Val Ala Lys Gly  Thr Asn Leu Phe Phe  Gly Val Tyr
    1370                1375                1380

Ala Asn  Asp Glu Gly Val Arg  Ser Phe Ala Thr Val  Pro Phe Tyr
    1385                1390                1395

Leu Ala  Val Glu Arg Glu Lys  Gln Gly Leu Pro Ala  Val Pro Gln
    1400                1405                1410

Glu Asn  Glu Asn Gly Asp Gln  Leu Leu Phe Trp Leu  Ser Pro Asn
    1415                1420                1425

Asp Leu  Val Tyr Val Pro Ser  Glu Glu Asp Ala His  Phe Ala Asn
```

```
    1430                1435                1440

Pro Lys  Gln Ile Glu Leu Asp  Asn Ser Arg Ile Tyr  Lys Met Val
    1445                1450                1455

Ser Ser  Thr Gly Thr Gln Cys  Phe Phe Ile Pro His  Phe Val Ala
    1460                1465                1470

Thr Pro  Ile Val Gln Thr Ile  Glu Leu Gly Pro Asn  Asn Lys Ser
    1475                1480                1485

Glu Arg  Ala Trp Asp Gly Gln  Met Ile Lys Lys Val  Cys Tyr Lys
    1490                1495                1500

Leu Ser  Val Asp Arg Leu Gly  Asn Val Glu Ile Glu
    1505                1510                1515
```

<210> 283
<211> 333
<212> PRT
<213> Bacillus cereus

<400> 283

```
Met Met Asn Pro Asn Asn Phe Thr Lys Glu Asp Phe Trp Arg Thr Ile
1               5                   10                  15

Ile Leu Tyr Gly Leu Asn Gln Ala Thr Tyr Lys Ile Ala Leu Gly Gln
            20                  25                  30

Ser Leu Ile Arg Phe Ser Glu Gln Gln Arg Asn Val Val Ser Met Asn
        35                  40                  45

Glu Leu Ala Glu Asp Phe Phe Asp Met Tyr Leu Glu Arg Leu Lys Asn
    50                  55                  60

Gly Lys Pro Gln Leu Ala Thr Pro Asn Arg Gln Thr Ala Met Glu Arg
65                  70                  75                  80
```

```
Ile Ile Asn Ser Tyr Asn Ile Gly Arg Leu Thr Arg Ser Gln Ala Ile
                85                  90                  95

Glu Lys Val Glu Arg Glu Ala Phe Asn Asp Val Ile Asp Arg Phe His
            100                 105                 110

Thr Val Asp Ser Leu Gln Val Pro Met Lys Phe Tyr Glu Lys Thr Asp
        115                 120                 125

Lys Gly Ile Val Ile Phe Asp Asn Val Phe Glu Ile Phe Ser Asp Asn
    130                 135                 140

Asn Asn Phe Glu Leu Arg Asn Glu Leu Asp Ala Arg Trp Asp Leu Leu
145                 150                 155                 160

Glu Ser Ala Phe Glu Ile Lys Arg Thr Asp Ser Gln Leu Val Asn Asp
                165                 170                 175

Ile Arg Lys Leu Tyr Leu Ala Asn Gly Tyr Glu Arg Thr Asp Ile Thr
            180                 185                 190

Lys Asn Arg Ser Val Leu Asn Gly Tyr Gln Ser Asn Val Cys Phe Tyr
        195                 200                 205

Cys Gly Glu Leu Met Ser Asp Asp Asp Val His Val Asp His Val Ile
    210                 215                 220

Pro Arg Gln Leu Ile Asn His Asp Asp Ile Trp Asn Leu Val Leu Ser
225                 230                 235                 240

His Gly Phe Cys Asn Gln Gln Lys Ser Asp Asn Leu Pro Asp Val Asn
                245                 250                 255

Tyr Ile Glu Lys Leu Ile Glu Arg Asn Glu Tyr Phe Ile Lys Ser Asn
            260                 265                 270

His Pro Ile Ser Asn Lys Leu Lys Glu Arg Leu Gly Asn Thr Pro Arg
        275                 280                 285
```

```
Arg Arg Arg Thr Thr Ile Asp Arg Ile Tyr Glu His Ala Lys Leu Val
    290                 295                 300

Leu Ala Pro Trp Lys Gly Ile Tyr Gly Tyr Asn Pro Ala Thr Asp Pro
305                 310                 315                 320

Phe Tyr Lys Thr Phe Ile Arg Asn Ile Val Leu Ser Lys
                325                 330
```

<210> 284
<211> 1068
<212> PRT
<213> Bacillus cereus

<400> 284

```
Met Arg Tyr Val Leu Gly Leu Asp Ile Gly Ile Ala Ser Cys Gly Trp
1               5                   10                  15

Ala Val Ile Asn Gln Glu Lys Glu Arg Ile Glu Asp Leu Gly Val Arg
            20                  25                  30

Ile Phe Asp Lys Ala Glu Asn Pro Lys Asp Gly Lys Ser Leu Ala Ala
        35                  40                  45

Pro Arg Arg Asp Ala Arg Ser Thr Arg Arg Thr Leu Arg Arg Lys Lys
    50                  55                  60

His Arg Met Gln Arg Ile Lys Ile Leu Leu Val Lys Gln Gly Leu Leu
65                  70                  75                  80

Phe Lys Thr Glu Leu Asn His Leu Tyr Glu Ser Ala Thr Glu Phe Asp
                85                  90                  95

Val Trp Asn Leu Arg Leu Asp Ala Leu Glu Arg Lys Leu His Pro Lys
            100                 105                 110

Glu Phe Ala Arg Val Leu Ile His Leu Ala Lys Arg Arg Gly Phe Lys
```

```
        115                 120                 125

Ser Asn Arg Lys Glu Thr Thr Leu Ser Glu Asn Gly Gln Ile Leu Glu
    130                 135                 140

Ser Ile Ser Glu Asn Gln Gln Ile Met Glu Gln Gln Asn Tyr Arg Thr
145                 150                 155                 160

Val Gly Glu Met Ile Leu Lys Asp Lys Lys Phe Glu Asn His Lys Arg
                165                 170                 175

Asn Lys Asp Gly Thr Tyr Ile Gly Thr Val Thr Arg Gln Gln Leu Gln
            180                 185                 190

Asp Glu Ile Gln Met Ile Phe His Thr Gln Arg Leu Tyr Lys Asn Asp
        195                 200                 205

Tyr Ala Thr Glu Glu Phe Glu Ser Ser Tyr Leu Glu Ile Trp Ala Ser
    210                 215                 220

Gln Arg Pro Tyr Ala Ser Lys Asp Gln Ile Glu Lys Met Ile Gly Tyr
225                 230                 235                 240

Cys Thr Leu Glu Pro Lys Glu Lys Arg Thr Pro Lys Ala Ser Trp Ser
                245                 250                 255

Phe Gln Tyr Phe Val Ala Leu Gln Thr Ile Asn Asn Leu Arg Leu Ile
            260                 265                 270

Ser Lys Asp Lys Ile Glu Glu Leu Ser Phe Glu Glu Lys Lys Gln Ile
        275                 280                 285

Met Asn Leu Ala Leu Glu Lys Pro Ile Val Lys Tyr Ile Asp Ile Arg
    290                 295                 300

Lys Leu Leu Ser Ile Pro Asn Asp Phe Gln Phe Asn Ser Leu Ser Tyr
305                 310                 315                 320
```

```
Ser Ala Asp Thr Val Asp Thr Thr Leu Glu Asn Lys Arg Cys Ile Glu
                325                 330                 335

Leu Lys Glu Tyr His Ser Ile Asn Lys Val Tyr Lys Gln Val Tyr Gly
            340                 345                 350

Lys Asn Thr Pro Asn Leu Leu Pro Ile Asp Tyr Asp Thr Ile Ala Tyr
        355                 360                 365

Gly Leu Thr Ile Phe Lys Asp Asp Lys Asp Ile Leu Glu Tyr Leu Gln
    370                 375                 380

Asn Lys Tyr Val Asn Ala Lys Gly Lys Pro Ile Lys Asn Leu Ala Lys
385                 390                 395                 400

Lys Thr Tyr Asp Asp Thr Phe Ile Gln Ala Leu Leu Asn Leu Asn Phe
                405                 410                 415

Thr Lys Met Gly His Leu Ser Phe Lys Ala Leu Lys Asn Ile Ile Pro
            420                 425                 430

Phe Leu Glu Glu Gly Leu Ser Tyr Asp Lys Ala Cys Glu Lys Ala Gly
        435                 440                 445

Tyr Asn Phe Lys Gly Thr Ser Tyr Thr Glu Arg Thr Lys Tyr Leu Pro
    450                 455                 460

Val Ile Pro Gln Asn Thr Asn Pro Val Val His Arg Ala Leu Ser Gln
465                 470                 475                 480

Thr Arg Lys Val Ile Asn Ala Ile Ile Lys Lys Tyr Gly Ser Pro Asn
                485                 490                 495

Ala Ile His Ile Glu Thr Ala Arg Glu Leu Ser Lys Thr Phe Gln Glu
            500                 505                 510

Arg Lys Glu Ile Asp Ser Arg Tyr Gln Asp Asn Ser Lys Lys Asn Glu
```

```
        515                 520                 525

His Ala Ile His Lys Leu Lys Glu Leu Gly Asn Ile Asn Pro Ser Gly
    530                 535                 540

Ile Asn Ile Val Lys Phe Lys Leu Trp Ser Glu Gln Asp Gly Arg Cys
545                 550                 555                 560

Met Tyr Ser Gly Lys Tyr Ile Glu Pro His Arg Leu Phe Glu Glu Gly
                565                 570                 575

Tyr Thr Glu Val Asp His Ile Leu Pro Tyr Ser Arg Ser Leu Asp Asp
            580                 585                 590

Ser Tyr Asn Asn Lys Ile Leu Thr Leu Gly Thr Glu Asn Gln Arg Lys
        595                 600                 605

Gly Asn Lys Thr Pro Tyr Glu Tyr Met Gly Asn Thr Ser Ile Trp Asp
    610                 615                 620

Glu Phe Glu Thr Arg Val Gln Ser Asn Lys Lys Ile Asn Phe Lys Lys
625                 630                 635                 640

Gln Gln Lys Leu Leu Leu Gln Asn Phe Ser Tyr Ala Arg Glu Gln Glu
                645                 650                 655

Phe Ile Glu Arg Asn Leu Asn Asp Thr Arg Tyr Ala Thr Ile Tyr Leu
            660                 665                 670

Thr Ser Leu Ile Gln Gln His Leu Ile Phe Ser Glu Ser Ser Ser Lys
        675                 680                 685

Lys Lys Val Arg Thr Val Ser Gly Ile Ile Thr Ser His Leu Arg Ser
    690                 695                 700

Arg Trp Gly Phe Asn Lys Asp Arg Lys Glu Gly His Ile His His Ala
705                 710                 715                 720
```

```
Leu Asp Ala Val Ile Val Ala Val Thr Ser Asn His Met Ile Gln Arg
               725                 730                 735

Val Thr Lys Tyr Tyr Lys Leu Lys Glu Leu Asn Lys Asn Leu Gln Ala
            740                 745                 750

Lys Gln Leu Pro Phe Pro Glu Pro Trp Glu Gly Phe Arg Leu Glu Leu
        755                 760                 765

Glu Ala Arg Ile Ser Pro Asn Thr Gln Gln Tyr Leu Lys Gly Ile His
    770                 775                 780

Phe Lys Asn Tyr Ala Asp Val Asn Leu Ser Asp Ile Lys Pro Ile Phe
785                 790                 795                 800

Val Ser Arg Met Pro Lys Arg Ser Ile Thr Gly Glu Leu His Gln Glu
               805                 810                 815

Thr Ile Arg Lys Phe Leu Gly Tyr Asn Glu Lys Gly Lys Val Leu Thr
            820                 825                 830

Ala Ile Lys Thr Lys Leu Glu Asp Ile Pro Phe Asp Ala Asn Gly Asp
        835                 840                 845

Phe Pro Met Tyr Gly Lys Glu Thr Asp Leu Tyr Thr Tyr Asn Ala Ile
    850                 855                 860

Lys Glu Arg Tyr Leu Ser His Glu Lys Asp Lys Arg Lys Ser Phe Gln
865                 870                 875                 880

Glu Pro Leu Tyr Lys Pro Thr Lys Ser Gly Glu Ile Gly Pro Leu Ile
               885                 890                 895

Lys Ser Ile Lys Ile Met Asp Thr Arg Thr Ile Val Asn Pro Val Asn
            900                 905                 910

Gln Gly Lys Gly Val Val Tyr Asn Ser Lys Ile Ala Arg Thr Asp Val
```

```
        915                 920                 925

Phe Lys Lys Glu Asp Lys Tyr Tyr Leu Ile Pro Ile Tyr Thr Ile Asp
    930                 935                 940

Leu Leu Lys Asn Ile Leu Pro His Lys Ala Ile Thr Ala Gly Lys Gly
945                 950                 955                 960

Tyr Glu Asp Trp Thr Thr Ile Asp Ser Ser Phe Thr Phe Leu Phe Ser
                965                 970                 975

Leu Phe Pro Asn Asp Leu Ile Gln Ile Val Pro Ser Lys Asn Lys Thr
            980                 985                 990

Ile Lys Ala Arg Thr Thr Val Ser  Lys Lys Glu Ile Leu  Leu Pro Ser
        995                 1000                1005

Leu Thr  Gly Tyr Phe Lys Gly  Val His Ser Gly Thr  Ala Gly Ile
    1010                1015                1020

Thr Val  Glu Thr His Asp Gly  Ser Val Ile Ala Asn  Val Gly Ser
    1025                1030                1035

Lys Gln  Leu Leu Leu Phe Glu  Lys Tyr Gln Val Asp  Val Leu Gly
    1040                1045                1050

His Tyr  Thr Lys Ile Lys Glu  Glu Lys Arg Met Gly  Met Ala Ile
    1055                1060                1065
```

<210> 285
<211> 1078
<212> PRT
<213> Bacillus cereus

<400> 285

```
Met Arg Tyr Val Leu Gly Leu Asp Ile Gly Ile Ala Ser Cys Gly Trp
1               5                   10                  15
```

```
Ala Val Ile Asn Gln Glu Lys Glu Arg Ile Glu Asp Leu Gly Val Arg
            20                  25                  30

Ile Phe Asp Lys Ala Glu Asn Pro Lys Asp Gly Lys Ser Leu Ala Ala
        35                  40                  45

Pro Arg Arg Asp Ala Arg Ser Thr Arg Arg Thr Leu Arg Arg Lys Lys
    50                  55                  60

His Arg Met Gln Arg Ile Lys Val Leu Leu Val Lys His Gly Leu Leu
65                  70                  75                  80

Ser Lys Thr Glu Leu Asp His Leu Tyr Glu Ser Ala Thr Glu Val Asp
                85                  90                  95

Val Trp Asn Leu Arg Leu Asp Ala Leu Glu Arg Lys Leu Tyr Pro Lys
            100                 105                 110

Glu Phe Ala Arg Ile Leu Ile His Leu Ala Lys Arg Arg Gly Phe Lys
        115                 120                 125

Ser Asn Arg Lys Glu Thr Thr Leu Ser Glu Asn Gly Gln Ile Leu Glu
    130                 135                 140

Ser Ile Ser Glu Asn Gln Gln Ile Met Glu Lys Gln Asn Tyr Arg Thr
145                 150                 155                 160

Val Gly Glu Met Ile Leu Lys Asp Lys Lys Phe Glu Asn His Lys Arg
                165                 170                 175

Asn Lys Asn Gly Thr Tyr Val Gly Thr Val Thr Arg Gln Gln Leu Gln
            180                 185                 190

Asp Glu Ile Gln Met Ile Phe His Ala Gln Arg Leu Tyr Lys Asn Asp
        195                 200                 205

Tyr Ala Thr Glu Glu Phe Glu Ser Ser Tyr Leu Glu Ile Trp Ala Ser
    210                 215                 220
```

```
Gln Arg Pro Tyr Ala Ser Lys Asp Gln Ile Glu Lys Met Ile Gly Tyr
225                 230                 235                 240

Cys Thr Leu Glu Pro Lys Glu Lys Arg Ala Pro Lys Ala Ser Trp Ser
                245                 250                 255

Phe Gln Tyr Phe Val Ala Leu Gln Thr Ile Asn Asn Leu Arg Leu Ile
            260                 265                 270

Ser Lys Asp Arg Ile Glu Glu Leu Ser Phe Glu Glu Lys Lys Gln Ile
        275                 280                 285

Met Asn Leu Ala Leu Glu Lys Ser Ile Val Lys Tyr Ile Asp Ile Arg
    290                 295                 300

Lys Leu Leu Ser Val Pro Asn Glu Phe Gln Phe Asn Ser Leu Ser Tyr
305                 310                 315                 320

Ser Ala Asp Thr Val Asp Thr Ala Val Glu Ser Arg Lys Cys Ile Glu
                325                 330                 335

Leu Lys Glu Tyr His Ser Ile Asn Lys Val Tyr Lys Gln Ile Tyr Gly
            340                 345                 350

Glu Asn Ala Leu Asn Leu Leu Pro Lys Tyr Tyr Asp Thr Ile Ala Tyr
        355                 360                 365

Gly Leu Thr Ile Phe Lys Asp Asp Lys Asp Ile Leu Glu Tyr Leu Gln
    370                 375                 380

Asn Lys Tyr Val Asn Ala Lys Gly Lys Pro Ile Ser Asn Phe Ala Asn
385                 390                 395                 400

Lys Thr Tyr Asp Asp Thr Phe Ile Gln Ala Leu Leu Asn Leu Asn Phe
                405                 410                 415
```

```
Thr Lys Met Gly His Leu Ser Phe Lys Ala Leu Lys Asn Ile Ile Pro
            420                 425                 430

Phe Leu Glu Glu Gly Leu Ser Tyr Asp Lys Ala Cys Glu Lys Ala Gly
        435                 440                 445

Tyr Asn Phe Lys Gly Thr Ser Tyr Thr Glu Gln Thr Lys Tyr Leu Pro
    450                 455                 460

Val Ile Pro Gln Asn Thr Asn Pro Val Val His Arg Ala Leu Ser Gln
465                 470                 475                 480

Thr Arg Lys Val Ile Asn Ala Ile Ile Lys Lys Tyr Gly Ser Pro Asn
                485                 490                 495

Ala Ile His Ile Glu Thr Ala Arg Glu Leu Ser Lys Thr Phe Gln Glu
            500                 505                 510

Arg Lys Glu Ile Asp Ser Met Tyr Gln Asp Asn Ser Lys Lys Asn Glu
        515                 520                 525

His Ala Ile His Lys Leu Lys Glu Leu Gly Asn Ile Asn Pro Ser Gly
    530                 535                 540

Ile Asn Ile Val Lys Phe Lys Leu Trp Asn Glu Gln Asp Gly Arg Cys
545                 550                 555                 560

Met Tyr Ser Gly Lys Tyr Ile Glu Pro His Arg Leu Phe Glu Glu Gly
                565                 570                 575

Tyr Thr Glu Val Asp His Ile Leu Pro Tyr Ser Arg Ser Leu Asp Asp
            580                 585                 590

Ser Tyr Asn Asn Lys Thr Leu Thr Leu Gly Thr Glu Asn Gln Arg Lys
        595                 600                 605

Gly Asn Lys Ile Pro Tyr Glu Tyr Met Gly Asn Thr Ser Ile Trp Asn
    610                 615                 620
```

```
Asp Phe Glu Thr Arg Val Gln Ser Asn Lys Lys Ile Asn Lys Lys Lys
625                 630                 635                 640

Gln Gln Lys Leu Leu Leu Gln His Phe Ser Tyr Ala Arg Glu Gln Glu
                645                 650                 655

Phe Ile Glu Arg Asn Leu Asn Asp Thr Arg Tyr Ala Thr Ile Tyr Leu
            660                 665                 670

Ser Ser Leu Ile Gln Gln His Leu Ile Phe Ser Glu Ser Ser Arg Lys
        675                 680                 685

Lys Lys Val His Thr Val Ser Gly Ile Ile Thr Ser His Leu Arg Ser
    690                 695                 700

Arg Trp Gly Phe Asn Lys Asp Arg Lys Glu Gly His Ile His His Ala
705                 710                 715                 720

Leu Asp Ala Val Ile Val Ala Val Thr Ser Asp His Met Ile Gln Arg
                725                 730                 735

Val Thr Lys Tyr Tyr Lys Leu Lys Glu Leu Asn Arg Asn Leu Gln Ala
            740                 745                 750

Lys Arg Met Pro Phe Pro Glu Pro Trp Glu Gly Phe Arg Leu Glu Leu
        755                 760                 765

Glu Ala Arg Ile Ser Pro Asn Thr Gln Gln Tyr Leu Lys Gly Leu Arg
    770                 775                 780

Phe Lys Asn Tyr Ala Asp Val Asn Leu Ser Glu Ile Lys Ser Ile Phe
785                 790                 795                 800

Val Ser Arg Met Pro Lys His Ser Ile Thr Gly Glu Leu His Gln Glu
                805                 810                 815
```

```
Thr Ile Arg Lys Phe Ile Gly Tyr Asn Glu Lys Gly Lys Val Leu Thr
            820                 825                 830

Ala Ile Lys Thr Lys Leu Glu Asp Ile Pro Phe Asp Ala Asn Gly Asp
        835                 840                 845

Phe Pro Met Tyr Gly Lys Glu Ser Asp Leu Tyr Thr Tyr Asn Ala Ile
    850                 855                 860

Lys Glu Arg Tyr Leu Ser His Lys Lys Asp Lys Arg Lys Ser Phe Gln
865                 870                 875                 880

Glu Pro Leu Tyr Lys Pro Thr Lys Ser Gly Gly Ile Gly Pro Leu Ile
                885                 890                 895

Lys Ser Ile Lys Ile Met Asp Thr Arg Thr Ile Val Asn Pro Val Asn
            900                 905                 910

Gln Gly Lys Gly Val Val Tyr Asn Ser Lys Ile Ala Arg Thr Asp Val
        915                 920                 925

Phe Lys Lys Glu Glu Lys Tyr Tyr Leu Ile Pro Ile Tyr Thr Ile Asp
    930                 935                 940

Leu Met Lys Asn Ile Leu Pro Gln Lys Ala Ile Thr Ala Gly Lys Gly
945                 950                 955                 960

Tyr Glu Asp Trp Thr Thr Ile Asp Pro Ser Phe Thr Phe Leu Phe Ser
                965                 970                 975

Leu Phe Pro Asn Asp Leu Ile Gln Ile Val Pro Ser Lys Asn Lys Thr
            980                 985                 990

Ile Lys Ala Arg Thr Thr Val Ser  Lys Lys Glu Val Leu  Leu Pro Ser
        995                 1000                1005

Leu Thr  Gly Tyr Phe Lys Gly  Val His Ser Gly Thr  Ala Gly Ile
    1010                1015                1020
```

```
Thr Val  Glu Thr His Asp Gly  Ser Val Ile Ala Asn  Val Gly Ser
    1025                1030                1035


Lys Gln  Leu Leu Leu Ile Glu  Lys Tyr Gln Val Asp  Val Leu Gly
    1040                1045                1050


Asn Tyr  Thr Lys Ile Lys Glu  Glu Lys Arg Ile Gly  Leu Thr Thr
    1055                1060                1065


Tyr Asn  Asp Asn Lys Lys Ile  Ala Ala Cys
    1070                1075
```

<210> 286
<211> 1088
<212> PRT
<213> Bacillus smithii

<400> 286

```
Met Asn Tyr Lys Met Gly Leu Asp Ile Gly Ile Ala Ser Val Gly Trp
1               5                   10                  15


Ala Val Ile Asn Leu Asp Leu Lys Arg Ile Glu Asp Leu Gly Val Arg
            20                  25                  30


Ile Phe Asp Lys Ala Glu His Pro Gln Asn Gly Glu Ser Leu Ala Leu
        35                  40                  45


Pro Arg Arg Ile Ala Arg Ser Ala Arg Arg Arg Leu Arg Arg Arg Lys
    50                  55                  60


His Arg Leu Glu Arg Ile Arg Arg Leu Leu Val Ser Glu Asn Val Leu
65                  70                  75                  80


Thr Lys Glu Glu Met Asn Leu Leu Phe Lys Gln Lys Lys Gln Ile Asp
                85                  90                  95


Val Trp Gln Leu Arg Val Asp Ala Leu Glu Arg Lys Leu Asn Asn Asp
```

```
            100                 105                 110

Glu Leu Ala Arg Val Leu Leu His Leu Ala Lys Arg Arg Gly Phe Lys
        115                 120                 125

Ser Asn Arg Lys Ser Glu Arg Asn Ser Lys Glu Ser Ser Glu Phe Leu
    130                 135                 140

Lys Asn Ile Glu Glu Asn Gln Ser Ile Leu Ala Gln Tyr Arg Ser Val
145                 150                 155                 160

Gly Glu Met Ile Val Lys Asp Ser Lys Phe Ala Tyr His Lys Arg Asn
                165                 170                 175

Lys Leu Asp Ser Tyr Ser Asn Met Ile Ala Arg Asp Asp Leu Glu Arg
            180                 185                 190

Glu Ile Lys Leu Ile Phe Glu Lys Gln Arg Glu Phe Asn Asn Pro Val
        195                 200                 205

Cys Thr Glu Arg Leu Glu Glu Lys Tyr Leu Asn Ile Trp Ser Ser Gln
    210                 215                 220

Arg Pro Phe Ala Ser Lys Glu Asp Ile Glu Lys Lys Val Gly Phe Cys
225                 230                 235                 240

Thr Phe Glu Pro Lys Glu Lys Arg Ala Pro Lys Ala Thr Tyr Thr Phe
                245                 250                 255

Gln Ser Phe Ile Val Trp Glu His Ile Asn Lys Leu Arg Leu Val Ser
            260                 265                 270

Pro Asp Glu Thr Arg Ala Leu Thr Glu Ile Glu Arg Asn Leu Leu Tyr
        275                 280                 285

Lys Gln Ala Phe Ser Lys Asn Lys Met Thr Tyr Tyr Asp Ile Arg Lys
    290                 295                 300
```

```
Leu Leu Asn Leu Ser Asp Asp Ile His Phe Lys Gly Leu Leu Tyr Asp
305                 310                 315                 320

Pro Lys Ser Ser Leu Lys Gln Ile Glu Asn Ile Arg Phe Leu Glu Leu
                325                 330                 335

Asp Ser Tyr His Lys Ile Arg Lys Cys Ile Glu Asn Val Tyr Gly Lys
            340                 345                 350

Asp Gly Ile Arg Met Phe Asn Glu Thr Asp Ile Asp Thr Phe Gly Tyr
        355                 360                 365

Ala Leu Thr Ile Phe Lys Asp Asp Glu Asp Ile Val Ala Tyr Leu Gln
    370                 375                 380

Asn Glu Tyr Ile Thr Lys Asn Gly Lys Arg Val Ser Asn Leu Ala Asn
385                 390                 395                 400

Lys Val Tyr Asp Lys Ser Leu Ile Asp Glu Leu Leu Asn Leu Ser Phe
                405                 410                 415

Ser Lys Phe Ala His Leu Ser Met Lys Ala Ile Arg Asn Ile Leu Pro
            420                 425                 430

Tyr Met Glu Gln Gly Glu Ile Tyr Ser Lys Ala Cys Glu Leu Ala Gly
        435                 440                 445

Tyr Asn Phe Thr Gly Pro Lys Lys Lys Glu Lys Ala Leu Leu Leu Pro
    450                 455                 460

Val Ile Pro Asn Ile Ala Asn Pro Val Val Met Arg Ala Leu Thr Gln
465                 470                 475                 480

Ser Arg Lys Val Val Asn Ala Ile Ile Lys Lys Tyr Gly Ser Pro Val
                485                 490                 495

Ser Ile His Ile Glu Leu Ala Arg Asp Leu Ser His Ser Phe Asp Glu
```

```
            500                 505                 510

Arg Lys Lys Ile Gln Lys Asp Gln Thr Glu Asn Arg Lys Lys Asn Glu
        515                 520                 525

Thr Ala Ile Lys Gln Leu Ile Glu Tyr Glu Leu Thr Lys Asn Pro Thr
    530                 535                 540

Gly Leu Asp Ile Val Lys Phe Lys Leu Trp Ser Glu Gln Gln Gly Arg
545                 550                 555                 560

Cys Met Tyr Ser Leu Lys Pro Ile Glu Leu Glu Arg Leu Leu Glu Pro
                565                 570                 575

Gly Tyr Val Glu Val Asp His Ile Leu Pro Tyr Ser Arg Ser Leu Asp
            580                 585                 590

Asp Ser Tyr Ala Asn Lys Val Leu Val Leu Thr Lys Glu Asn Arg Glu
        595                 600                 605

Lys Gly Asn His Thr Pro Val Glu Tyr Leu Gly Leu Gly Ser Glu Arg
    610                 615                 620

Trp Lys Lys Phe Glu Lys Phe Val Leu Ala Asn Lys Gln Phe Ser Lys
625                 630                 635                 640

Lys Lys Lys Gln Asn Leu Leu Arg Leu Arg Tyr Glu Glu Thr Glu Glu
                645                 650                 655

Lys Glu Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr Ile Ser Lys
            660                 665                 670

Phe Phe Ala Asn Phe Ile Lys Glu His Leu Lys Phe Ala Asp Gly Asp
        675                 680                 685

Gly Gly Gln Lys Val Tyr Thr Ile Asn Gly Lys Ile Thr Ala His Leu
    690                 695                 700
```

```
Arg Ser Arg Trp Asp Phe Asn Lys Asn Arg Glu Glu Ser Asp Leu His
705                 710                 715                 720

His Ala Val Asp Ala Val Ile Val Ala Cys Ala Thr Gln Gly Met Ile
                725                 730                 735

Lys Lys Ile Thr Glu Phe Tyr Lys Ala Arg Glu Gln Asn Lys Glu Ser
            740                 745                 750

Ala Lys Lys Lys Glu Pro Ile Phe Pro Gln Pro Trp Pro His Phe Ala
        755                 760                 765

Asp Glu Leu Lys Ala Arg Leu Ser Lys Phe Pro Gln Glu Ser Ile Glu
    770                 775                 780

Ala Phe Ala Leu Gly Asn Tyr Asp Arg Lys Lys Leu Glu Ser Leu Arg
785                 790                 795                 800

Pro Val Phe Val Ser Arg Met Pro Lys Arg Ser Val Thr Gly Ala Ala
                805                 810                 815

His Gln Glu Thr Leu Arg Arg Cys Val Gly Ile Asp Glu Gln Ser Gly
            820                 825                 830

Lys Ile Gln Thr Ala Val Lys Thr Lys Leu Ser Asp Ile Lys Leu Asp
        835                 840                 845

Lys Asp Gly His Phe Pro Met Tyr Gln Lys Glu Ser Asp Pro Arg Thr
    850                 855                 860

Tyr Glu Ala Ile Arg Gln Arg Leu Leu Glu His Asn Asn Asp Pro Lys
865                 870                 875                 880

Lys Ala Phe Gln Glu Pro Leu Tyr Lys Pro Lys Lys Asn Gly Glu Pro
                885                 890                 895

Gly Pro Val Ile Arg Thr Val Lys Ile Ile Asp Thr Lys Asn Lys Val
```

```
            900                 905                 910

Val His Leu Asp Gly Ser Lys Thr Val Ala Tyr Asn Ser Asn Ile Val
        915                 920                 925

Arg Thr Asp Val Phe Glu Lys Asp Gly Lys Tyr Tyr Cys Val Pro Val
    930                 935                 940

Tyr Thr Met Asp Ile Met Lys Gly Thr Leu Pro Asn Lys Ala Ile Glu
945                 950                 955                 960

Ala Asn Lys Pro Tyr Ser Glu Trp Lys Glu Met Thr Glu Glu Tyr Thr
                965                 970                 975

Phe Gln Phe Ser Leu Phe Pro Asn Asp Leu Val Arg Ile Val Leu Pro
            980                 985                 990

Arg Glu Lys Thr Ile Lys Thr Ser  Thr Asn Glu Glu Ile  Ile Ile Lys
        995                 1000                1005

Asp Ile  Phe Ala Tyr Tyr Lys  Thr Ile Asp Ser Ala  Thr Gly Gly
    1010                1015                1020

Leu Glu  Leu Ile Ser His Asp  Arg Asn Phe Ser Leu  Arg Gly Val
    1025                1030                1035

Gly Ser  Lys Thr Leu Lys Arg  Phe Glu Lys Tyr Gln  Val Asp Val
    1040                1045                1050

Leu Gly  Asn Ile His Lys Val  Lys Gly Glu Lys Arg  Val Gly Leu
    1055                1060                1065

Ala Ala  Pro Thr Asn Gln Lys  Lys Gly Lys Thr Val  Asp Ser Leu
    1070                1075                1080

Gln Ser  Val Ser Asp
    1085
```

<210> 287
<211> 1069
<212> PRT
<213> Bacillus thuringiensis

<400> 287

```
Met Asn Tyr Asp Ile Gly Leu Arg Ile Gly Ile Thr Ser Cys Gly Trp
1               5                  10                  15


Ser Ile Ile Asn Lys Asp Leu Glu Arg Ile Glu Asp Leu Gly Val Arg
            20                  25                  30


Val Phe Glu Lys Ala Glu Asn Pro Asp Gly Thr Ala Ser Ala Ala Pro
        35                  40                  45


Arg Arg Glu Ala Arg Lys Ser Arg Arg Lys His Arg Arg Lys Lys His
    50                  55                  60


Arg Ile Glu Arg Ile Lys Arg Leu Ile Val Gln His Asp Leu Leu Ser
65                  70                  75                  80


Lys Lys Glu Leu Asp Ser Leu Tyr Leu Ser Pro Phe Asn Ile Asp Val
                85                  90                  95


Trp Asn Leu Arg Val Glu Ala Leu Glu Arg Lys Leu Asp Asn Arg Glu
            100                 105                 110


Phe Ala Arg Val Leu Ile His Leu Val Gln Arg Arg Gly Phe Gln Thr
        115                 120                 125


Ile Arg Lys Ser Val Glu Ile Gln Glu Glu Gly Lys Leu Leu Glu Asn
    130                 135                 140


Val Ser Glu Asn Glu Arg Ile Met Lys Val Asn Gly Tyr Lys Thr Val
145                 150                 155                 160


Gly Glu Met Phe Ser Lys His Glu Lys Phe Thr His His Lys Arg Asn
                165                 170                 175
```

```
Lys Asp Gly Ser Tyr Thr Ser Val Val Thr Arg Ser Leu Leu Leu Lys
            180                 185                 190

Glu Ile Lys Thr Ile Phe Asn Ser Gln Arg Ile Leu Gly Asn Val Phe
        195                 200                 205

Ser Thr Gln Lys Leu Glu Ser Asp Tyr Leu Tyr Ile Trp Gly Ser Gln
    210                 215                 220

Arg Pro Thr Leu Thr Tyr Glu Gln Leu Met Ser Met Val Gly Asn Cys
225                 230                 235                 240

Ile Tyr Glu Lys Lys Glu Lys Arg Ala Pro Lys Thr Ser Trp Ala Phe
                245                 250                 255

Gln Tyr Phe Ser Leu Leu Gln Lys Ile Asn Lys Leu Lys Val Ser Asp
            260                 265                 270

Asp Asn Thr Leu Arg Lys Leu Ser Lys Glu Glu Arg Asp Ile Val Ile
        275                 280                 285

Glu Leu Ala Phe Lys Lys Lys Asn Val Ser Phe Val Asp Ile Arg Lys
    290                 295                 300

Ala Leu Lys Leu Asn Asp Asn Thr Lys Phe Asn His Leu Thr Tyr Ser
305                 310                 315                 320

His Val Val Glu Thr Lys Lys Val Glu Lys Ala Thr Phe Ile Glu Leu
                325                 330                 335

Lys Gly Tyr His Leu Ile Lys Lys Gln Leu Lys Asp Arg Asn Val Glu
            340                 345                 350

Leu Thr Gln Glu Leu Gln Pro Lys Asp Tyr Asp Ala Ile Ala Ala Ala
        355                 360                 365
```

```
Ser Thr Phe Phe Lys Asn Asp Ile Glu Phe Arg Asp Tyr Leu Arg Asn
    370                 375                 380

Gln Tyr Leu Asp Ser Asn Gly Lys Arg Lys Ser Asn Ile Ala Asn Lys
385                 390                 395                 400

Val Phe Glu Asp Lys Val Ile Ala Ala Val Phe Glu Leu Asn Phe Ser
                405                 410                 415

Lys Val Cys His Leu Ser Phe Lys Ser Leu Tyr Lys Leu Ile Pro His
            420                 425                 430

Leu Glu Lys Gly Leu Asp Tyr Lys Glu Ala Ile Leu Cys Ala Gly Tyr
        435                 440                 445

Asn Phe Arg Asp Glu Asn Lys Arg Asp Lys Lys Leu Phe Leu Pro Val
    450                 455                 460

Ile Gln Gln Glu Thr Asn Pro Val Val His Arg Ala Leu Thr Gln Ala
465                 470                 475                 480

Arg Lys Val Ile Asn Ala Ile Ile Arg Glu Tyr Gly Ser Pro Asn Thr
                485                 490                 495

Ile Arg Phe Val Val Ala Asn Asp Leu Ala Lys Thr Tyr Lys Gln Arg
            500                 505                 510

Lys Glu Leu Glu Ser Thr Leu Lys Lys Asn Arg Ala Glu Asn Glu Lys
        515                 520                 525

Ile Lys Thr Lys Leu Leu Ser Met Gly Ile Ile Asn Pro Thr Gly Met
    530                 535                 540

Asp Ile Val Lys Tyr Lys Leu Trp Tyr Glu Gln Ser Gly Ile Cys Leu
545                 550                 555                 560

Tyr Thr Gly Arg Gln Met Glu Leu Ser Ser Leu Phe Lys Pro Gly Tyr
                565                 570                 575
```

```
Ser Ile Val Asn His Ile Ile Pro Tyr Asn Arg Ser Phe Asp Asp Thr
            580                 585                 590

Tyr His Asn Arg Val Leu Thr Leu Thr Glu Thr Lys Tyr Glu Lys Gly
        595                 600                 605

Asn Lys Ile Pro Phe Glu Tyr Phe Gly Ala Glu Glu Thr Cys Trp Asn
    610                 615                 620

Glu Tyr Glu Lys Arg Val Ser Thr Ser Lys Lys Ile His Asp Lys Lys
625                 630                 635                 640

Arg Glu Lys Leu Leu Ile Arg Asn Phe Asp Ile Glu Tyr Glu Asn Glu
                645                 650                 655

Met Ile Ser Asn Asn Val Phe Asp Thr His Tyr Ile Gly Ser Tyr Phe
            660                 665                 670

Glu Lys Tyr Ile Asp Glu His Leu Gln Phe Lys Lys Ser Thr Lys Lys
        675                 680                 685

Gln Lys Val Phe Ser Ile His Gly Asn Met Val Ala His Leu His Ser
    690                 695                 700

Arg Trp Gly Phe Asn Lys Asn Ser Arg Glu Ile Tyr Leu Asn His Ala
705                 710                 715                 720

Val Asp Ala Ala Ile Val Ala Val Leu Thr Asp Gln Leu Ile Arg Asn
                725                 730                 735

Ile Ala Asp Tyr Tyr Arg Arg Asp Asn Ile Leu Glu Gln Lys Gly Ser
            740                 745                 750

Leu Lys Phe Pro Glu Pro Trp Lys Ser Phe Ser Ile Glu Leu Glu Ala
        755                 760                 765
```

```
Arg Ile Ser Pro Gln Val Arg Asp Leu Ile Lys Lys Leu Asn Leu Asp
    770                 775                 780

Ser Tyr Leu Asp Val Asp Ile Leu His Ile Lys Pro Val Phe Ile Ser
785                 790                 795                 800

Lys Lys Pro Arg Arg Lys Val Asn Gly Glu Ala His Lys Ser Thr Ile
                805                 810                 815

Arg Ser Leu Ile Gly Ile Asn Glu Ile Gly Lys Thr Val Thr Cys Ile
            820                 825                 830

Lys Thr Arg Leu Glu Asp Ile Pro Phe Asp Glu Asn Gly Asp Phe Pro
        835                 840                 845

Met Tyr Gly Lys Asp Thr Asp Lys Tyr Thr Tyr Thr Ala Ile Lys Glu
    850                 855                 860

Arg Tyr Leu Glu Phe Asn Lys Asp Lys Glu Lys Ala Phe Ser Thr Pro
865                 870                 875                 880

Leu Tyr Lys Leu Lys Arg Asn Gly Glu Pro Gly Asn Gln Ile Lys Ser
                885                 890                 895

Val Lys Ile Ile Asp Thr Arg Asn Ile Val Asn Lys Val Asn Gln Gly
            900                 905                 910

Lys Gly Ile Ala Tyr Asn Ser Asn Ile Ile Arg Val Asp Val Phe Ser
        915                 920                 925

Arg Asp Gln Lys Tyr Tyr Val Val Pro Ile Tyr Leu Arg Asp Phe Ile
    930                 935                 940

Lys Gly Ser Leu Pro Asn Lys Ile Ile Thr Ala Ala Lys Gly Phe Met
945                 950                 955                 960

Gln Trp Pro Glu Thr Asp Asn Ser Tyr Thr Phe Leu Phe Ser Ile Phe
                965                 970                 975
```

```
Pro Asn Asp Leu Ile Lys Val Val Pro Lys Glu Gly Lys Phe Ile Lys
            980                 985                 990


Ala Lys Asn Glu Asn Lys Glu Asn  Ile Asn Leu Thr Glu  Ile Leu Gly
        995                 1000                1005


Tyr Phe  Lys Gly Leu Asp Ser  Ser Thr Gly Ala Phe  Thr Leu Glu
    1010                1015                1020


Ser His  Asp Gly Ser Leu Leu  Ala Arg Gly Ile Gly  Thr Lys Asn
    1025                1030                1035


Leu Leu  Leu Ile Glu Lys Tyr  Gln Val Asp Val Leu  Gly Arg Tyr
    1040                1045                1050


Asn Lys  Val Gly Asn Glu Glu  Arg Gln Asp Ile Lys  Ile Gln Gln
    1055                1060                1065


Asn
```

<210> 288
<211> 206
<212> PRT
<213> Bacteroides cellulosilyticus

<400> 288

```
Met Lys Lys Ile Leu Gly Leu Asp Leu Gly Cys Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Leu Val Asn Glu Ala Glu Asn Thr Glu Glu Ile Ser Ser Ile Ile
            20                  25                  30


Lys Leu Gly Val Arg Val Asn Pro Leu Thr Val Asp Glu Met Gln Asn
        35                  40                  45


Phe Glu Lys Gly Lys Ser Ile Thr Thr Asn Ala Asp Arg Thr Leu Lys
```

```
    50                  55                  60

Arg Ser Met Arg Arg Asn Leu Gln Arg Tyr Lys Leu Arg Arg Asp Thr
65                  70                  75                  80

Leu Ile Glu Val Leu Lys Glu His Gly Phe Ile Thr Asp Ser Thr Leu
                85                  90                  95

Leu Ser Glu His Gly Asn Lys Thr Thr Phe Glu Thr Tyr Arg Leu Arg
            100                 105                 110

Ala Lys Ala Ala Val Glu Glu Ile Ser Leu Glu Lys Phe Ala Arg Val
        115                 120                 125

Leu Leu Met Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Ala
    130                 135                 140

Lys Gly Ser Glu Asp Gly Val Leu Ile Asp Gly Met Asp Val Ala Arg
145                 150                 155                 160

Lys Leu Tyr Glu Glu Gly Leu Thr Pro Gly Glu Leu Cys Leu Gln Ile
                165                 170                 175

Leu Glu Ala Gly Lys Lys Asn Leu Pro Asp Phe Tyr Arg Ser Asp Leu
            180                 185                 190

Gln Asn Glu Phe Asp Arg Ile Trp Asn Phe Gln Lys Leu Val
        195                 200                 205


<210>  289
<211>  349
<212>  PRT
<213>  Bacteroides coprosuis

<400>  289

Met Lys Lys Ile Leu Gly Leu Asp Ile Gly Thr Asn Ser Val Gly Trp
1               5                   10                  15
```

```
Ala Val Val Asn Thr Asn Gln Glu Gly Glu Pro Ser Gln Ile Glu Lys
            20                  25                  30

Leu Gly Ser Arg Ile Ile Pro Met Ser Gln Asp Ile Leu Asp Lys Phe
        35                  40                  45

Gly Gln Gly Gln Thr Val Ser Ser Thr Ala Ser Arg Thr Asp Tyr Arg
    50                  55                  60

Gly Ile Arg Arg Leu Arg Glu Arg Ser Leu Leu Arg Arg Glu Arg Leu
65                  70                  75                  80

His Arg Val Leu His Ile Leu Asp Phe Leu Pro Lys His Tyr Ala Asp
                85                  90                  95

Ser Ile Gly Trp Asp Pro Arg Asn Ser Lys Thr Tyr Gly Lys Phe Leu
            100                 105                 110

Pro Gly Thr Glu Val Lys Leu Ala Trp Val Pro Thr Ala Asp Gly His
        115                 120                 125

Gln Phe Leu Phe Tyr Ser Thr Tyr Leu Glu Met Leu Glu Asp Leu Lys
    130                 135                 140

Gln Thr Gln Ala Gln Leu Phe Glu Thr Ser Gln Thr Pro Val Pro Leu
145                 150                 155                 160

Asp Trp Thr Ile Tyr Tyr Leu Arg Lys Lys Ala Leu Thr Gln Pro Ile
                165                 170                 175

Thr Lys His Glu Leu Ala Trp Leu Leu Leu His Phe Asn Thr Lys Arg
            180                 185                 190

Gly Tyr Tyr Gln Arg Arg Gly Glu Leu Glu Asp Thr Pro Thr Asp Lys
        195                 200                 205

Leu Val Glu Tyr His Ala Leu Lys Val Val Asp Val Glu Val Asp Pro
    210                 215                 220
```

```
Glu Asp Gln Ser Lys Lys Pro Trp Tyr Phe Val His Leu Glu Asn Gly
225                 230                 235                 240


Trp Ile Tyr Lys Arg Gln Ser Ser Glu Pro Leu Asp Asn Trp Lys Gly
                245                 250                 255


Leu Val Lys Glu Phe Ile Val Thr Thr His Leu Asp Lys Glu Gly Lys
            260                 265                 270


Pro Lys Leu Asp Lys Glu Gly Glu Val Arg Arg Ser Phe Ser Ser Pro
        275                 280                 285


Lys Glu Asp Asp Trp Thr Leu Val Lys Lys Lys Thr Glu Asn Asp Leu
    290                 295                 300


Glu Lys Ser Gly Leu Thr Val Gly Ala Tyr Ile Tyr Gln Thr Leu Leu
305                 310                 315                 320


Asn Lys Pro Asn Gln Lys Ile Arg Gly Gly Leu Ile Lys His Ile Glu
                325                 330                 335


Arg Asn Tyr Tyr Val Glu Glu Leu Glu Gln Ile Leu Arg
            340                 345


<210>  290
<211>  1504
<212>  PRT
<213>  Bacteroides coprosuis

<400>  290

Met Lys Lys Val Leu Gly Leu Asp Ile Gly Thr Asn Ser Val Gly Trp
1               5                   10                  15


Ala Val Val Asn Gln Asn Asp Lys Gly Glu Phe Leu Ser Ile Glu Lys
            20                  25                  30


Ile Gly Ser Arg Ile Ile Pro Met Ser Gln Asp Val Met Asp Lys Phe
```

```
        35                  40                  45

Gly Ala Gly Gln Thr Glu Ser Ser Thr Ala Gln Arg Thr Gln Tyr Arg
    50                  55                  60

Gly Val Arg Arg Leu Arg Glu Arg Ser Leu Leu Arg Arg Glu Arg Leu
65                  70                  75                  80

His Arg Val Leu His Ile Leu His Phe Leu Pro Gln His Tyr Asp Ala
                85                  90                  95

Ala Ile Gly Trp Asn Lys Lys Glu Asn Lys Thr Tyr Gly Lys Phe Leu
            100                 105                 110

Pro Gly Val Glu Val Asn Ile Pro Trp Val Ala Thr Asp Gln Gly His
        115                 120                 125

Gln Phe Ile Phe Met Asp Ser Tyr Ala Glu Met Leu Lys Asp Leu Lys
    130                 135                 140

Gln His Gln Pro His Leu Phe Glu Lys Ser Ser Thr Pro Val Pro Leu
145                 150                 155                 160

Asp Trp Thr Ile Tyr Tyr Leu Arg Lys Lys Ala Leu Thr Gln Ala Ile
                165                 170                 175

Ser Lys Glu Glu Leu Ala Trp Ile Leu Leu Asn Phe Asn Gln Lys Arg
            180                 185                 190

Gly Tyr Tyr Gln Leu Arg Gly Glu Glu Val Glu Asp Asn Thr Lys Arg
        195                 200                 205

Glu Glu Phe Tyr Ala Leu Lys Val Val Lys Val Glu Leu Asp Lys Asp
    210                 215                 220

Asn Thr Ser Ala Lys Thr Trp Tyr Lys Val His Leu Glu Asn Gly Phe
225                 230                 235                 240
```

```
Ile Tyr Pro Cys Pro Ser Asp Thr Pro Ile Asp Ser Trp Val Gly Met
                245                 250                 255

Val Lys Asp Phe Ile Val Thr Thr Thr Leu Glu Lys Asp Gly Ser Glu
            260                 265                 270

Lys Arg Thr Ala Asp Gly Glu Ile Lys Arg Ser Phe Arg Ala Pro Lys
        275                 280                 285

Glu Asp Asp Trp Thr Leu Leu Lys Lys Lys Thr Glu Ser Glu Leu Glu
    290                 295                 300

Lys Ser Gly Lys Gln Val Gly Ala Phe Ile Tyr Asp Thr Leu Leu Ser
305                 310                 315                 320

Asn Pro Asp Gln Lys Ile Ile Gly Gly Leu Ile Lys Thr Ile Glu Arg
                325                 330                 335

Lys Tyr Tyr Lys Lys Glu Leu Glu Gln Ile Leu Glu Thr Gln Gln Lys
            340                 345                 350

Phe Ile Ala Glu Leu Ser Asp Lys Lys Leu Phe Gln Ala Cys Ala Glu
        355                 360                 365

Glu Leu Tyr Pro Leu Asn Asp Ser His Arg Glu Asn Leu Leu Glu Arg
    370                 375                 380

Asp Phe Lys His Leu Phe Val Gln Asp Ile Ile Phe Tyr His Arg Pro
385                 390                 395                 400

Leu Lys Thr Lys Lys Ser Leu Ile Ser Asn Cys Thr Tyr Glu Tyr Arg
                405                 410                 415

Thr Phe Tyr Lys Asn Gly Glu Lys Gln Ile Ser Pro Ile Lys Cys Ile
            420                 425                 430

Ala Lys Ser Asn Pro Leu Phe Gln Glu Phe Arg Val Trp Gln Phe Val
```

```
        435                 440                 445

Gln Asn Leu Arg Ile Leu Gln Arg Gln Arg Ser Glu Gly Asp Ser Ile
    450                 455                 460

Lys Tyr Asn Val Asp Val Thr Ala Glu Phe Leu Lys Asp Glu Asn Asp
465                 470                 475                 480

Ile Ala Asn Leu Phe Thr Trp Leu Asn Glu Arg Lys Val Ile Lys Gln
                485                 490                 495

Asp Gln Leu Leu Lys Ser Tyr Phe Lys Leu Lys Val Asn Lys Glu Thr
            500                 505                 510

Lys Glu Leu Asp Tyr Arg Trp Asn Tyr Val Asp Asp Lys Asn Lys Glu
        515                 520                 525

Tyr Pro Cys Asn Ala Thr Arg Thr His Ile Leu Ser Phe Leu Glu Lys
    530                 535                 540

Cys Lys Glu Glu Lys Arg Ile Glu Asp Asp Arg Phe Val Tyr Ser Leu
545                 550                 555                 560

Trp His Leu Leu Tyr Ser Val Val Glu Pro Ile Glu Leu Arg Gly Ala
                565                 570                 575

Leu Ala Lys Phe Ala Glu Arg Glu His Leu His Pro Ser Phe Val Asp
            580                 585                 590

Val Phe Ala Gln Phe Pro Pro Leu Glu Lys Glu Tyr Gly Ser Tyr Ser
        595                 600                 605

Glu Lys Ala Ile Lys Arg Leu Leu Pro Leu Met Arg Met Gly Asp Tyr
    610                 615                 620

Trp His Glu Asp Lys Ile Asp Val Lys Thr Lys Gln Arg Ile Gln Arg
625                 630                 635                 640
```

```
Ile Ile Asp Gly Glu Ala Asp Asp Asp Ile Thr His Arg Ser Arg Glu
               645                 650                 655

Lys Val Glu Asn Leu Arg Ser Ile Thr Asp Phe Lys Gly Leu Pro Leu
            660                 665                 670

Trp Lys Ala Gly Tyr Val Val Tyr Asn Arg His Ser Glu Ser Gly Glu
        675                 680                 685

Leu Thr Lys Trp Lys Thr Pro His Glu Leu Ser Asn Tyr Ile Gln Asn
    690                 695                 700

Glu Phe Lys Gln Tyr Ser Leu Arg Asn Pro Ile Val Glu Gln Ile Val
705                 710                 715                 720

Leu Glu Thr Leu Arg Val Val His Asp Leu Trp Val Lys His Gly Asp
               725                 730                 735

Phe Ser Glu Ile His Leu Glu Leu Gly Arg Asp Ile Lys Asn Ser Ser
            740                 745                 750

Asp Lys Arg Lys Arg Met Ala Glu Arg Gln Gln Glu Asn Glu Asn Ser
        755                 760                 765

Arg Gln Arg Val Leu Glu Met Leu Ile Asp Leu Lys Lys Glu Ala Ala
    770                 775                 780

Phe Ala Asp Leu Asn Pro Tyr Ser Pro Ser Gln Gln Glu Lys Leu Arg
785                 790                 795                 800

Ile Val Glu Asp Gly Val Leu Arg Ser Asn Ile Glu Ile Pro Lys Asp
               805                 810                 815

Ile Glu Lys Ile Thr Lys Ser Ala Lys Pro Thr Ser Arg Glu Leu Thr
            820                 825                 830

Lys Tyr Arg Leu Trp Leu Asp Gln Lys Tyr Arg Ser Pro Tyr Thr Gly
```

```
        835                 840                 845

Gln Pro Ile Ser Leu Ala Gln Leu Phe Thr Ser Lys Tyr Glu Ile Glu
    850                 855                 860

His Val Ile Pro Gln Ala Lys Tyr Phe Asp Asp Ser Phe Thr Asn Lys
865                 870                 875                 880

Val Ile Cys Glu Ser Glu Val Asn Lys Glu Lys Gly Ser Met Leu Ala
                885                 890                 895

His Glu Phe Ile Leu Lys Asn Gly Gly Ser Thr Val Asn Val Gly Gly
            900                 905                 910

Arg Gln Val Gln Val Leu Lys Asn Asp Ala Tyr Val Glu Leu Ile Asn
        915                 920                 925

Arg Leu Tyr Gly Lys Asn Asn Pro Val Lys Ala Lys Lys Leu Leu Ala
    930                 935                 940

Glu Asp Ile Asp Glu Val Val Gly Asp Phe Ser Glu Arg Gln Leu Asn
945                 950                 955                 960

Asp Thr Arg Tyr Ile Ser Arg Val Val Gln Lys Leu Leu Ser Asn Ile
                965                 970                 975

Val Arg Glu Glu Asp Glu Gln Glu Ser Thr Ser Lys His Val Ile Gly
            980                 985                 990

Cys Ser Gly Gln Val Thr Thr Ala  Leu Lys Lys Asp Trp  Gly Leu Asn
        995                 1000                1005

Asp Ile  Trp Asn Lys Ile Ile  Gln Pro Arg Phe Glu  Arg Leu Asn
    1010                1015                1020

Glu Met  Thr Ala Thr Glu Asp  Tyr Gly Val Trp Gln  Ser Pro Asn
    1025                1030                1035
```

```
His Phe  Gln Ile Arg Val Pro  Glu Glu Ile Gln Lys  Gly Phe Thr
    1040                1045                1050

Lys Lys  Arg Ile Asp His Arg  His His Ala Met Asp  Ala Leu Val
    1055                1060                1065

Ile Ala  Cys Ala Thr Arg Ser  His Ile Asn Tyr Ile  Ser Asn Arg
    1070                1075                1080

Ser Gly  Gln Asp Arg Asn Ala  Lys Phe Glu Thr Thr  Arg Thr Asp
    1085                1090                1095

Leu Arg  Ser Lys Leu Cys Tyr  Lys Glu Asn Ser Ser  Gly Asn Asn
    1100                1105                1110

Tyr Asn  Tyr Ile Phe Asn Lys  Pro Trp Asp Thr Phe  Thr Gln Asp
    1115                1120                1125

Ala His  Arg Ala Leu Glu Asn  Ile Val Val Ser His  Lys Gln Asn
    1130                1135                1140

Leu Arg  Val Leu Thr Lys Thr  Asn Asn Tyr Thr Gln  Phe Ile Asn
    1145                1150                1155

Lys Asp  Gly Lys Lys Asp Leu  Gln Lys Gln Val Lys  Gly Asp His
    1160                1165                1170

Phe Ala  Val Arg Lys Pro Met  His Gln Glu Thr Ile  Tyr Gly Arg
    1175                1180                1185

Val Ser  Ile Arg Ser Ile Lys  Glu Val Ala Leu Lys  Lys Ala Leu
    1190                1195                1200

Glu Asn  Trp Lys Gln Ile Val  Asp Arg Thr Leu Lys  Asp Lys Ile
    1205                1210                1215

Arg Glu  Leu Ile Gly Ala Tyr  Gly Lys Tyr Asp Ala  Gln Thr Ile
```

```
    1220                1225                1230

Leu Lys  Tyr Phe Lys Asp Arg  Asp Tyr Lys Phe Asn  Asn Leu Lys
    1235                1240                1245

Ile Asn  Arg Val Glu Val Tyr  Glu Tyr Asp His Asn  Cys Ala Ala
    1250                1255                1260

Val Arg  Lys Ser Ile Gly Asp  Asp Leu Thr Ile Lys  Gln Ile Glu
    1265                1270                1275

Arg Ile  Thr Asp Glu Ser Ile  Arg Lys Ile Leu Met  Asn His Leu
    1280                1285                1290

Ser Asn  Tyr Asp Asp Asn Leu  Lys Glu Ala Phe Ser  Pro Glu Gly
    1295                1300                1305

Leu Met  Glu Met Asn Lys Asn  Ile Lys Glu Leu Asn  Gly Gly Lys
    1310                1315                1320

Asn His  Gln Pro Ile Tyr Lys  Val Arg Leu Phe Glu  Asp Leu Gly
    1325                1330                1335

Ser Lys  Phe Pro Leu Gly Val  Ser His Asn Asn Pro  Asp Lys Tyr
    1340                1345                1350

Ala Ile  Ala Ala Lys Gly Thr  Asn Leu Phe Phe Gly  Ile Tyr Glu
    1355                1360                1365

Asp Gln  Glu Gly Lys Arg Met  Phe Asp Ser Ile Pro  Leu Asn Ile
    1370                1375                1380

Val Ile  Asp Arg Leu Lys Glu  Lys Lys Ser Pro Val  Pro Glu Thr
    1385                1390                1395

Tyr Asn  Glu Ser Lys Leu Lys  Phe His Leu Ser Pro  Asn Asp Leu
    1400                1405                1410
```

```
Val Tyr  Val Pro Thr Asp Glu  Glu Gln Lys Gln Pro  Glu Leu Val
    1415                1420                1425


Asp Val  Asp His Leu Ser Asp  Glu Gln Lys Gly Arg  Val Tyr Lys
    1430                1435                1440


Ala Val  Ser Phe Thr Gly Asn  Arg Ala Phe Phe Val  Asn His Arg
    1445                1450                1455


Val Ser  Lys Val Ile His Asp  Tyr Val Glu Phe Gly  Thr Lys Asn
    1460                1465                1470


Lys Ile  Glu Asn Asp Asp Asp  Lys Arg Ser Leu Lys  His Ile Cys
    1475                1480                1485


Trp Lys  Leu Lys Val Asn Arg  Leu Gly Glu Ile Thr  Asp Val Lys
    1490                1495                1500


Arg
```

<210> 291
<211> 1509
<212> PRT
<213> Bacteroides eggerthii

<400> 291

```
Met Lys Thr Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Val Gly Trp
1               5                   10                  15


Ala Val Ile Asn Ser Val Ile Lys Glu Gln Ala Glu Arg Ile Trp Ile
            20                  25                  30


Glu Met Ala Gly Ser Arg Ile Ile Pro Met Asp Ala Ala Val Leu Gly
        35                  40                  45


Asp Phe Asp Lys Gly Asn Ser Ile Ser Gln Thr Ser Glu Arg Thr Arg
    50                  55                  60
```

```
Leu Arg Gly Ala Arg Arg Leu Arg Glu Arg Gln Leu Leu Arg Arg Glu
65                  70                  75                  80

Arg Leu His Lys Val Leu Asn Ile Leu Gly Phe Leu Pro Asn His Tyr
                85                  90                  95

Leu Glu Tyr Ile Asp Phe Glu Lys His Pro Gly Lys Phe Leu Ala Asp
            100                 105                 110

Ala Glu Pro Lys Leu Ala Trp Val Lys Asp Glu Gln Gly Lys Tyr Thr
        115                 120                 125

Phe Leu Phe Gln Ala Ala Phe Asp Glu Met Leu Ala Asp Phe Ala Ile
    130                 135                 140

His Gln Pro Ser Leu Val Ser Gly Asp Lys Lys Ile Pro Tyr Asp Trp
145                 150                 155                 160

Thr Ile Tyr Tyr Leu Arg Lys Lys Ala Leu Thr Glu Met Ile Ser Lys
                165                 170                 175

Glu Glu Leu Ala Trp Ile Leu Leu Asn Phe Asn Gln Lys Arg Gly Tyr
            180                 185                 190

Tyr Gln Leu Arg Gly Glu Glu Glu Glu Asp Asn Ala Gly Lys Ser Val
        195                 200                 205

Glu Phe Tyr Ala Leu Lys Val Leu Thr Val Glu Ala Thr Asp Glu Lys
    210                 215                 220

Lys Gly Arg Asp Val Trp Tyr Asn Val His Leu Glu Asn Gly Trp Ile
225                 230                 235                 240

Tyr Arg Arg Ser Ser Ser Val Pro Leu Asp Trp Glu Gly Gln Val Lys
                245                 250                 255
```

```
Glu Phe Ile Val Thr Thr Asp Leu Asn Pro Asp Gly Thr Pro Lys Leu
            260                 265                 270

Asp Lys Tyr Gly Glu Val Lys Arg Ser Phe Arg Ala Pro Lys Glu Asp
        275                 280                 285

Asp Trp Met Leu Ile Lys Lys Arg Thr Glu Ala Asp Ile Ala Asn Thr
    290                 295                 300

His Lys Thr Val Gly Ala Tyr Ile Tyr Asp Thr Leu Leu Gln Lys Pro
305                 310                 315                 320

Gln Gln Lys Ile Ile Gly Lys Leu Val Lys Thr Val Glu Arg Lys Leu
                325                 330                 335

Tyr Arg Asp Glu Leu Ser Leu Ile Leu Gln Lys Gln Cys Ala Phe His
            340                 345                 350

Ala Glu Leu Gln Asp Arg Ala Leu Tyr Ala Arg Cys Val Glu Ala Leu
        355                 360                 365

Tyr Pro Ser Asn Glu Val Arg Arg Lys Asn Ile Ala Asn Arg Asp Phe
    370                 375                 380

Val Tyr Leu Leu Met Asp Asp Ile Leu Phe Tyr Gln Arg Pro Leu Lys
385                 390                 395                 400

Thr Lys Lys Ser Leu Ile Ala Asn Cys Pro Tyr Glu Glu Asn Glu Tyr
                405                 410                 415

Val Asp Arg Glu Thr Gly Glu Ile Lys Lys Thr Pro Leu Lys Cys Ile
            420                 425                 430

Ala Lys Ser His Pro Leu Phe Gln Glu Phe Arg Leu Trp Asn Phe Leu
        435                 440                 445

Ser Asn Ile Arg Ile Tyr Gln Lys Glu Lys Glu Ile Asn Gly Thr Leu
    450                 455                 460
```

```
His Leu Asp Val Asp Val Thr Ala Glu Phe Leu Lys Thr Glu Asp Asp
465                 470                 475                 480

Tyr Val Ala Leu Phe Asp Trp Leu Asn Ser Arg Lys Glu Ile Glu Gln
                485                 490                 495

Lys Thr Phe Leu Lys Tyr Pro Lys Phe Gly Leu Lys Lys Glu Ile Ser
            500                 505                 510

Asn Tyr Arg Trp Asn Tyr Val Glu Asp Lys Gln Tyr Pro Cys Asn Glu
        515                 520                 525

Thr Arg His Ala Ile Leu Ser Ser Leu Glu Lys Ala Asn Val Cys Ile
    530                 535                 540

Asp Phe Leu Ser Asn Glu Lys Glu Val Ala Leu Trp His Ile Leu Tyr
545                 550                 555                 560

Ser Val Ser Asp Lys Gln Glu Ile Glu Lys Ala Leu Arg Thr Phe Ala
                565                 570                 575

Ala Lys Asn Gly Leu Asp Glu Ser Phe Val Glu Ala Phe Lys Lys Phe
            580                 585                 590

Pro Pro Phe Lys Ser Glu Tyr Gly Ala Tyr Ser Ala Lys Ala Ile Lys
        595                 600                 605

Lys Met Leu Pro Leu Met Arg Cys Gly Lys Tyr Trp Asp Val Ser Ser
    610                 615                 620

Ile Asp Asp Thr Thr Lys Glu Arg Ile Lys Lys Ile Val Thr Gly Glu
625                 630                 635                 640

Tyr Asp Glu Arg Ile Ser Val Lys Val Arg Asp Lys Val Met Asn Leu
                645                 650                 655
```

```
Ser Asp Ile Ser Cys Phe Arg Arg Leu Pro Leu Trp Leu Ala Cys Tyr
            660                 665                 670

Ile Val Tyr Asn Arg His Ser Glu Asp Lys Glu Ala Val Lys Trp Glu
        675                 680                 685

Ser Pro Ala Asp Ile Asp Ala Tyr Leu Ala Ser Phe Lys Gln His Ser
    690                 695                 700

Leu Arg Asn Pro Ile Val Glu Gln Val Ile Thr Glu Thr Leu Arg Val
705                 710                 715                 720

Val Arg Asp Ile Trp Lys Gln Val Gly Arg Ile Asp Glu Ile His Ile
                725                 730                 735

Glu Leu Gly Arg Glu Met Lys Asn Pro Ala Asp Lys Arg Lys Arg Met
            740                 745                 750

Thr Ala Gln Ile Leu Glu Asn Glu Asn Ala Asn Leu Arg Ile Lys Ala
        755                 760                 765

Leu Leu Ala Glu Phe Met Asn Pro Glu Tyr Glu Ile Glu Asn Val Arg
    770                 775                 780

Pro Tyr Ser Pro Ser Gln Gln Glu Ile Leu Arg Ile Tyr Glu Asp Thr
785                 790                 795                 800

Val Leu His Ala Glu Asp Gln Leu Pro Glu Glu Ile Asp Ala Ile Leu
                805                 810                 815

Lys Lys Phe Asn Ser Ser Lys Val Pro Thr Lys Ser Glu Phe Leu Arg
            820                 825                 830

Tyr Lys Leu Trp Leu Glu Gln Lys Tyr Arg Ser Pro Tyr Thr Gly Glu
        835                 840                 845

Leu Ile Pro Leu Gly Lys Leu Phe Thr Ala Ala Tyr Glu Ile Glu His
    850                 855                 860
```

```
Val Ile Pro Gln Ser Arg Tyr Phe Asp Asp Ser Phe Ser Asn Lys Val
865                 870                 875                 880


Ile Cys Glu Ser Ala Val Asn Lys Leu Lys Asp Asn Gln Leu Gly Tyr
                885                 890                 895


Glu Phe Ile Lys Asn His His Gly Gln Lys Val Glu Val Gly Phe Gly
            900                 905                 910


Lys Ser Val Glu Ile Phe Ser Val Asp Ser Tyr Glu Arg Phe Val Lys
        915                 920                 925


Glu Gln Tyr Ala Lys Ser Ala Val Lys Met Lys Lys Leu Leu Met Asp
    930                 935                 940


Asp Ile Pro Glu Gln Phe Ile Glu Arg Gln Leu Asn Asp Ser Arg Tyr
945                 950                 955                 960


Ile Ser Lys Val Ile Lys Gly Leu Leu Ser Asn Ile Val Arg Glu Lys
                965                 970                 975


Asn Asp Ser Gly Glu Tyr Glu Pro Glu Ala Val Ser Lys Asn Ile Val
            980                 985                 990


Val Cys Thr Gly Ser Val Thr Asp  Arg Leu Lys Arg Asp  Trp Gly Met
        995                 1000                1005


Asn Asp  Val Trp Asn Ser Ile  Val Tyr Pro Arg Phe  Glu Arg Leu
    1010                1015                1020


Asn Ser  Leu Thr Asp Thr Gln  Ser Phe Gly His Trp  Glu Asn Lys
    1025                1030                1035


Ser Gly  Lys Lys Val Phe Gln  Thr Glu Leu Pro Leu  Glu Tyr Gln
    1040                1045                1050
```

```
Lys Gly  Phe Ser Lys Lys Arg  Ile Asp His Arg His  His Ala Met
    1055                1060                1065

Asp Ala  Ile Val Ile Ala Cys  Ala Thr Arg Asn His  Val Asn Tyr
    1070                1075                1080

Leu Ser  Asn Glu Ser Ala Ser  Arg Asn Ala Lys Ile  Ser Arg Tyr
    1085                1090                1095

Asp Leu  Gln Arg Leu Leu Cys  Asp Lys Asn Arg Thr  Asp Asp Asn
    1100                1105                1110

Gly Asn  Tyr Lys Trp Val Ile  Lys Lys Pro Trp Asp  Thr Phe Thr
    1115                1120                1125

Gln Asp  Ala Arg Glu Val Leu  Ser Lys Ile Val Val  Ser Leu Lys
    1130                1135                1140

Gln Asn  Leu Arg Ile Ile Asn  Lys Thr Thr Asn Val  Tyr Arg His
    1145                1150                1155

Leu Asp  Ala Thr Gly Asn Arg  Val Tyr Glu Lys Gln  Lys Thr Gly
    1160                1165                1170

Asp Ser  Trp Ala Ile Arg Lys  Pro Met His Lys Asp  Thr Val Phe
    1175                1180                1185

Gly Ala  Val Asn Leu Arg Lys  Val Lys Val Val Arg  Leu Ser Val
    1190                1195                1200

Ala Leu  Asp Thr Pro Ala Met  Ile Val Asp Lys Arg  Val Lys Asn
    1205                1210                1215

Lys Val  Phe Glu Leu Leu Ser  Tyr Lys Tyr Asp Lys  Lys Arg Ile
    1220                1225                1230

Glu Lys  Tyr Phe Lys Glu Asn  Ala Phe Leu Trp Lys  Glu Leu Asp
    1235                1240                1245
```

```
Leu Ala  Lys Val Ala Val Tyr  Tyr Phe Thr Glu Ala  Thr Thr Glu
    1250                1255                1260

Pro Leu  Val Ala Val Arg Lys  Pro Leu Asp Ser Thr  Phe Asn Glu
    1265                1270                1275

Lys Lys  Ile Lys Glu Ser Val  Thr Asp Thr Gly Ile  Gln Lys Ile
    1280                1285                1290

Leu Leu  Asn His Leu Cys Thr  Lys Glu Gly Lys Pro  Asp Leu Ala
    1295                1300                1305

Phe Ser  Ala Glu Gly Ile Glu  Glu Met Asn Arg Asn  Leu Leu Gln
    1310                1315                1320

Leu Asn  Asn Gly Lys Ser His  Gln Pro Ile Tyr Lys  Val Arg Val
    1325                1330                1335

Tyr Glu  Pro Arg Gly Asn Lys  Phe Ser Val Gly Val  Leu Gly Asn
    1340                1345                1350

Lys Gly  Thr Lys Trp Val Glu  Ala Ala Lys Gly Thr  Asn Leu Phe
    1355                1360                1365

Phe Ala  Ile Tyr Ile Thr Glu  Asp Gly Lys Arg Thr  Tyr Glu Thr
    1370                1375                1380

Ile Pro  Leu Asn Val Val Ile  Glu Arg Glu Lys Gln  Gly Leu Val
    1385                1390                1395

Pro Val  Pro Asp Arg Asn Lys  Lys Gly Asp Lys Leu  Leu Phe Trp
    1400                1405                1410

Leu Ser  Pro Asn Asp Leu Val  Tyr Leu Pro Thr Glu  Glu Glu Arg
    1415                1420                1425
```

```
Glu Phe  Gly Arg Ile Asn Glu  Pro Ile Asp Arg Gly  Arg Ile Tyr
    1430                1435                1440


Lys Met  Val Ser Cys Thr Gly  Asn Glu Gly His Phe  Ile Pro Ala
    1445                1450                1455


Asn Val  Ala Asn Pro Ile Val  Pro Val Ile Glu Leu  Gly Ser Asn
    1460                1465                1470


Asn Lys  Ala Gln Arg Ala Trp  Thr Asn Glu Met Ile  Lys Asp Ile
    1475                1480                1485


Cys Ile  Pro Ile Lys Val Asp  Arg Leu Gly His Ile  Ile Glu Val
    1490                1495                1500


Lys Tyr  Arg Ile Asp Glu
    1505


<210>  292
<211>  1526
<212>  PRT
<213>  Bacteroides faecis

<400>  292

Met Lys Lys Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Val Leu Asn Ala Ala Asp Asp Asn Ser Leu Lys Tyr Ile Glu Ala
            20                  25                  30


Ala Gly Ser Arg Ile Ile Pro Met Asp Ala Ala Ile Leu Gly Asp Phe
        35                  40                  45


Asp Arg Gly Asn Ser Ile Ser Gln Thr Ala Glu Arg Thr Arg Ile Arg
    50                  55                  60


Gly Met Arg His Leu Arg Glu Arg Tyr Leu Leu Arg Arg Ala Arg Leu
65                  70                  75                  80
```

```
His Arg Ile Leu Asn Leu Leu Gly Phe Leu Pro Phe His Tyr Ala Gln
                85                  90                  95

Asp Ile Asp Arg Tyr Gly Asn Phe Ser Ala Asp Met Glu Pro Lys Ile
            100                 105                 110

Ala Trp Cys Lys Asn Leu Glu Gly Glu Leu Glu Phe Ile Phe Ile Glu
        115                 120                 125

Ser Phe Asn Glu Met Leu Glu Asp Phe Arg Lys Asn Gln Pro Glu Leu
    130                 135                 140

Val Ala Asp Asn Lys Lys Val Pro Tyr Asp Trp Val Ile Tyr Tyr Leu
145                 150                 155                 160

Arg Lys Lys Ala Leu Glu Lys Lys Ile Ser Lys Glu Glu Leu Ala Trp
                165                 170                 175

Ile Leu Leu Asn Phe Asn Gln Lys Arg Gly Tyr Tyr Gln Leu Arg Gly
            180                 185                 190

Glu Asp Asp Asp Glu Ser Met Lys Thr Ala Lys Thr Arg Gln Tyr Phe
        195                 200                 205

Asp Lys Gln Ile Ile Lys Asn Ile Ile Asp Thr Asn Gln Thr Tyr Lys
    210                 215                 220

Gly Gln Arg Ile Leu Ile Val Glu Leu Gln Asn Gly Asp Lys Gly Lys
225                 230                 235                 240

Ile Phe Lys Lys Glu Ile Pro Asp Trp Ile Gly Gln Glu Lys Asn Ile
                245                 250                 255

Ile Val Thr Val Asp Ile Asp Lys Asp Gly Asn Asp Lys Tyr Glu Glu
            260                 265                 270

Ser Gly Ser Leu Ser Cys Arg Phe Lys Ile Pro Thr Asp Ala Glu Trp
```

```
        275                 280                 285

Glu Ser Glu Trp Lys Leu Ile Lys Met Lys Thr Gln Lys Asp Leu Asp
    290                 295                 300

Glu Ser Asn Lys Thr Val Gly Thr Tyr Ile Tyr Asp Ser Ile Leu Gln
305                 310                 315                 320

Asn Pro Thr Gln Lys Val Arg Gly Lys Leu Val Arg Thr Ile Glu Arg
                325                 330                 335

Lys Tyr Tyr Lys Ala Glu Leu Lys Gln Ile Leu Glu Lys Gln Thr Glu
            340                 345                 350

Phe His Ser Glu Leu Gln Asp Lys Asp Leu Tyr Ile Glu Cys Leu Asn
        355                 360                 365

Glu Leu Tyr Ser Asn Asn Asp Thr His Arg Asn Ala Ile Thr Asp Arg
    370                 375                 380

Asp Phe Val Tyr Leu Phe Met Asn Asp Ile Leu Phe Tyr Gln Arg Pro
385                 390                 395                 400

Leu Lys Ser Lys Lys Ser Leu Ile Asp Asn Cys Pro Tyr Glu Arg Asn
                405                 410                 415

Ile Tyr Ile Asp Lys Glu Thr Gly Glu Ile Lys Tyr Ser Pro Ile Lys
            420                 425                 430

Cys Ile Ala Lys Ser His Pro Leu Phe Gln Glu Phe Arg Leu Trp Lys
        435                 440                 445

Phe Ile Ser Ser Ile Arg Ile Tyr Gln Arg Glu Ser Val Val Glu Val
    450                 455                 460

Val Asp Lys Gln Leu Asp Leu Phe Ser Ser Gln Ser Thr Ser Val Gln
465                 470                 475                 480
```

```
Lys Leu Val Thr Asp Val Asp Val Thr Asp Lys Phe Leu Thr Cys Glu
                485                 490                 495

Asn Asp Tyr Val Ala Leu Phe Glu Trp Leu Asn Lys Lys Lys Ile Ile
            500                 505                 510

Asp Gln Lys Glu Phe Leu Lys Tyr Arg Pro Phe Gly Leu Lys Gly Asp
        515                 520                 525

Ile Asp Asn Tyr Arg Trp Asn Tyr Val Glu Asp Lys Ser Tyr Pro Cys
    530                 535                 540

Asn Glu Thr His Ala Met Ile Leu Thr Tyr Phe Ala Lys Ala Gly Ile
545                 550                 555                 560

Ser Glu Asp Ile Leu Thr Lys Glu Met Glu Glu Ala Leu Trp His Ile
                565                 570                 575

Leu Tyr Ser Val Glu Asp Arg Gln Glu Ile Thr Lys Ala Leu Arg Thr
            580                 585                 590

Phe Ala Ser Lys Tyr His Leu Ser Asp Ser Phe Val Lys Val Phe Ser
        595                 600                 605

Asn Ile Pro Pro Phe Lys Lys Glu Tyr Gly Ser Tyr Ser Ala Lys Ala
    610                 615                 620

Ile Lys Lys Leu Leu Ser Leu Met Arg Met Gly Lys Tyr Trp Ser Glu
625                 630                 635                 640

Asp Ala Ile Asp Val Asn Thr Arg Glu Arg Ile Asp Lys Ile Val Thr
                645                 650                 655

Gly Glu Tyr Asp Glu Lys Ile Arg Asp Arg Val Arg Glu Lys Thr Ile
            660                 665                 670

Arg Leu Asn Asp Ile Arg His Phe Arg Ala Leu Pro Asp Trp Leu Ala
```

```
        675                 680                 685

Cys Tyr Val Val Tyr Asp Arg His Ser Glu Thr Arg Glu Ile Thr Glu
    690                 695                 700

Trp Lys Ser Pro Glu Glu Ile Asp Glu Tyr Ile Arg Asn Phe Lys Gln
705                 710                 715                 720

His Ser Leu Arg Asn Pro Ile Val Glu Gln Val Ile Thr Glu Thr Leu
                725                 730                 735

Arg Thr Val Arg Asp Ile Trp Lys Gln Val Gly Cys Ile Asp Glu Ile
            740                 745                 750

His Val Glu Leu Gly Arg Glu Met Lys Asn Pro Ala Asp Lys Arg Lys
        755                 760                 765

Arg Ile Thr Ser Gln Ile Ile Glu Asn Glu Asn Ala Asn Leu Arg Val
    770                 775                 780

Lys Ala Leu Leu Thr Glu Phe Val Asn Ser Glu Phe Glu Ile Glu Asn
785                 790                 795                 800

Val Arg Pro Tyr Ser Leu Ser Gln Gln Asp Ile Leu Arg Ile Tyr Glu
                805                 810                 815

Asp Gly Val Leu Asn Ser Val Ala Glu Val Pro Gly Asp Ile Ala Gly
            820                 825                 830

Ile Leu Lys Lys Phe Asn Glu Asn Asp Ala Lys Lys Arg Pro Thr Thr
        835                 840                 845

Ser Glu Ile Leu Arg Tyr Lys Leu Trp Leu Glu Gln Lys Tyr Arg Ser
    850                 855                 860

Pro Tyr Thr Gly Glu Met Ile Pro Leu Ser Lys Leu Phe Thr Ser Ala
865                 870                 875                 880
```

```
Tyr Glu Ile Glu His Val Ile Pro Gln Ser Arg Tyr Phe Asp Asp Ser
               885                 890                 895


Phe Ser Asn Lys Val Ile Cys Glu Ala Glu Val Asn Lys Leu Lys Asp
            900                 905                 910


Asn Ala Leu Gly Tyr Glu Phe Ile Lys Lys His His Gly Glu Lys Val
        915                 920                 925


Glu Leu Gly Phe Gly Lys Ile Val Glu Ile Phe Ser Val Ser Val Tyr
    930                 935                 940


Glu Gln Phe Val Lys Asp Asn Tyr Ser Arg Asn Arg Gly Lys Met Lys
945                 950                 955                 960


Lys Leu Leu Met Asp Glu Ile Pro Glu Gln Phe Ile Glu Arg Gln Leu
               965                 970                 975


Asn Asp Ser Arg Tyr Ile Ser Lys Val Val Lys Thr Leu Leu Ser Asn
            980                 985                 990


Val Val Arg Glu Lys Ala Glu Gln  Glu Ala Val Ser Lys  Asn Val Ile
        995                 1000                1005


Val Cys  Thr Gly Gly Val Thr  Asp Arg Leu Lys Lys  Asp Trp Gly
    1010                1015                1020


Ile Asn  Asp Val Trp Asn Lys  Ile Val Leu Pro Arg  Phe Leu Arg
    1025                1030                1035


Leu Asn  Glu Leu Thr Asn Ser  Thr Asn Phe Thr Ala  Lys Asn Ala
    1040                1045                1050


Ala Gly  Asn Glu Ile Pro Ala  Met Pro Leu Glu Leu  Gln Lys Gly
    1055                1060                1065


Phe Asn  Lys Lys Arg Ile Asp  His Arg His His Ala  Met Asp Ala
```

```
    1070                1075                1080

Ile Val  Ile Ala Cys Ala Asn  Arg Asn Ile Val Asn  Tyr Leu Asn
    1085                1090                1095

Asn Glu  Ser Ala Ser Arg Lys  Ala Lys Ile Ser Arg  His Asp Leu
    1100                1105                1110

Gln Ala  Ile Leu Cys Asp Lys  Val Arg Thr Asp Asp  Lys Gly Asn
    1115                1120                1125

Tyr Gln  Trp Arg Val Lys Lys  Pro Trp Asp Thr Phe  Thr Gln Asp
    1130                1135                1140

Val Tyr  Val Ala Leu Glu Asn  Ile Ile Val Ser Phe  Lys Gln Asn
    1145                1150                1155

Leu Arg  Val Ile Asn Lys Thr  Ser Asn Tyr Tyr Trp  His Tyr Glu
    1160                1165                1170

Asn Gly  Lys Lys Val Leu Val  Lys Gln Val Lys Gly  Asp Ser Trp
    1175                1180                1185

Ala Ile  Arg Lys Pro Met His  Lys Asp Thr Val Phe  Gly Glu Val
    1190                1195                1200

Asn Leu  Arg Lys Val Lys Ser  Val Ser Leu Asn Glu  Ala Leu Lys
    1205                1210                1215

Asn Pro  Gln Phe Ile Val Glu  Lys Asp Leu Lys Arg  Gln Leu Leu
    1220                1225                1230

Ser Leu  Leu Gln Gln Asn Phe  Asp Ile Lys Lys Ile  Lys Lys Tyr
    1235                1240                1245

Phe Glu  Glu His Lys Asp Ile  Trp Ser Asp Ile Ser  Leu Ser Lys
    1250                1255                1260
```

```
Met Asn  Ile Tyr Tyr Phe Thr  Lys Glu Thr Lys Asp  Arg Tyr Phe
    1265                1270                1275

Ala Thr  Arg Lys Pro Leu Asp  Ala Ser Phe Asp Lys  Lys Lys Ile
    1280                1285                1290

Glu Ser  Cys Ile Thr Asp Thr  Gly Ile Gln Gln Ile  Leu Leu Arg
    1295                1300                1305

His Leu  Glu Leu Lys Glu Asn  Asp Pro Glu Arg Ala  Phe Ser Pro
    1310                1315                1320

Asp Gly  Ile Asp Glu Met Asn  Arg Asn Ile Ile Gln  Leu Asn Lys
    1325                1330                1335

Gly Lys  Gly His His Pro Ile  Ala Lys Val Arg Val  Tyr Glu Lys
    1340                1345                1350

Ala Asp  Lys Phe Glu Val Gly  Gln Arg Gly Asn Lys  Ser Ser Lys
    1355                1360                1365

Phe Val  Glu Ala Ala Lys Gly  Thr Asn Leu Phe Phe  Ala Val Tyr
    1370                1375                1380

Glu Thr  Glu Tyr Pro Asp Glu  Lys Thr Asn Ser Ile  Val Arg Lys
    1385                1390                1395

Arg Asn  Tyr Ala Thr Ile Pro  Leu Asn Ile Ala Ile  Glu Arg Gln
    1400                1405                1410

Lys Arg  Gly Leu Ser Thr Ala  Pro Glu Asp Glu Lys  Gly Asn Val
    1415                1420                1425

Pro Ser  Phe Val Leu Ser Pro  Asn Asp Leu Val Tyr  Leu Pro Thr
    1430                1435                1440

Ser Glu  Asp Ile Val Asn Gly  His Ile Thr Gln Pro  Ile Asp Lys
```

```
    1445                1450                1455

Ser Arg  Ile Tyr Lys Met Val  Ser Ser Ser Gly Ser  Gln Cys Phe
    1460                1465                1470

Phe Ile  Lys His Asn Ile Ala  Asn Ile Ile Val Asp  Lys Tyr Glu
    1475                1480                1485

Phe Ser  Pro Leu Asn Lys Met  Glu Arg Ala Ile Ser  Asn Glu Met
    1490                1495                1500

Ile Lys  Glu Ile Cys Ile Pro  Val Lys Val Asp Arg  Leu Gly Asn
    1505                1510                1515

Ile Val  Lys Leu Gly Lys Ser  Glu
    1520                1525
```

<210> 293
<211> 1509
<212> PRT
<213> Bacteroides fluxus

<400> 293

```
Met Lys Thr Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Val Gly Trp
1               5                   10                  15

Ala Val Ile Asn Ser Val Ile Lys Glu Gln Ala Glu Arg Ile Trp Ile
            20                  25                  30

Glu Met Ala Gly Ser Arg Ile Ile Pro Met Asp Ala Ala Val Leu Gly
        35                  40                  45

Asp Phe Asp Lys Gly Asn Ser Ile Ser Gln Thr Ser Glu Arg Thr Arg
    50                  55                  60

Leu Arg Gly Val Arg Arg Leu Arg Glu Arg Gln Leu Leu Arg Arg Glu
65                  70                  75                  80
```

```
Arg Leu His Lys Val Leu Asn Ile Leu Gly Phe Leu Pro Asn His Tyr
                85                  90                  95

Leu Glu Tyr Ile Asp Phe Glu Lys His Pro Gly Lys Phe Leu Ser Asp
            100                 105                 110

Ala Glu Pro Lys Leu Pro Trp Val Lys Asp Glu Gln Gly Lys Tyr Thr
        115                 120                 125

Phe Leu Phe Gln Ala Ala Phe Asp Glu Met Leu Ala Asp Phe Ala Ile
    130                 135                 140

His Gln Pro Ser Leu Val Ser Gly Asp Lys Lys Ile Pro Tyr Asp Trp
145                 150                 155                 160

Thr Ile Tyr Tyr Leu Arg Lys Lys Ala Leu Thr Glu Met Ile Ser Lys
                165                 170                 175

Glu Glu Leu Ala Trp Ile Leu Leu Asn Phe Asn Gln Lys Arg Gly Tyr
            180                 185                 190

Tyr Gln Leu Arg Gly Glu Glu Glu Glu Asp Asn Ala Gly Lys Ser Val
        195                 200                 205

Glu Phe Tyr Ala Leu Lys Val Leu Thr Val Glu Ala Thr Asp Glu Lys
    210                 215                 220

Lys Gly Arg Asp Val Trp Tyr Asn Val His Leu Glu Asn Gly Trp Ile
225                 230                 235                 240

Tyr Arg Arg Ser Ser Ser Val Pro Leu Asp Trp Glu Gly Gln Ile Lys
                245                 250                 255

Glu Phe Ile Val Thr Thr Asp Leu Asn Pro Asp Ser Thr Pro Lys Leu
            260                 265                 270

Asp Lys Tyr Gly Glu Val Lys Arg Ser Phe Arg Ala Pro Lys Glu Asp
        275                 280                 285
```

```
Asp Trp Met Leu Ile Lys Lys Arg Thr Glu Ala Asp Ile Ala Asn Thr
    290                 295                 300

His Lys Thr Val Gly Ala Tyr Ile Tyr Asp Thr Leu Leu Gln Lys Pro
305                 310                 315                 320

Gln Gln Lys Ile Ile Gly Lys Leu Val Lys Thr Val Glu Arg Lys Leu
                325                 330                 335

Tyr Arg Asp Glu Leu Ser Leu Ile Leu Gln Lys Gln Cys Ala Phe His
            340                 345                 350

Ala Glu Leu Gln Asp Arg Thr Leu Tyr Ala Arg Cys Val Glu Ala Leu
        355                 360                 365

Tyr Pro Asn Asn Glu Val Gln Arg Arg Asn Ile Ala Asn Arg Asp Phe
    370                 375                 380

Val Tyr Leu Leu Met Asp Asp Val Leu Phe Tyr Gln Arg Pro Leu Lys
385                 390                 395                 400

Thr Lys Lys Ser Leu Ile Ala Asn Cys Pro Tyr Glu Glu Asn Glu Tyr
                405                 410                 415

Val Asp Arg Glu Thr Gly Glu Ile Lys Lys Ala Pro Leu Lys Cys Ile
            420                 425                 430

Ala Lys Ser His Pro Leu Phe Gln Glu Phe Arg Leu Trp Asn Phe Leu
        435                 440                 445

Ser Asn Ile Arg Ile Tyr Gln Lys Glu Lys Glu Ile Asn Gly Thr Leu
    450                 455                 460

His Leu Asp Val Asp Val Thr Ala Glu Phe Leu Lys Thr Glu Asp Asp
465                 470                 475                 480
```

```
Tyr Val Ala Leu Phe Asp Trp Leu Asn Ser Arg Lys Glu Ile Glu Gln
                485                 490                 495

Lys Thr Phe Leu Lys Tyr Pro Lys Phe Gly Leu Lys Lys Glu Ile Ser
            500                 505                 510

Asn Tyr Arg Trp Asn Tyr Val Glu Asp Lys Gln Tyr Pro Cys Asn Glu
        515                 520                 525

Thr Arg His Ala Ile Leu Ser Arg Leu Glu Lys Ala Asn Val Cys Ile
    530                 535                 540

Asp Phe Leu Ser Asn Glu Lys Glu Val Ala Leu Trp His Ile Leu Tyr
545                 550                 555                 560

Ser Val Ser Asp Lys Gln Glu Ile Glu Lys Ala Leu Arg Thr Phe Ala
                565                 570                 575

Ala Lys Asn Gly Leu Asp Glu Ser Phe Val Glu Ala Phe Lys Lys Phe
            580                 585                 590

Pro Pro Phe Lys Ser Glu Tyr Gly Ala Tyr Ser Ala Lys Ala Ile Lys
        595                 600                 605

Lys Leu Leu Pro Leu Met Arg Cys Gly Lys Tyr Trp Asp Val Ser Ser
    610                 615                 620

Ile Asp Asp Thr Thr Lys Glu Arg Ile Lys Lys Ile Val Ala Gly Glu
625                 630                 635                 640

Tyr Asp Glu Arg Ile Ala Val Lys Val Arg Asp Lys Val Met Asn Leu
                645                 650                 655

Ser Asp Ile Ser Cys Phe Lys Arg Leu Pro Leu Trp Leu Ala Cys Tyr
            660                 665                 670

Ile Val Tyr Asn Arg His Ser Glu Asp Lys Glu Ala Val Lys Trp Glu
        675                 680                 685
```

```
Ser Pro Ala Asp Ile Asp Ala Tyr Leu Ala Ser Phe Lys Gln His Ser
    690                 695                 700

Leu Arg Asn Pro Ile Val Glu Gln Val Ile Thr Glu Thr Leu Arg Val
705                 710                 715                 720

Val Arg Asp Ile Trp Lys Gln Val Gly Arg Ile Asp Glu Ile His Ile
                725                 730                 735

Glu Leu Gly Arg Glu Met Lys Asn Pro Ala Asp Lys Arg Lys Arg Met
            740                 745                 750

Thr Ala Gln Ile Leu Glu Asn Glu Asn Ala Asn Leu Arg Ile Lys Ala
        755                 760                 765

Leu Leu Ala Glu Phe Met Asn Pro Glu Tyr Glu Ile Glu Asn Val Arg
    770                 775                 780

Pro Tyr Ser Pro Ser Gln Gln Glu Ile Leu Arg Ile Tyr Glu Asp Met
785                 790                 795                 800

Val Leu His Ala Glu Asp Gln Leu Pro Glu Glu Ile Asp Ala Ile Leu
                805                 810                 815

Lys Lys Phe Asn Ser Ser Lys Val Pro Thr Lys Ser Glu Phe Leu Arg
            820                 825                 830

Tyr Lys Leu Trp Leu Glu Gln Lys Tyr Arg Ser Pro Tyr Thr Gly Glu
        835                 840                 845

Leu Ile Pro Leu Gly Lys Leu Phe Thr Ala Ala Tyr Glu Ile Glu His
    850                 855                 860

Val Ile Pro Gln Ser Arg Tyr Phe Asp Asp Ser Phe Ser Asn Lys Val
865                 870                 875                 880
```

```
Ile Cys Glu Ser Ala Val Asn Lys Leu Lys Asp Asn Gln Leu Gly Tyr
                885                 890                 895


Glu Phe Ile Lys Asn His His Gly Gln Lys Val Glu Val Gly Phe Gly
            900                 905                 910


Lys Ser Val Glu Ile Phe Ser Val Asp Ser Tyr Glu Arg Phe Val Lys
        915                 920                 925


Glu Gln Tyr Ala Lys Ser Ala Val Lys Met Lys Lys Met Leu Met Asp
    930                 935                 940


Asp Ile Pro Glu Gln Phe Ile Glu Arg Gln Leu Asn Asp Ser Arg Tyr
945                 950                 955                 960


Ile Ser Lys Val Ile Lys Gly Leu Leu Ser Asn Ile Val Arg Glu Lys
                965                 970                 975


Asn Asp Ser Gly Glu Tyr Glu Pro Glu Ala Val Ser Lys Asn Ile Val
            980                 985                 990


Val Cys Thr Gly Ser Val Thr Asp  Arg Leu Lys Arg Asp  Trp Gly Met
        995                 1000                1005


Asn Asp  Val Trp Asn Ser Ile  Val Tyr Pro Arg Phe  Glu Arg Leu
    1010                1015                1020


Asn Ser  Leu Thr Asp Thr Gln  Ser Phe Gly His Trp  Glu Asn Lys
    1025                1030                1035


Ser Gly  Lys Lys Val Phe Gln  Thr Glu Leu Pro Leu  Glu Tyr Gln
    1040                1045                1050


Lys Gly  Phe Ser Lys Lys Arg  Ile Asp His Arg His  His Ala Met
    1055                1060                1065


Asp Ala  Ile Val Ile Ala Cys  Ala Thr Arg Asn His  Val Asn Tyr
    1070                1075                1080
```

```
Leu Ser  Asn Glu Ser Ala Ser  Arg Asn Ala Lys Ile  Ser Arg Tyr
    1085                1090                1095

Asp Leu  Gln Arg Leu Leu Cys  Asp Lys Ser Arg Thr  Asp Asp Asn
    1100                1105                1110

Gly Asn  Tyr Lys Trp Val Ile  Lys Lys Pro Trp Asp  Thr Phe Thr
    1115                1120                1125

Gln Asp  Ala Arg Glu Val Leu  Ser Lys Ile Val Val  Ser Leu Lys
    1130                1135                1140

Gln Asn  Leu Arg Ile Ile Asn  Lys Thr Thr Asn Val  Tyr Arg His
    1145                1150                1155

Leu Asp  Ala Thr Gly Asn Arg  Val Tyr Glu Lys Gln  Lys Thr Gly
    1160                1165                1170

Asp Ser  Trp Ala Ile Arg Lys  Pro Met His Lys Asp  Thr Val Phe
    1175                1180                1185

Gly Ala  Val Asn Leu Arg Lys  Val Lys Val Val Arg  Leu Ser Val
    1190                1195                1200

Ala Leu  Asp Ala Pro Thr Met  Ile Val Asp Lys Arg  Val Lys Asn
    1205                1210                1215

Lys Val  Phe Glu Leu Leu Ser  Tyr Lys Tyr Asp Lys  Lys Arg Ile
    1220                1225                1230

Glu Lys  Tyr Phe Lys Glu Asn  Ala Val Leu Trp Lys  Glu Leu Asp
    1235                1240                1245

Leu Ala  Arg Val Ala Val Tyr  Tyr Phe Thr Glu Ala  Thr Thr Glu
    1250                1255                1260
```

```
Pro Leu  Val Ala Val Arg Lys  Pro Leu Asp Ser Thr  Phe Asn Glu
    1265                1270                1275

Lys Lys  Ile Lys Glu Ser Val  Thr Asp Thr Gly Ile  Gln Lys Ile
    1280                1285                1290

Leu Leu  Asn His Leu Cys Thr  Lys Glu Gly Lys Pro  Asp Leu Ala
    1295                1300                1305

Phe Ser  Ala Glu Gly Ile Glu  Glu Met Asn Arg Asn  Leu Leu Gln
    1310                1315                1320

Leu Asn  Asn Gly Lys Arg His  Gln Pro Ile Tyr Lys  Val Arg Val
    1325                1330                1335

Tyr Glu  Pro Arg Gly Asn Lys  Phe Ser Val Gly Val  Leu Gly Asn
    1340                1345                1350

Lys Gly  Thr Lys Trp Val Glu  Ala Ala Lys Gly Thr  Asn Leu Phe
    1355                1360                1365

Phe Ala  Ile Tyr Ile Thr Glu  Asp Gly Lys Arg Thr  Tyr Glu Thr
    1370                1375                1380

Ile Pro  Leu Asn Met Val Ile  Glu Arg Glu Lys Gln  Gly Leu Ala
    1385                1390                1395

Pro Val  Pro Asp Lys Asn Glu  Lys Gly Asp Lys Leu  Leu Phe Trp
    1400                1405                1410

Leu Ser  Pro Asn Asp Leu Val  Tyr Leu Pro Thr Glu  Glu Glu Leu
    1415                1420                1425

Glu Phe  Gly Arg Ile Asn Glu  Pro Ile Asp Arg Gly  Arg Ile Tyr
    1430                1435                1440

Lys Met  Val Ser Ser Ser Gly  Asn Gln Cys Phe Phe  Ile Pro Gln
    1445                1450                1455
```

Ser Ile Ser Asn Ala Ile Ile Pro Thr Lys Glu Leu Gly Ala Asn
    1460   1465   1470

Asn Lys Ala Glu Arg Ser Trp Asp Gly Ala Met Ile Lys Asn Ile
    1475   1480   1485

Cys Ile Pro Val Lys Val Asp Arg Leu Gly Arg Ile Ile Glu Val
    1490   1495   1500

Lys Tyr Arg Ile Asn Glu
    1505

<210> 294
<211> 1436
<212> PRT
<213> Bacteroides fragilis

<400> 294

Met Lys Arg Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1   5   10   15

Ala Leu Val Asn Glu Ala Glu Asn Lys Asp Glu Arg Ser Ser Ile Val
            20   25   30

Lys Leu Gly Val Arg Val Asn Pro Leu Thr Val Asp Glu Leu Thr Asn
        35   40   45

Phe Glu Lys Gly Lys Ser Ile Thr Thr Asn Ala Asp Arg Thr Leu Lys
    50   55   60

Arg Gly Met Arg Arg Asn Leu Gln Arg Tyr Lys Leu Arg Arg Glu Thr
65   70   75   80

Leu Thr Glu Val Leu Lys Glu His Lys Leu Ile Thr Glu Asp Thr Ile
                85   90   95

Leu Ser Glu Asn Gly Asn Arg Thr Thr Phe Glu Thr Tyr Arg Leu Arg

```
            100                 105                 110

Ala Lys Ala Val Thr Glu Glu Ile Ser Leu Glu Glu Phe Ala Arg Val
        115                 120                 125

Leu Leu Met Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Ala
    130                 135                 140

Lys Gly Val Glu Glu Gly Thr Leu Ile Asp Gly Met Asp Ile Ala Arg
145                 150                 155                 160

Glu Leu Tyr Asn Asn Asn Leu Thr Pro Gly Glu Leu Cys Leu Gln Leu
                165                 170                 175

Leu Asp Ala Gly Lys Lys Phe Leu Pro Asp Phe Tyr Arg Ser Asp Leu
            180                 185                 190

Gln Asn Glu Leu Asp Arg Ile Trp Glu Lys Gln Lys Glu Tyr Tyr Pro
        195                 200                 205

Glu Ile Leu Thr Asp Val Leu Lys Glu Glu Leu Arg Gly Lys Lys Arg
    210                 215                 220

Asp Ala Val Trp Ala Ile Cys Ala Lys Tyr Phe Val Trp Lys Glu Asn
225                 230                 235                 240

Tyr Thr Glu Trp Asn Lys Glu Lys Gly Lys Thr Glu Gln Gln Glu Arg
                245                 250                 255

Glu His Lys Leu Glu Gly Ile Tyr Ser Lys Arg Lys Arg Asp Glu Ala
            260                 265                 270

Lys Arg Glu Asn Leu Gln Trp Arg Val Asn Gly Leu Lys Glu Lys Leu
        275                 280                 285

Ser Leu Glu Gln Leu Val Ile Val Phe Gln Glu Met Asn Thr Gln Ile
    290                 295                 300
```

```
Asn Asn Ser Ser Gly Tyr Leu Gly Ala Ile Ser Asp Arg Ser Lys Glu
305                 310                 315                 320

Leu Tyr Phe Asn Lys Gln Thr Val Gly Gln Tyr Gln Met Glu Met Leu
                325                 330                 335

Asp Lys Asn Pro Asn Ala Ser Leu Arg Asn Met Val Phe Tyr Arg Gln
            340                 345                 350

Asp Tyr Leu Asp Glu Phe Asn Met Leu Trp Glu Lys Gln Ala Val Tyr
        355                 360                 365

His Lys Glu Leu Thr Glu Glu Leu Lys Lys Glu Ile Arg Asp Ile Ile
    370                 375                 380

Ile Phe Tyr Gln Arg Arg Leu Lys Ser Gln Lys Gly Leu Ile Gly Phe
385                 390                 395                 400

Cys Glu Phe Glu Ser Arg Gln Ile Glu Val Asp Ile Asp Gly Lys Lys
                405                 410                 415

Lys Ile Lys Thr Val Gly Asn Arg Val Ile Ser Arg Ser Ser Pro Leu
            420                 425                 430

Phe Gln Glu Phe Lys Ile Trp Gln Ile Leu Asn Asn Ile Glu Val Thr
        435                 440                 445

Val Val Gly Lys Lys Arg Lys Arg Arg Lys Leu Lys Glu Asn Tyr Ser
    450                 455                 460

Ala Leu Phe Glu Glu Leu Asn Asp Ala Glu Gln Leu Glu Leu Asn Gly
465                 470                 475                 480

Ser Arg Arg Leu Cys Gln Glu Glu Lys Glu Leu Leu Ala Gln Glu Leu
                485                 490                 495

Phe Ile Arg Asp Lys Met Thr Lys Ser Glu Val Leu Lys Leu Leu Phe
```

```
            500                 505                 510

Asp Asn Pro Gln Glu Leu Asp Leu Asn Phe Lys Thr Ile Asp Gly Asn
        515                 520                 525

Lys Thr Gly Tyr Ala Leu Phe Gln Ala Tyr Ser Lys Met Ile Glu Met
    530                 535                 540

Ser Gly His Glu Pro Val Asp Phe Lys Lys Pro Val Glu Lys Val Val
545                 550                 555                 560

Glu Tyr Ile Lys Ala Val Phe Asp Leu Leu Asn Trp Asn Thr Asp Ile
                565                 570                 575

Leu Gly Phe Asn Ser Asn Glu Glu Leu Asp Asn Gln Ser Tyr Tyr Lys
            580                 585                 590

Leu Trp His Leu Leu Tyr Ser Phe Glu Gly Asp Asn Thr Pro Thr Gly
        595                 600                 605

Asn Gly Arg Leu Ile Gln Lys Met Thr Glu Leu Tyr Gly Phe Glu Lys
    610                 615                 620

Glu Tyr Ala Thr Ile Leu Ala Asn Val Ser Phe Gln Asp Asp Tyr Gly
625                 630                 635                 640

Ser Leu Ser Ala Lys Ala Ile His Lys Ile Leu Pro His Leu Lys Glu
                645                 650                 655

Gly Asn Arg Tyr Asp Val Ala Cys Val Tyr Ala Gly Tyr Arg His Ser
            660                 665                 670

Glu Ser Ser Leu Thr Arg Glu Glu Ile Ala Asn Lys Val Leu Lys Asp
        675                 680                 685

Arg Leu Met Leu Leu Pro Lys Asn Ser Leu His Asn Pro Val Val Glu
    690                 695                 700
```

```
Lys Ile Leu Asn Gln Met Val Asn Val Ile Asn Val Ile Ile Asp Ile
705                 710                 715                 720


Tyr Gly Lys Pro Asp Glu Ile Arg Val Glu Leu Ala Arg Glu Leu Lys
                725                 730                 735


Lys Asn Ala Lys Glu Arg Glu Glu Leu Thr Lys Ser Ile Ala Gln Thr
            740                 745                 750


Thr Lys Ala His Glu Glu Tyr Lys Thr Leu Leu Gln Thr Glu Phe Gly
        755                 760                 765


Leu Thr Asn Val Ser Arg Thr Asp Ile Leu Arg Tyr Lys Leu Tyr Lys
    770                 775                 780


Glu Leu Glu Ser Cys Gly Tyr Lys Thr Leu Tyr Ser Asn Thr Tyr Ile
785                 790                 795                 800


Ser Arg Glu Lys Leu Phe Ser Lys Glu Phe Asp Ile Glu His Ile Ile
                805                 810                 815


Pro Gln Ala Arg Leu Phe Asp Asp Ser Phe Ser Asn Lys Thr Leu Glu
            820                 825                 830


Ala Arg Ser Val Asn Ile Glu Lys Gly Asn Lys Thr Ala Tyr Asp Phe
        835                 840                 845


Val Lys Glu Lys Phe Gly Glu Ser Gly Ala Asp Asn Ser Leu Glu His
    850                 855                 860


Tyr Leu Asn Asn Ile Glu Asp Leu Phe Lys Ser Gly Lys Ile Ser Lys
865                 870                 875                 880


Thr Lys Tyr Asn Lys Leu Lys Met Ala Glu Gln Asp Ile Pro Asp Gly
                885                 890                 895


Phe Ile Glu Arg Asp Leu Arg Asn Thr Gln Tyr Ile Ala Lys Lys Ala
```

```
            900                 905                 910

Leu Ser Met Leu Asn Glu Ile Ser His Arg Val Val Ala Thr Ser Gly
        915                 920                 925

Ser Val Thr Asp Lys Leu Arg Glu Asp Trp Gln Leu Ile Asp Val Met
    930                 935                 940

Lys Glu Leu Asn Trp Glu Lys Tyr Lys Ala Leu Gly Leu Val Glu Tyr
945                 950                 955                 960

Phe Glu Asp Arg Asp Gly Arg Gln Ile Gly Arg Ile Lys Asp Trp Thr
                965                 970                 975

Lys Arg Asn Asp His Arg His His Ala Met Asp Ala Leu Thr Val Ala
            980                 985                 990

Phe Thr Lys Asp Val Phe Ile Gln  Tyr Phe Asn Asn Lys  Asn Ala Ser
        995                 1000                1005

Leu Asp  Pro Asn Ala Asn Glu  His Ala Ile Lys Asn  Lys Tyr Phe
    1010                1015                1020

Gln Asn  Gly Arg Ala Ile Ala  Pro Met Pro Leu Arg  Glu Phe Arg
    1025                1030                1035

Ala Glu  Ala Lys Lys His Leu  Glu Asn Thr Leu Ile  Ser Ile Lys
    1040                1045                1050

Ala Lys  Asn Lys Val Ile Thr  Gly Asn Ile Asn Lys  Thr Arg Lys
    1055                1060                1065

Lys Gly  Gly Val Asn Lys Asn  Met Gln Gln Thr Pro  Arg Gly Gln
    1070                1075                1080

Leu His  Leu Glu Thr Ile Tyr  Gly Ser Gly Lys Gln  Tyr Leu Thr
    1085                1090                1095
```

```
Lys Glu  Glu Lys Val Asn Ala  Ser Phe Asp Met Arg  Lys Ile Gly
    1100                1105                1110

Thr Val  Ser Lys Leu Ala Tyr  Arg Asp Ala Leu Leu  Lys Arg Leu
    1115                1120                1125

Tyr Glu  Asn Asp Asn Asp Pro  Lys Lys Ala Phe Ala  Gly Lys Asn
    1130                1135                1140

Ser Leu  Asp Lys Gln Pro Ile  Trp Leu Asp Lys Glu  Gln Met Arg
    1145                1150                1155

Lys Val  Pro Glu Lys Val Lys  Ile Val Thr Leu Glu  Ala Ile Tyr
    1160                1165                1170

Thr Ile  Arg Lys Glu Ile Ser  Pro Asp Leu Lys Val  Asp Lys Val
    1175                1180                1185

Ile Asp  Val Gly Val Arg Lys  Ile Leu Ile Asp Arg  Leu Asn Glu
    1190                1195                1200

Tyr Gly  Asn Asp Ala Lys Lys  Ala Phe Ser Asn Leu  Asp Glu Asn
    1205                1210                1215

Pro Ile  Trp Leu Asn Lys Glu  Lys Gly Ile Ser Ile  Lys Arg Val
    1220                1225                1230

Thr Ile  Ser Gly Ile Ser Asn  Ala Gln Ser Leu His  Val Lys Lys
    1235                1240                1245

Asp Lys  Asp Gly Lys Pro Ile  Leu Asp Glu Asn Gly  Arg Asn Ile
    1250                1255                1260

Pro Val  Asp Phe Val Asn Thr  Gly Asn Asn His His  Val Ala Val
    1265                1270                1275

Tyr Tyr  Arg Pro Val Ile Asp  Lys Arg Gly Gln Leu  Val Val Asp
```

```
    1280                1285                1290

Glu Ala  Gly Asn Pro Lys Tyr  Glu Leu Glu Glu Val  Val Val Ser
    1295                1300                1305

Phe Phe  Glu Ala Val Thr Arg  Ala Asn Leu Gly Gln  Pro Ile Ile
    1310                1315                1320

Asp Lys  Asp Tyr Lys Thr Thr  Glu Gly Trp Gln Phe  Leu Phe Ser
    1325                1330                1335

Met Lys  Gln Asn Glu Tyr Phe  Val Phe Pro Asn Glu  Lys Thr Gly
    1340                1345                1350

Phe Asn  Pro Lys Glu Ile Asp  Leu Leu Asp Val Glu  Asn Tyr Gly
    1355                1360                1365

Leu Ile  Ser Pro Asn Leu Phe  Arg Val Gln Lys Phe  Ser Leu Lys
    1370                1375                1380

Asn Tyr  Val Phe Arg His His  Leu Glu Thr Thr Ile  Lys Asp Thr
    1385                1390                1395

Ser Ser  Ile Leu Arg Gly Ile  Thr Trp Ile Asp Phe  Arg Ser Ser
    1400                1405                1410

Lys Gly  Leu Asp Thr Ile Val  Lys Val Arg Val Asn  His Ile Gly
    1415                1420                1425

Gln Ile  Val Ser Val Gly Glu  Tyr
    1430                1435


<210>  295
<211>  1512
<212>  PRT
<213>  Bacteroides nordii

<400>  295
```

```
Met Lys Asn Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                  10                  15

Ala Val Ile Asn Ser Glu Glu Asp Gly Pro Ile Val Lys Lys Arg Ile
            20                  25                  30

Glu Leu Ala Gly Ser Arg Ile Ile Pro Met Asp Ala Ala Val Leu Gly
        35                  40                  45

Asn Phe Asp Ser Gly Val Thr Lys Ser Gln Thr Ala Glu Arg Thr Ser
    50                  55                  60

Phe Arg Ser Ile Arg Arg Leu Arg Glu Arg Gln Leu Leu Arg Arg Glu
65                  70                  75                  80

Arg Leu His Lys Val Leu Gln Ile Leu Gly Phe Leu Pro Glu His Tyr
                85                  90                  95

Val Asn Asp Ile Asp Phe Glu Asn His Pro Gly Lys Ile Lys Arg Asn
            100                 105                 110

Thr Glu Pro Lys Leu Pro Trp Arg Lys Asn Ser Met Gly Gln Phe Glu
        115                 120                 125

Phe Ile Phe Gln Asp Ser Phe Glu Ala Met Leu Thr Asp Phe Ala Thr
    130                 135                 140

His Gln Pro Val Phe Val Ser Glu Gly Lys Lys Val Pro Tyr Asp Trp
145                 150                 155                 160

Thr Leu Tyr Tyr Leu Arg Lys Lys Ala Leu Thr Glu Gly Ile Ser Lys
                165                 170                 175

Glu Glu Leu Ala Trp Leu Ile Leu Asn Phe Asn Gln Lys Arg Gly Tyr
            180                 185                 190

Tyr Gln Leu Arg Gly Glu Glu Glu Glu Glu Gln Ser Asn Lys Leu Val
        195                 200                 205
```

```
Glu Phe Tyr Ala Leu Arg Val Val Lys Val Glu Ala Thr Asp Asp Lys
    210                 215                 220

Lys Gly Lys Asp Thr Trp Tyr Asn Val His Leu Glu Asn Gly Trp Ile
225                 230                 235                 240

Tyr Arg Arg Thr Ser Asn Ile Pro Leu Asp Trp Glu Gly Lys Val Lys
                245                 250                 255

Glu Phe Ile Val Thr Thr Asp Leu Asn Glu Asp Gly Thr Pro Lys Leu
            260                 265                 270

Asp Lys Tyr Gly Glu Val Lys Arg Ser Phe Arg Ala Pro Lys Glu Asp
        275                 280                 285

Asp Trp Thr Leu Ile Lys Lys Lys Thr Glu Ser Asp Ile Ala Asn Ser
    290                 295                 300

His Lys Thr Val Gly Cys Tyr Ile Tyr Asp Ala Leu Leu Gln Asn Pro
305                 310                 315                 320

His Gln Lys Ile Lys Gly Arg Leu Val Arg Thr Val Glu Arg Lys Phe
                325                 330                 335

Tyr Lys Glu Glu Leu Arg Leu Ile Leu Glu Lys Gln Leu Ser Phe His
            340                 345                 350

Pro Glu Leu Gln Asp Arg Asp Leu Tyr Arg Ala Cys Ile Asp Ala Leu
        355                 360                 365

Tyr Val Ser Asn Glu Ala His Lys Asn Asn Ile Ser Gly Arg Asp Phe
    370                 375                 380

Val Tyr Leu Phe Ile Asp Asp Ile Ile Phe Tyr Gln Arg Pro Leu Lys
385                 390                 395                 400
```

```
Thr Lys Lys Ser Leu Ile Asp Asn Cys Pro Tyr Glu Glu Asn Gln Tyr
                405                 410                 415

Met Asp Arg Glu Thr Gly Glu Val Lys Gln Ala Pro Ile Lys Cys Ile
            420                 425                 430

Ala Lys Ser His Pro Leu Phe Gln Glu Phe Arg Leu Trp Gln Phe Ile
        435                 440                 445

Ser Asn Ile Arg Ile Tyr Gln Arg Glu Arg Val Leu Asp Asp Gly Lys
    450                 455                 460

Leu Glu Thr Asp Val Asp Val Thr Pro Asp Phe Leu Lys Thr Glu Asp
465                 470                 475                 480

Asp Tyr Thr Thr Leu Phe Glu Trp Phe Asn Asp Arg Lys Glu Val Asp
                485                 490                 495

Gln Lys Ala Phe Leu Lys Asn Pro Gln Phe Gly Leu Lys Lys Thr Phe
            500                 505                 510

Thr Glu Tyr Arg Trp Asn Tyr Val Glu Asp Lys Ser Tyr Pro Cys Asn
        515                 520                 525

Glu Thr Arg Asn Ala Ile Leu Asn Gly Leu Gln Lys Ala Gly Val Ser
    530                 535                 540

Ala Asp Phe Leu Ser Arg Glu Val Glu Glu Ala Leu Trp His Ile Leu
545                 550                 555                 560

Tyr Ser Val Glu Asp Lys Ile Glu Ile Glu Ser Ala Leu Arg Lys Phe
                565                 570                 575

Ala Ser Lys His Asp Leu Asp Asp Arg Phe Ala Asp Val Phe Lys Lys
            580                 585                 590

Leu Pro Pro Phe Lys Lys Glu Tyr Gly Ala Tyr Ser Ala Lys Ala Ile
        595                 600                 605
```

```
Lys Lys Leu Leu Pro Leu Met Arg Ile Gly Lys Tyr Trp Glu Leu Ser
    610                 615                 620

Asn Ile Asp Asp Lys Thr Lys Glu Arg Ile Asp Lys Ile Ile Thr Gly
625                 630                 635                 640

Glu Trp Asp Glu Asn Ile His Asp Arg Val Arg Glu Lys Ala Ile Lys
                645                 650                 655

Leu Ser Asp Ile Thr Asp Phe Lys Gly Leu Pro Leu Trp Leu Ser Cys
            660                 665                 670

Tyr Val Val Tyr Asn Arg His Ser Glu Ala Arg Ala Ile Ala Lys Trp
        675                 680                 685

Glu Ser Pro Glu Asp Ile Asp Ser Tyr Leu Arg Leu Phe Arg Gln His
    690                 695                 700

Ser Leu Arg Asn Pro Ile Val Glu Gln Val Ile Thr Glu Thr Leu Arg
705                 710                 715                 720

Thr Val Arg Asp Ile Trp Lys Arg Val Gly Gln Ile Asp Glu Ile His
                725                 730                 735

Val Glu Leu Gly Arg Glu Ile Lys Asn Pro Ala Asp Lys Arg Ala Lys
            740                 745                 750

Met Thr Ala Gln Ile Val Glu Asn Glu Asn Thr Asn Leu Arg Ile Lys
        755                 760                 765

Ala Leu Leu Ala Glu Phe Ile Asn Ser Glu Tyr Glu Ile Glu Asn Val
    770                 775                 780

Arg Pro Tyr Ser Ser Asn Gln Gln Glu Lys Leu Lys Ile Tyr Glu Asp
785                 790                 795                 800
```

```
Thr Val Leu Asn Gly Val Lys Glu Ile Pro Glu Asp Ile Asn Thr Ile
                805                 810                 815

Leu Lys Lys Phe Arg Glu Ser Asp Leu Lys Lys Arg Pro Thr Lys Ser
            820                 825                 830

Asp Phe Leu His Tyr Lys Leu Trp Leu Glu Gln Lys Tyr Cys Ser Pro
        835                 840                 845

Tyr Thr Gly Arg Ile Ile Pro Leu Gly Lys Leu Phe Thr Ser Ala Tyr
    850                 855                 860

Glu Ile Glu His Ile Ile Pro Gln Ala His Tyr Phe Asp Asp Ser Phe
865                 870                 875                 880

Ser Asn Lys Val Ile Cys Glu Ala Glu Val Asn Gly Leu Lys Asp Lys
                885                 890                 895

Lys Leu Gly Tyr Glu Phe Ile Lys His Asn Pro Gly Lys Met Val Glu
            900                 905                 910

Ile Gly Phe Gly Lys Pro Pro Val Arg Ile Phe Ser Val Glu Glu Tyr
        915                 920                 925

Glu Arg Phe Val Lys Glu Asn Tyr Ser Gly Ile Lys Asn Lys Met Asn
    930                 935                 940

Lys Leu Leu Met Asp Asp Ile Pro Glu Thr Phe Ile Glu Arg Gln Leu
945                 950                 955                 960

Asn Asp Ser Arg Tyr Ile Ser Lys Val Val Lys Ser Leu Leu Ser Asn
                965                 970                 975

Ile Val Arg Glu Lys Asp Ser Asn Gly Glu Tyr Glu Pro Glu Ala Ile
            980                 985                 990

Ser Lys Asn Val Ile Val Cys Thr  Gly Ser Val Thr Asp  Arg Leu Lys
        995                 1000                1005
```

```
Arg Asp  Trp Gly Val Asn Asp  Val Trp Asn Ser Ile  Ile Tyr Pro
    1010                1015                1020

Arg Phe  Glu Arg Leu Asn Glu  Leu Thr Gly Ser Gln  Gln Phe Gly
    1025                1030                1035

Cys Trp  Glu Asn Lys Glu Gly  Lys Arg Val Phe Gln  Thr Ala Val
    1040                1045                1050

Pro Leu  Glu Met Gln Lys Gly  Phe Ser Lys Lys Arg  Ile Asp His
    1055                1060                1065

Arg His  His Ala Met Asp Ala  Ile Val Ile Ala Cys  Ala Thr Arg
    1070                1075                1080

Asn His  Ile Asn Tyr Leu Ser  Asn Glu Ser Ala Ser  Lys Lys Ala
    1085                1090                1095

Lys Ile  Ser Arg Thr Asp Leu  Gln Arg Leu Leu Cys  Thr Lys Cys
    1100                1105                1110

Arg Thr  Asp Asp Asn Gly Asn  Tyr Lys Trp Ile Val  Lys Lys Pro
    1115                1120                1125

Trp Pro  Ala Phe Thr Gln Asp  Ile Arg Lys Ala Leu  Glu Asn Ile
    1130                1135                1140

Thr Val  Ser Phe Lys Gln Asn  Leu Arg Val Ile Asn  Lys Thr Thr
    1145                1150                1155

Asn Tyr  Tyr Val His Phe Asp  Glu Ser Gly Lys Lys  Val Leu Glu
    1160                1165                1170

Lys Gln  Ile Asn Gly Asp Ser  Trp Ala Ile Arg Lys  Pro Met His
    1175                1180                1185
```

```
Lys Asp  Thr Val Phe Gly Lys  Val Asn Leu Gln Lys  Val Lys Glu
    1190                1195                1200

Val Arg  Leu Ser Leu Ala Leu  Asp Thr Pro Lys Met  Ile Val Asp
    1205                1210                1215

Lys Lys  Leu Lys Glu Lys Val  Leu Gln Leu Tyr Ser  Tyr Lys Tyr
    1220                1225                1230

Asp Lys  Lys Arg Ile Asp Lys  Tyr Phe Lys Glu Asn  Ala Ser Leu
    1235                1240                1245

Trp Lys  Asp Leu Asn Leu Ser  Lys Val Ala Val Tyr  Tyr Phe Thr
    1250                1255                1260

Asn Asp  Ser Thr Glu Pro Leu  Val Ala Val Arg Lys  Pro Leu Asp
    1265                1270                1275

Thr Ser  Phe Asn Ala Lys Lys  Ile Lys Glu Ser Val  Thr Asp Thr
    1280                1285                1290

Gly Ile  Gln Lys Ile Leu Leu  Asn His Leu Ser Asn  Asn Gln Asp
    1295                1300                1305

Asp Pro  Asn Leu Ala Phe Ser  Pro Asp Gly Ile Asp  Lys Met Asn
    1310                1315                1320

Lys Asn  Leu Thr Ala Leu Asn  Asp Gly Lys Tyr His  Gln Pro Ile
    1325                1330                1335

Tyr Lys  Val Arg Val Cys Glu  Pro Gln Gly Asn Lys  Phe Ser Val
    1340                1345                1350

Gly Thr  Ser Gly Asn Lys Thr  Ser Lys Tyr Val Glu  Ala Ala Lys
    1355                1360                1365

Gly Thr  Asn Leu Phe Phe Ala  Val Tyr Gln Thr Glu  Asp Gly Lys
    1370                1375                1380
```

```
Arg Ser  Tyr Glu Thr Ile Pro  Leu Asn Val Val Ile  Glu Arg Glu
    1385                1390                1395


Lys Leu  Gly Trp Thr Pro Val  Pro Glu Asn Asn Asn  Asn Gly Asp
    1400                1405                1410


Lys Leu  Leu Phe Trp Leu Ser  Pro Asn Asp Leu Val  Tyr Val Pro
    1415                1420                1425


Thr Ala  Asp Glu Leu Asn Asn  Gly Met Arg Leu Asp  Asn Met Asp
    1430                1435                1440


Lys Gly  Arg Ile Tyr Lys Met  Ile Ser Cys Ser Gly  Pro Gln Cys
    1445                1450                1455


Phe Phe  Ile Pro Gln Asn Val  Ser Asn Ala Ile Ile  Pro Val Ile
    1460                1465                1470


Glu Leu  Gly Ala Asn Asn Lys  Ala Glu Lys Ser Trp  Asn Asn Glu
    1475                1480                1485


Met Ile  Lys Val Val Cys Val  Pro Ile Arg Val Asp  Arg Leu Gly
    1490                1495                1500


Cys Ile  Thr Gln Ile Asn Asn  Gln Lys
    1505                1510


<210>  296
<211>  779
<212>  PRT
<213>  Bacteroides oleiciplenus

<400>  296

Met Lys Glu Gly Asn Gln Tyr Asp Val Ala Cys Glu Tyr Ala Gly Tyr
1               5                  10                  15


Arg His Ser Lys Ser Ser Leu Thr Arg Glu Glu Ile Asp Asn Lys Val
```

```
            20                  25                  30

Leu Lys Asn Arg Leu Glu Ile Leu Pro Lys Asn Ser Leu Arg Asn Pro
        35                  40                  45

Val Val Glu Lys Ile Leu Asn Gln Met Val Asn Val Val Asn Ala Val
    50                  55                  60

Ile Asp Thr Tyr Gly Lys Pro Asp Glu Ile Arg Val Glu Leu Ala Arg
65                  70                  75                  80

Glu Leu Lys Lys Gly Ala Lys Glu Arg Glu Glu Leu Ala Lys Ser Ile
                85                  90                  95

Ala Gln Asn Thr Arg Glu His Glu Ala Ile Arg Gln Leu Leu Gln Thr
            100                 105                 110

Glu Phe Gly Met Met His Val Thr Arg Asn Asp Ile Ile Arg Tyr Lys
        115                 120                 125

Leu Tyr Glu Glu Leu Lys Asp Asn Gly Tyr Lys Thr Leu Tyr Ser Asp
    130                 135                 140

Gln Tyr Ile Pro Arg Glu Lys Val Phe Ser Lys Glu Ile Asp Ile Glu
145                 150                 155                 160

His Ile Ile Pro Gln Ala Arg Leu Phe Asp Asp Ser Leu Ser Asn Lys
                165                 170                 175

Thr Leu Glu Tyr Arg Ala Val Asn Ile Glu Lys Gly Asn Lys Thr Ala
            180                 185                 190

Tyr Asp Phe Val Lys Glu Lys Tyr Gly Asn Asp Gly Leu Arg Arg Tyr
        195                 200                 205

Leu Asn His Cys Glu Ala Leu Phe Lys Asp Lys Lys Thr Lys Leu Lys
    210                 215                 220
```

```
Lys Leu Lys Met Glu Asp Gln Asp Ile Pro Asp Gly Phe Ile Asp Arg
225                 230                 235                 240


Asp Leu Arg Asn Thr Gln Tyr Ile Ala Lys Lys Ala Leu Ser Met Leu
                245                 250                 255


Ser Glu Ile Ser Arg Arg Val Val Ala Thr Thr Gly Ser Ile Thr Asp
            260                 265                 270


Glu Leu Arg Lys Asp Trp Gln Leu Val Asp Ile Met Lys Glu Leu Asn
        275                 280                 285


Leu Pro Lys Tyr Glu Ala Leu Gly Phe Val Glu Thr Phe Lys Asp Lys
    290                 295                 300


Asp Gly Arg Ile Ile Lys Lys Ile Lys Asp Trp Ser Lys Arg Asn Asp
305                 310                 315                 320


His Arg His His Ala Met Asp Ala Leu Thr Val Ala Phe Thr Lys Asp
                325                 330                 335


Val Phe Ile Gln Tyr Phe Asn Asn Lys Asn Ala Phe Trp Met Ser Gly
            340                 345                 350


Ser Lys Glu His Ala Asn Ile Thr Ala Ile Lys Asn Lys Tyr Phe Glu
        355                 360                 365


Lys Gly Lys Ala Leu Ala Pro Ile Pro Leu Glu Leu Phe Arg Thr Glu
    370                 375                 380


Ala Lys His His Leu Glu Asn Ile Leu Val Ser Ile Lys Ala Lys Asn
385                 390                 395                 400


Lys Val Val Thr Asn Asn Ile Asn Arg Thr Lys Lys Lys Asn Gly Glu
                405                 410                 415


Asn Leu Lys Leu Gln Gln Thr Pro Arg Gly Gln Leu His Leu Glu Ser
```

```
            420                 425                 430

Ile Tyr Gly Ser Tyr Arg Gln Cys Ile Ile Arg Asp Glu Lys Val Asn
        435                 440                 445

Ala Ser Phe Asp Ala Ser Lys Ile Ala Asn Val Ser Lys Ser Ala Tyr
    450                 455                 460

Arg Asn Ala Leu Leu Lys Arg Leu Glu Ala Tyr Asp Asn Asp Pro Lys
465                 470                 475                 480

Lys Ala Phe Thr Gly Lys Asn Ser Leu Asp Lys Asn Pro Val Tyr Leu
                485                 490                 495

Asp Glu Asn Lys Met Glu Lys Val Pro Asp Arg Val Lys Ile Val Glu
            500                 505                 510

Phe Glu Thr Val Tyr Thr Ile Arg Lys Pro Ile Asp Pro Lys Leu Ser
        515                 520                 525

Ile Asp Lys Val Val Asp Ala Arg Ile Arg Thr Leu Leu Lys Lys Arg
    530                 535                 540

Leu Glu Glu Tyr Gly Gly Asp Ala Gln Arg Ala Phe Ser Asn Ile Glu
545                 550                 555                 560

Glu Asn Pro Ile Trp Leu Asn Lys Glu Lys Gly Ile Ser Val Lys Arg
                565                 570                 575

Val Ala Ile Arg Gly Ile Ser Asn Ala Gln Ala Leu His Asp Lys Lys
            580                 585                 590

Asp Lys Asp Gly Asn Pro Ile Leu Asp Lys Glu Gly Lys Gly Ile Pro
        595                 600                 605

Thr Asp Phe Val Asn Thr Ser Asn Asn His His Val Ala Ile Tyr Arg
    610                 615                 620
```

```
Lys Pro Val Val Asp Lys Met Gly Gln Val Ile Leu Asp Glu Asn Gly
625                 630                 635                 640


Ser Pro Arg Tyr Glu Leu Gly Glu Asp Val Ile Ser Phe Phe Glu Ala
                645                 650                 655


Val Ala Arg Val Asn Leu Arg Gln Pro Val Val Asp Lys Asp Tyr Lys
            660                 665                 670


Arg Ser Glu Gly Trp Gln Phe Leu Phe Ser Met Lys Gln Asn Glu Tyr
        675                 680                 685


Phe Val Phe Pro Asn Glu Lys Thr Gly Phe Asn Pro Lys Glu Ile Asp
    690                 695                 700


Leu Leu Asn Pro Glu Asn Tyr Ala Leu Ile Ser Pro Asn Leu Phe Arg
705                 710                 715                 720


Val Gln Lys Ile Gly Leu Asn Asp Tyr Thr Phe Arg His His Leu Glu
                725                 730                 735


Thr Ser Ile Gln Asn Asn Ser Asn Glu Leu Lys Phe Ile Thr Trp Ile
            740                 745                 750


Arg Cys Gly Lys Asn Gly Ile Asn Gly Val Ile Lys Val Arg Val Asn
        755                 760                 765


His Ile Gly Gln Ile Val Ser Met Gly Glu Tyr
    770                 775


<210>  297
<211>  653
<212>  PRT
<213>  Bacteroides oleiciplenus

<400>  297

Met Lys Lys Ile Leu Gly Leu Asp Leu Gly Ser Ser Ser Ile Gly Trp
1               5                   10                  15
```

```
Ala Leu Val Asn Glu Gly Ala Asn Asp Glu Glu Lys Ser Ser Ile Ile
            20                  25                  30

Lys Leu Gly Val Arg Val Asn Pro Leu Thr Val Asp Glu Ala Gln Asn
        35                  40                  45

Phe Glu Lys Gly Lys Ser Ile Thr Thr Asn Ala Asp Arg Thr Leu Lys
    50                  55                  60

Arg Gly Met Arg Arg Asn Leu Gln Arg Tyr Lys Gln Arg Arg Glu Ala
65                  70                  75                  80

Leu Val Glu Val Leu Lys Lys His Glu Phe Ile Thr Ala Gly Thr Leu
                85                  90                  95

Met Ser Glu Gln Gly Asn Lys Thr Thr Phe Glu Thr Tyr Arg Leu Arg
            100                 105                 110

Ala Lys Ala Val Glu Glu Glu Ile Ser Leu Glu Glu Phe Ala Arg Val
        115                 120                 125

Leu Leu Met Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Ala
    130                 135                 140

Lys Gly Asp Glu Asp Gly Val Leu Ile Asp Gly Met Asp Val Ala Lys
145                 150                 155                 160

Lys Leu Tyr Asp Glu Asp Leu Asn Pro Gly Glu Leu Cys Leu Gln Leu
                165                 170                 175

Leu Glu Ala Gly Lys Lys Thr Leu Pro Asp Phe Tyr Arg Ser Asp Leu
            180                 185                 190

Gln Asp Glu Phe Asp Lys Ile Trp Asn Phe Gln Lys Gln Phe Asn Pro
        195                 200                 205
```

```
Glu Ser Phe Cys Asp Thr Ala Lys Glu Glu Val Arg Gly Lys Asn Arg
    210                 215                 220

Thr Gln Thr Trp Thr Ile Leu Ser Lys Tyr Phe Val Trp Thr Glu Gly
225                 230                 235                 240

Asp Ser Val Trp Asn Asn Glu Glu Ala Arg Thr Glu Glu Arg Ile Lys
                245                 250                 255

Glu Tyr Lys Leu Val Gly Ile Lys Arg Thr Thr Lys Gly Tyr Glu Gln
            260                 265                 270

Lys Leu Glu Asn Tyr Arg Trp Arg Val Gln Ala Leu Ser Glu Gln Leu
        275                 280                 285

Asn Pro Glu Ile Ile Ala Ile Val Leu Gln Glu Ile Asn Gly Gln Ile
    290                 295                 300

Ser Ala Ser Ser Gly Tyr Leu Gly Ala Ile Ser Asp Arg Ser Lys Glu
305                 310                 315                 320

Leu Phe Phe Asn His Gln Thr Val Gly Gln Ser Leu Met Ser Glu Leu
                325                 330                 335

Asp Lys Asn Pro Asn Gly Ser Leu Arg Asn Lys Val Phe Tyr Arg Gln
            340                 345                 350

Asp Tyr Leu Asp Glu Phe Asn Thr Ile Trp Glu Lys Gln Ser Leu Tyr
        355                 360                 365

His Lys Glu Leu Thr Val Glu Leu Lys Lys Glu Ile Arg Asp Ile Ile
    370                 375                 380

Ile Phe Tyr Gln Arg Arg Leu Lys Ser Gln Lys Gly Leu Ile Ser Thr
385                 390                 395                 400

Cys Glu Phe Glu Gln Arg Glu Ile Ile Val Glu Lys Asp Gly Lys Arg
                405                 410                 415
```

```
Lys Thr Lys Ile Ile Gly Cys Lys Val Ile Pro Arg Ser His Pro Leu
            420                 425                 430

Phe Gln Glu Phe Lys Ile Trp Gln Thr Leu Asn Asp Val Glu Val Tyr
        435                 440                 445

Val Ala Asp Arg Arg Thr Lys Arg Lys Gln Asp Arg Lys Ser Thr Thr
    450                 455                 460

Leu Phe Ser Asp Thr Glu Asp Ile Leu Leu Val Glu Gly Lys Arg Tyr
465                 470                 475                 480

Leu Tyr Gln Glu Glu Lys Glu Leu Leu Ala Lys Glu Leu Phe Val Arg
                485                 490                 495

Glu Asn Met Lys Lys Ala Glu Val Leu Lys Leu Leu Phe Glu Asp Pro
            500                 505                 510

Lys Glu Leu Asp Leu Asn Phe Lys Gln Ile Asp Gly Asn Arg Thr Gly
        515                 520                 525

Phe Ala Leu Phe Ser Ala Tyr Ser Lys Met Ile Glu Lys Tyr Gly Tyr
    530                 535                 540

Glu Ser Val Asn Phe Lys Asn Ser Ala Asp Glu Ile Ile Glu Lys Leu
545                 550                 555                 560

Gln Ile Ile Phe Ala Asp Leu Gly Trp Asn Thr Glu Leu Phe Ser Ile
                565                 570                 575

Asp Leu Ser Lys Asp Asp Lys Glu Leu Glu Lys Gln Pro Tyr Phe Arg
            580                 585                 590

Leu Trp His Leu Leu Tyr Ser Phe Glu Gly Asp Asn Thr Pro Thr Gly
        595                 600                 605
```

```
Asn Gly Lys Leu Ile Glu Ala Leu Met Arg Leu Cys Ser Val Glu Lys
    610                 615                 620

Glu Tyr Ala Ser Val Leu Ala Asn Val Ser Phe Gln Glu Asp Tyr Gly
625                 630                 635                 640

Ser Leu Ser Ala Lys Ala Ile Lys Lys Tyr Tyr Leu Ile
                645                 650
```

<210> 298
<211> 1436
<212> PRT
<213> Bacteroides sp.

<400> 298

```
Met Lys Arg Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15

Ala Leu Val Asp Glu Ala Glu Asn Lys Asp Glu Arg Ser Ser Ile Val
            20                  25                  30

Lys Leu Gly Val Arg Val Asn Pro Leu Thr Val Asp Glu Leu Thr Asn
        35                  40                  45

Phe Glu Lys Gly Lys Ser Ile Thr Thr Asn Ala Asp Arg Thr Leu Lys
    50                  55                  60

Arg Gly Met Arg Arg Asn Leu Gln Arg Tyr Lys Leu Arg Arg Glu Thr
65                  70                  75                  80

Leu Met Glu Val Leu Lys Glu His Lys Leu Ile Thr Glu Asp Thr Ile
                85                  90                  95

Leu Ser Glu Asn Gly Asn Arg Thr Thr Phe Glu Thr Tyr Arg Leu Arg
            100                 105                 110

Ala Lys Ala Ala Thr Glu Lys Ile Ser Leu Glu Glu Phe Ala Arg Val
        115                 120                 125
```

```
Leu Leu Met Ile Asn Lys Lys Arg Gly Tyr Lys Ser Cys Arg Lys Ala
    130                 135                 140

Lys Gly Ala Glu Glu Gly Thr Leu Ile Asp Gly Met Asp Ile Ala Arg
145                 150                 155                 160

Glu Leu Tyr Asn Asn Asn Leu Thr Pro Gly Glu Leu Cys Leu Gln Leu
                165                 170                 175

Leu Asp Ala Gly Lys Lys Tyr Leu Pro Asp Phe Tyr Arg Ser Asp Leu
            180                 185                 190

Gln Asn Glu Leu Asp Arg Ile Trp Glu Lys Gln Lys Glu Tyr Tyr Pro
        195                 200                 205

Glu Ile Leu Thr Glu Val Leu Lys Glu Glu Leu Arg Gly Lys Lys Arg
    210                 215                 220

Asp Ala Val Trp Ala Ile Cys Ala Lys Ser Phe Val Trp Glu Glu Tyr
225                 230                 235                 240

Tyr Thr Glu Trp Asn Lys Glu Lys Gly Lys Thr Glu Gln Gln Glu Arg
                245                 250                 255

Glu His Lys Leu Glu Gly Ile Tyr Ser Lys Arg Lys Arg Asp Glu Ala
            260                 265                 270

Lys Arg Glu Asn Leu Gln Trp Arg Val Asn Gly Leu Lys Glu Lys Leu
        275                 280                 285

Ser Leu Glu Gln Leu Val Ile Val Leu Gln Glu Met Asn Ile Gln Ile
    290                 295                 300

Asn Asn Ser Ser Gly Tyr Leu Gly Ala Ile Ser Asp Arg Ser Lys Glu
305                 310                 315                 320

Leu Tyr Phe Asn Lys Gln Thr Val Gly Gln Tyr Gln Met Glu Met Leu
```

```
                325                 330                 335

Asp Lys Asn Pro Asn Ala Ser Leu Arg Asn Met Val Phe Tyr Arg Gln
            340                 345                 350

Asp Tyr Leu Asp Glu Phe Asn Thr Leu Trp Glu Lys Gln Ala Glu Tyr
        355                 360                 365

His Lys Glu Leu Thr Gly Glu Leu Lys Lys Glu Ile Arg Asp Ile Val
    370                 375                 380

Ile Phe Tyr Gln Arg Arg Leu Lys Ser Gln Lys Gly Leu Val Gly Phe
385                 390                 395                 400

Cys Glu Phe Glu Ser Arg Gln Ile Glu Val Glu Ile Asp Gly Lys Lys
                405                 410                 415

Lys Ile Lys Thr Val Gly Asn Arg Val Ile Pro Arg Ser Ser Pro Leu
            420                 425                 430

Phe Gln Glu Phe Lys Ile Trp Gln Ile Leu Asn Asn Ile Glu Val Thr
        435                 440                 445

Val Val Gly Lys Lys Gly Lys Arg Arg Lys Gln Lys Asp Asn Ser Pro
    450                 455                 460

Thr Leu Phe Asp Gly Leu Asp Asp Thr Glu Gln Leu Glu Leu Asn Gly
465                 470                 475                 480

Ser Arg Tyr Leu Tyr Gln Glu Glu Lys Glu Leu Leu Ala Gln Glu Leu
                485                 490                 495

Phe Val Arg Asp Lys Met Thr Lys Ser Asp Val Leu Lys Leu Leu Phe
            500                 505                 510

Asp Asn Pro Gln Glu Leu Asp Leu Asn Phe Lys Thr Ile Asp Gly Asn
        515                 520                 525
```

```
Lys Thr Gly Tyr Thr Leu Phe Gln Ala Tyr Ser Lys Met Ile Glu Met
    530                 535                 540

Ser Gly His Glu Pro Val Asp Phe Lys Lys Thr Val Glu Lys Val Val
545                 550                 555                 560

Glu His Val Lys Ala Val Phe Asp Leu Leu Asn Trp Asn Thr Asp Ile
                565                 570                 575

Leu Gly Phe Asn Ser Asn Glu Glu Leu Asp Asn Gln Ser Tyr Tyr Lys
            580                 585                 590

Leu Trp His Leu Leu Tyr Ser Phe Glu Gly Asp Asn Thr Pro Thr Gly
        595                 600                 605

Asn Ala Arg Leu Val Gln Lys Ile Thr Glu Leu Tyr Gly Phe Glu Lys
    610                 615                 620

Glu Tyr Ala Ile Ile Leu Ala Asn Val Thr Phe Gln Asp Asp Tyr Gly
625                 630                 635                 640

Ser Leu Ser Ala Lys Ala Ile His Lys Ile Leu Pro His Leu Lys Glu
                645                 650                 655

Gly Asn Arg Tyr Asp Val Ala Cys Ala Tyr Ala Gly Tyr Lys His Ser
            660                 665                 670

Glu Ser Ser Leu Thr Lys Glu Glu Ile Ala Asn Lys Ala Leu Lys Asp
        675                 680                 685

Arg Leu Thr Leu Leu Pro Lys Asn Asn Leu Arg Asn Pro Val Val Glu
    690                 695                 700

Lys Ile Leu Asn Gln Met Val Asn Val Ile Asn Ala Ile Ile Asp Thr
705                 710                 715                 720

Tyr Gly Lys Pro Asp Glu Ile Arg Val Glu Leu Ala Arg Glu Leu Lys
```

```
                725                 730                 735

Lys Asn Ala Lys Glu Arg Glu Glu Leu Thr Lys Phe Ile Ala Glu Thr
            740                 745                 750

Thr Arg Lys His Glu Glu Phe Lys Ile Leu Leu Gln Ser Glu Phe Gly
        755                 760                 765

Leu Thr Asn Val Ser Arg Thr Asp Ile Leu Arg Tyr Lys Leu Tyr Lys
    770                 775                 780

Glu Leu Glu Ser Cys Gly Tyr Lys Thr Leu Tyr Ser Asn Thr Tyr Ile
785                 790                 795                 800

Pro Arg Glu Lys Leu Phe Ser Lys Glu Phe Asp Ile Glu His Ile Ile
                805                 810                 815

Pro Gln Ala Arg Leu Phe Asp Asp Ser Phe Ser Asn Lys Thr Leu Glu
            820                 825                 830

Ala Arg Ser Ile Asn Leu Glu Lys Gly Asn Lys Thr Ala Tyr Asp Phe
        835                 840                 845

Val Lys Glu Lys Phe Gly Glu Ser Gly Ala Asp Asn Ser Leu Asp His
    850                 855                 860

Tyr Leu Asn Asn Ile Glu Asp Leu Phe Lys Ser Gly Lys Ile Ser Lys
865                 870                 875                 880

Thr Lys Tyr Asn Lys Leu Lys Met Ala Glu Gln Asp Ile Pro Asp Gly
                885                 890                 895

Phe Ile Asn Arg Asp Leu Arg Asn Thr Gln Tyr Ile Ala Lys Lys Ala
            900                 905                 910

Leu Ser Met Leu Asn Glu Ile Ser Arg Arg Val Val Ala Thr Ser Gly
        915                 920                 925
```

```
Thr Ile Thr Asp Lys Leu Arg Gln Asp Trp Gln Leu Val Asp Val Met
    930                 935                 940

Lys Glu Leu Asn Trp Glu Lys Tyr Lys Ala Leu Gly Leu Val Glu Tyr
945                 950                 955                 960

Phe Glu Asp Lys Asp Gly Arg Gln Ile Gly Arg Ile Lys Asp Trp Thr
                965                 970                 975

Lys Arg Asn Asp His Arg His His Ala Met Asp Ala Leu Thr Val Ala
            980                 985                 990

Phe Thr Lys Asp Ile Phe Ile Gln  Tyr Phe Asn Asn Lys  Asn Ala Ser
        995                 1000                1005

Leu Asn  Ser Asn Thr Asn Glu  Tyr Ala Ile Lys Asn  Lys Tyr Phe
    1010                1015                1020

Gln Asn  Gly Arg Ala Ile Ala  Pro Ile Pro Leu Arg  Glu Phe Arg
    1025                1030                1035

Val Glu  Ala Lys Lys His Leu  Glu Asn Thr Leu Ile  Ser Ile Lys
    1040                1045                1050

Ala Lys  Asn Lys Val Val Thr  Gly Asn Ile Asn Lys  Thr Lys Lys
    1055                1060                1065

Arg Gly  Gly Val Asn Lys Tyr  Leu Gln Gln Thr Pro  Arg Gly Gln
    1070                1075                1080

Leu His  Leu Glu Thr Ile Tyr  Gly Ser Gly Lys Gln  Tyr Leu Thr
    1085                1090                1095

Lys Glu  Glu Lys Val Asn Ala  Ser Phe Asp Met Lys  Lys Ile Ala
    1100                1105                1110

Thr Val  Ser Lys Ser Ala Tyr  Arg Asp Val Leu Leu  Lys Arg Leu
```

```
    1115                1120                1125

His Glu  Asn Asp Asn Asp Pro  Lys Lys Ala Phe Thr  Gly Lys Asn
    1130                1135                1140

Ser Leu  Asp Lys Gln Pro Ile  Trp Leu Asp Lys Glu  Gln Thr Arg
    1145                1150                1155

Lys Val  Pro Glu Lys Val Lys  Thr Val Thr Leu Glu  Thr Ile Tyr
    1160                1165                1170

Thr Val  Arg Lys Glu Ile Ser  Pro Asp Leu Lys Val  Asp Lys Val
    1175                1180                1185

Ile Asp  Ala Gly Val Arg Lys  Ile Leu Thr Gly Arg  Leu Asn Glu
    1190                1195                1200

Tyr Gly  Asn Asp Ala Lys Lys  Ala Phe Ser Asn Leu  Asp Glu Asn
    1205                1210                1215

Pro Ile  Trp Leu Asn Lys Glu  Lys Gly Ile Ser Ile  Lys Arg Val
    1220                1225                1230

Thr Ile  Ser Gly Ile Ser Asn  Ala Gln Ser Leu His  Val Lys Lys
    1235                1240                1245

Asp Lys  Asp Gly Lys Pro Ile  Leu Asp Glu Asp Ser  Arg Asn Ile
    1250                1255                1260

Pro Val  Asp Phe Val Asn Thr  Gly Asn Asn His His  Val Ala Val
    1265                1270                1275

Tyr Arg  Arg Pro Val Ile Asp  Lys Arg Gly Gln Leu  Val Ile Asp
    1280                1285                1290

Glu Ala  Gly Asn Pro Lys Tyr  Glu Leu Glu Glu Val  Val Val Ser
    1295                1300                1305
```

```
Phe Phe  Glu Ala Val Thr Arg  Ala Asn Leu Gly Gln  Pro Ile Ile
    1310                1315                1320


Asp Lys  Asp Tyr Lys Thr Ser  Glu Gly Trp Gln Phe  Leu Phe Ser
    1325                1330                1335


Met Lys  Gln Asn Glu Tyr Phe  Val Phe Pro Asn Glu  Lys Thr Gly
    1340                1345                1350


Phe Asn  Pro Lys Glu Ile Asp  Leu Leu Asp Ala Glu  Asn Tyr Gly
    1355                1360                1365


Val Ile  Ser Pro Asn Leu Phe  Arg Val Gln Lys Phe  Ala His Lys
    1370                1375                1380


Asn Tyr  Val Phe Arg His His  Leu Glu Thr Thr Ile  Lys Asp Thr
    1385                1390                1395


Ser Ser  Ile Leu Lys Gly Ile  Thr Trp Ile Asp Phe  Arg Ser Ser
    1400                1405                1410


Lys Gly  Leu Asp Ala Ile Val  Lys Val Arg Val Asn  His Ile Gly
    1415                1420                1425


Gln Ile  Val Ser Val Gly Glu  Tyr
    1430                1435


<210>  299
<211>  1510
<212>  PRT
<213>  Bacteroides sp.

<400>  299

Met Lys Arg Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                  10                  15


Ala Leu Val Asp Ser Glu Glu Gln Arg Ile Leu Gly Met Gly Ser Arg
            20                  25                  30
```

```
Ile Ile Pro Met Asp Gln Gly Val Leu Asp Thr Phe Ser Gly Gly Asn
        35                  40                  45

Pro Val Glu Thr Gln Thr Ala Ala Arg Thr Ala Tyr Arg Gly Thr Arg
    50                  55                  60

Arg Leu Arg Glu Arg Ala Leu Leu Arg Arg Glu Arg Leu Ile Arg Val
65                  70                  75                  80

Leu Asn Met Met Lys Phe Leu Pro Glu His Tyr Ala Ser Gln Ile Asp
                85                  90                  95

Phe Glu Lys Arg Leu Gly Gln Phe Phe Asp Glu Lys Glu Pro Lys Leu
            100                 105                 110

Ala Trp Lys Gln Asn Asp Glu Gly Arg Phe Glu Phe Ile Phe Gln Gln
        115                 120                 125

Ser Phe Asn Glu Met Ile Glu Glu Phe Lys Asn Lys Gly Val Val Arg
    130                 135                 140

Glu Asp Lys Lys Ile Pro Tyr Asp Trp Thr Ile Tyr Tyr Leu Arg Lys
145                 150                 155                 160

Lys Ala Leu Ser Gln Glu Ile Glu Lys Glu Glu Leu Ala Trp Ile Leu
                165                 170                 175

Leu Asn Phe Asn Gln Lys Arg Gly Tyr Tyr Gln Leu Arg Gly Glu Glu
            180                 185                 190

Glu Glu Glu Asn Pro Asn Lys Leu Val Glu Tyr Tyr Ser Leu Lys Ile
        195                 200                 205

Val Asp Val Ile Ala Asp Glu Lys Pro Asn Ser Lys Gly Asp Ile Trp
    210                 215                 220
```

```
Tyr Ser Leu His Leu Glu Asn Gly Trp Ile Tyr Arg Arg Ser Ser Lys
225                 230                 235                 240

Ile Pro Leu Phe Gly Trp Lys Asp Lys Thr Arg Asp Phe Ile Val Thr
                245                 250                 255

Thr Asp Leu Asn Asp Asp Gly Thr Val Lys Lys Asp Lys Glu Gly Ile
            260                 265                 270

Glu Lys Arg Ser Phe Arg Ala Pro Ser Glu Asn Asp Trp Val Leu Leu
        275                 280                 285

Lys Lys Lys Thr Glu Ser Asp Ile Glu Lys Ser His Lys Thr Val Gly
    290                 295                 300

Ala Tyr Val Tyr Glu Thr Leu Leu Gln Asn Pro Met Gln Lys Val Arg
305                 310                 315                 320

Gly Lys Leu Val Arg Thr Ile Glu Arg Lys Phe Tyr Lys Asp Glu Leu
                325                 330                 335

Lys Gln Ile Leu Glu Lys Gln Arg Glu Phe His Pro Glu Leu Arg Asp
            340                 345                 350

Glu Asp Leu Tyr Asn Asp Cys Val Arg Glu Leu Tyr Arg Ser Asn Glu
        355                 360                 365

Thr Tyr Gln Phe Ile Leu Ser Lys Arg Asp Phe Val His Leu Phe Leu
    370                 375                 380

Asp Asp Ile Leu Phe Tyr Gln Arg Pro Leu Arg Ser Gln Lys Ser Ala
385                 390                 395                 400

Ile Gly Asp Cys Ile Leu Glu Phe Lys Thr Tyr Lys Asp Lys Asp Gly
                405                 410                 415

Asn Asn Ile Lys Glu Tyr Leu Lys Val Ile Ser Lys Ser Asn Pro Leu
            420                 425                 430
```

```
Tyr Gln Glu Phe Arg Ile Trp Gln Trp Leu Tyr Asn Leu Lys Ile Tyr
        435                 440                 445

Arg Lys Glu Asp Asp Glu Asp Val Thr Leu Gln Phe Ile Ala Asn Ile
    450                 455                 460

Glu Asp Lys Glu Gln Leu Phe Asp Phe Leu Ser Asn Arg Lys Ser Ile
465                 470                 475                 480

Glu Gln Lys Pro Leu Leu Glu Tyr Leu Ile Lys Ala Lys Gly Leu Lys
                485                 490                 495

Lys Gln Val Lys Thr Glu Ala Tyr Arg Trp Asn Tyr Val Glu Asp Lys
            500                 505                 510

Ile Tyr Pro Cys Ser Glu Thr Lys Thr Met Ile Ser Thr Arg Leu Ala
        515                 520                 525

Lys Val Glu Asn Ile Pro Asp Asn Phe Phe Thr Lys Glu Ile Glu Gln
    530                 535                 540

Lys Leu Trp His Ile Ile Tyr Ser Val Thr Asp Lys Asn Glu Phe Glu
545                 550                 555                 560

Lys Ala Leu Arg Thr Phe Ala Lys Lys Tyr Asp Leu Asp Ile Ala Ser
                565                 570                 575

Phe Val Asp Asn Phe Lys Lys Ile Pro Pro Phe Lys Asn Glu Tyr Gly
            580                 585                 590

Ser Phe Ser Glu Lys Ala Ile Lys Lys Leu Leu Pro Leu Met Arg Leu
        595                 600                 605

Gly Lys Tyr Trp Lys Trp Asn Asp Ile Asp Asn Asn Thr Gln Asn Arg
    610                 615                 620
```

```
Ile Ser Lys Ile Ile Thr Gly Glu Tyr Asp Glu Glu Ile Lys Asp Ile
625                 630                 635                 640

Val Arg Glu Lys Ser Ile Ala Leu Thr Asn Glu Asn Asp Phe Gln Gly
                645                 650                 655

Leu Gln Leu Trp Leu Ala Gln Tyr Leu Val Tyr Gly Arg His Ser Glu
            660                 665                 670

Ala Asp Ile Ala Gly Lys Trp His Ser Val Ala Asp Leu Glu Lys Tyr
        675                 680                 685

Leu Asn Glu Phe Lys Gln His Ser Leu Arg Asn Pro Ile Val Glu Gln
    690                 695                 700

Ile Ile Thr Glu Thr Leu Arg Val Val Arg Asp Ile Trp Arg Lys Tyr
705                 710                 715                 720

Gly Gln Gly Ala Glu Asn Phe Phe Ser Glu Ile His Val Glu Leu Gly
                725                 730                 735

Arg Asp Met Lys Asn Thr Ala Asp Glu Arg Lys Lys Ile Val Asn Val
            740                 745                 750

Val Thr Glu Asn Glu Asn Thr Asn Leu Arg Ile Lys Ala Leu Leu Met
        755                 760                 765

Glu Leu Lys Asn Asn Ser Asp Gly Lys Leu Glu Val Glu Asn Val Arg
    770                 775                 780

Pro Tyr Ser Pro Thr Gln Gln Asp Ile Leu Lys Ile Tyr Glu Glu Tyr
785                 790                 795                 800

Ala Ile Ser Thr Gly Leu Asp Asn Glu Lys Asp Glu Lys Val Lys Glu
                805                 810                 815

Asp Ile Lys Lys Ile Ser Arg Val Ala Gln Pro Thr Thr Thr Glu Leu
            820                 825                 830
```

```
Gln Arg Tyr Lys Leu Trp Leu Glu Gln Lys Tyr Cys Ser Pro Tyr Thr
        835                 840                 845

Gly Lys Val Ile Pro Leu Gly Lys Leu Phe Thr Glu Glu Tyr Gln Ile
    850                 855                 860

Glu His Ile Ile Pro Lys Ser Arg Tyr Tyr Asp Asp Ser Phe Ser Asn
865                 870                 875                 880

Lys Val Ile Cys Glu Ala Ala Val Asn Lys Leu Lys Asp Lys Cys Leu
                885                 890                 895

Gly Leu Glu Phe Ile Lys Asn Tyr His Gly Gln Ile Val Glu Thr Gly
            900                 905                 910

Phe Gly Gln Lys Val Thr Ile Phe Asp Glu Glu Ala Tyr Gln Asn Phe
        915                 920                 925

Val Lys Gln His Tyr Ala Tyr Asn Arg Ser Lys Arg Thr Lys Leu Leu
    930                 935                 940

Leu Glu Glu Ile Pro Glu Lys Met Ile Glu Arg Gln Met Asn Asp Thr
945                 950                 955                 960

Arg Tyr Ile Ser Lys Phe Val Leu Pro Leu Leu Ser Asn Leu Val Arg
                965                 970                 975

Ala Glu Glu Asn Asp Asn Gly Val Asn Ser Lys Asn Val Leu Pro Val
            980                 985                 990

Asn Gly Lys Ile Thr Thr Met Leu  Lys Gln Asp Trp Gly  Leu Asn Asp
        995                 1000                1005

Val Trp  Asn Asp Leu Ile Leu  Pro Arg Phe Val Arg  Met Asn Glu
    1010                1015                1020
```

```
Leu Ala  Lys Thr Ile Ala Phe  Thr Ser Trp Asn Glu  Gln His Gln
    1025                1030                1035

Lys Tyr  Leu Pro Thr Val Pro  Leu Glu Leu Ser Lys  Gly Phe Gln
    1040                1045                1050

Lys Lys  Arg Ile Asp His Arg  His His Ala Met Asp  Ala Leu Val
    1055                1060                1065

Ile Ala  Cys Ala Thr Arg Asp  His Val Asn Leu Leu  Asn Asn Lys
    1070                1075                1080

His Ala  Asn Thr Asp Thr Ile  Arg Tyr Asp Leu Gln  Arg Lys Leu
    1085                1090                1095

Arg Leu  Phe Glu Arg Val Thr  Tyr Ile Asp Pro Gln  Thr Lys Asn
    1100                1105                1110

Asn Val  Thr Lys Asp Ile Pro  Lys Glu Phe Lys Lys  Pro Trp Asp
    1115                1120                1125

Asn Phe  Thr Val Asp Ala Arg  Asn Glu Leu Glu Lys  Ile Ile Val
    1130                1135                1140

Ser Phe  Lys Gln Asn Leu Arg  Ile Ile Asn Lys Ala  Thr Asn Ile
    1145                1150                1155

Tyr Thr  Lys Tyr Glu Asn Gly  Lys Lys Ile Lys Val  Gly Gln Lys
    1160                1165                1170

Gly Leu  Asn Trp Ala Ile Arg  Lys Pro Leu His Lys  Glu Thr Val
    1175                1180                1185

Phe Ala  Lys Val Ser Leu Arg  Lys Arg Lys Thr Val  Arg Leu Ser
    1190                1195                1200

Glu Ala  Leu Lys Asp Trp Lys  Lys Ile Val Asp Lys  Lys Leu Lys
    1205                1210                1215
```

```
Gln Glu  Ile Lys Arg Leu Thr  Cys Gln Tyr Gly Lys  Phe Asp Val
    1220                1225                1230

Asp Thr  Ile Leu Arg Tyr Phe  Lys Asp Arg Lys Tyr  Gln Phe Gly
    1235                1240                1245

Glu Val  Asp Val Ser Lys Val  Lys Met Tyr Tyr Phe  Asp Glu Glu
    1250                1255                1260

Asn Ala  Ala Val Arg Lys Asn  Val Asp Thr Ser Phe  Thr Glu Lys
    1265                1270                1275

Phe Ile  Gln Gly Ser Val Thr  Asp Thr Gly Ile Gln  Lys Ile Leu
    1280                1285                1290

Leu Asn  His Leu Glu Ala Lys  Gly Asn Lys Val Glu  Ile Ala Phe
    1295                1300                1305

Ser Pro  Glu Gly Ile Glu Glu  Met Asn Lys Asn Ile  Ile Gln Leu
    1310                1315                1320

Asn Glu  Gly Lys Leu His Leu  Pro Ile Phe Lys Val  Arg Val Tyr
    1325                1330                1335

Glu Thr  Ile Gly Asn Lys Phe  Ser Val Gly Val Lys  Gly Asn Lys
    1340                1345                1350

Lys Asp  Lys Tyr Val Glu Ala  Ala Lys Gly Thr Asn  Leu Phe Phe
    1355                1360                1365

Ala Ile  Tyr Val Asp Glu Asn  Gly Ile Arg Ser Tyr  Glu Thr Ile
    1370                1375                1380

Pro Leu  Asn Ile Val Ile Glu  Arg Leu Lys Gln Gly  Leu Ser Val
    1385                1390                1395
```

```
Val Pro  Glu Lys Asn Arg Lys  Glu His Ser Leu Leu  Phe Tyr Leu
    1400                1405                1410


Ser Pro  Asn Asp Leu Val Tyr  Val Pro Ile Glu Asp  Glu Arg Glu
    1415                1420                1425


Asn Ile  His Ala Val Asn Leu  Asp Gln Leu Asn Asn  Glu Gln Arg
    1430                1435                1440


Lys Arg  Ile Tyr Lys Met Val  Ser Cys Thr Gly Ser  Glu Cys His
    1445                1450                1455


Phe Val  Pro Tyr Tyr Val Ala  Ser Pro Ile Val Asn  Lys Val Glu
    1460                1465                1470


Tyr Ser  Ser Leu Asn Lys Ile  Gly Arg Ser Leu Thr  Gly Glu Met
    1475                1480                1485


Ile Lys  Asp Val Cys Ile Lys  Leu Lys Val Asp Arg  Leu Gly Asn
    1490                1495                1500


Val Lys  Gly Ile Ser Gly Leu
    1505                1510


<210>  300
<211>  1436
<212>  PRT
<213>  Bacteroides sp.

<400>  300

Met Lys Arg Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                  10                  15


Ala Leu Val Asn Glu Ala Glu Asn Lys Asp Glu Arg Ser Ser Ile Val
            20                  25                  30


Lys Leu Gly Val Arg Val Asn Pro Leu Thr Val Asp Glu Leu Thr Asn
        35                  40                  45
```

```
Phe Glu Lys Gly Lys Ser Ile Thr Thr Asn Ala Asp Arg Thr Leu Lys
    50                  55                  60

Arg Gly Met Arg Arg Asn Leu Gln Arg Tyr Lys Leu Arg Arg Glu Thr
65                  70                  75                  80

Leu Thr Glu Val Leu Lys Glu His Lys Leu Ile Thr Glu Asp Thr Ile
                85                  90                  95

Leu Ser Glu Asn Gly Asn Arg Thr Thr Phe Glu Thr Tyr Arg Leu Arg
            100                 105                 110

Ala Lys Ala Val Thr Glu Glu Ile Ser Leu Glu Glu Phe Ala Arg Val
        115                 120                 125

Leu Leu Met Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Ala
    130                 135                 140

Lys Gly Val Glu Glu Gly Thr Leu Ile Asp Gly Met Asp Ile Ala Arg
145                 150                 155                 160

Glu Leu Tyr Asn Asn Asn Leu Thr Pro Gly Glu Leu Cys Leu Gln Leu
                165                 170                 175

Leu Asp Ala Gly Lys Lys Phe Leu Pro Asp Phe Tyr Arg Ser Asp Leu
            180                 185                 190

Gln Asn Glu Leu Asp Arg Ile Trp Glu Lys Gln Lys Glu Tyr Tyr Pro
        195                 200                 205

Glu Ile Leu Thr Asp Val Leu Lys Glu Glu Leu Arg Gly Lys Lys Arg
    210                 215                 220

Asp Ala Val Trp Ala Ile Cys Ala Lys Tyr Phe Val Trp Lys Glu Thr
225                 230                 235                 240

Tyr Thr Glu Trp Asn Lys Glu Lys Gly Lys Thr Glu Gln Gln Glu Arg
```

```
                245                 250                 255

Glu His Lys Leu Glu Gly Ile Tyr Ser Lys Arg Lys Arg Asp Glu Ala
            260                 265                 270

Lys Arg Glu Asn Leu Gln Trp Arg Val Asn Gly Leu Lys Glu Lys Leu
        275                 280                 285

Ser Leu Glu Gln Leu Val Ile Val Phe Gln Glu Met Asn Thr Gln Ile
    290                 295                 300

Asn Asn Ser Ser Gly Tyr Leu Gly Ala Ile Ser Asp Arg Ser Lys Glu
305                 310                 315                 320

Leu Tyr Phe Asn Lys Gln Thr Val Gly Gln Tyr Gln Met Glu Met Leu
                325                 330                 335

Asp Lys Asn Pro Asn Ala Ser Leu Arg Asn Met Val Phe Tyr Arg Gln
            340                 345                 350

Asp Tyr Leu Asp Glu Phe Asn Met Leu Trp Glu Lys Gln Ala Val Tyr
        355                 360                 365

His Lys Glu Leu Thr Glu Glu Leu Lys Lys Glu Ile Arg Asp Ile Ile
    370                 375                 380

Ile Phe Tyr Gln Arg Arg Leu Lys Ser Gln Lys Gly Leu Ile Gly Phe
385                 390                 395                 400

Cys Glu Phe Glu Ser Arg Gln Ile Glu Val Asp Ile Asp Gly Lys Lys
                405                 410                 415

Lys Ile Lys Thr Val Gly Asn Arg Val Ile Ser Arg Ser Ser Pro Leu
            420                 425                 430

Phe Gln Glu Phe Lys Ile Trp Gln Ile Leu Asn Asn Ile Glu Val Thr
        435                 440                 445
```

```
Val Val Gly Lys Lys Arg Lys Arg Arg Lys Leu Lys Glu Asn Tyr Ser
    450                 455                 460

Ala Ile Phe Glu Glu Leu Asn Asp Ala Glu Gln Leu Glu Leu Asn Gly
465                 470                 475                 480

Ser Arg Arg Leu Cys Gln Glu Glu Lys Glu Leu Leu Ala Gln Glu Leu
                485                 490                 495

Phe Val Arg Asp Lys Met Thr Lys Ser Glu Val Leu Lys Leu Leu Phe
            500                 505                 510

Asp Asn Pro Gln Glu Leu Asp Leu Asn Phe Lys Thr Ile Asp Gly Asn
        515                 520                 525

Lys Thr Gly Tyr Ala Leu Phe Gln Ala Tyr Ser Lys Met Ile Glu Met
    530                 535                 540

Ser Gly His Glu Pro Val Asp Phe Lys Lys Pro Val Glu Lys Val Val
545                 550                 555                 560

Glu Tyr Ile Lys Ala Val Phe Asp Leu Leu Asn Trp Asn Thr Asp Ile
                565                 570                 575

Leu Gly Phe Asn Ser Asn Glu Glu Leu Asp Asn Gln Ser Tyr Tyr Lys
            580                 585                 590

Leu Trp His Leu Leu Tyr Ser Phe Glu Gly Asp Asn Thr Pro Thr Gly
        595                 600                 605

Asn Gly Arg Leu Ile Gln Lys Met Thr Glu Leu Tyr Gly Phe Glu Lys
    610                 615                 620

Glu Tyr Ala Thr Ile Leu Ala Asn Val Ser Phe Gln Asp Asp Tyr Gly
625                 630                 635                 640

Ser Leu Ser Ala Lys Ala Ile His Lys Ile Leu Pro His Leu Lys Glu
```

```
                645                 650                 655

Gly Asn Arg Tyr Asp Val Ala Cys Val Tyr Ala Gly Tyr Arg His Ser
            660                 665                 670

Glu Ser Ser Leu Thr Arg Glu Glu Ile Ala Asn Lys Val Leu Lys Asp
        675                 680                 685

Arg Leu Met Leu Leu Pro Lys Asn Ser Leu His Asn Pro Val Val Glu
    690                 695                 700

Lys Ile Leu Asn Gln Met Val Asn Val Ile Asn Val Ile Ile Asp Ile
705                 710                 715                 720

Tyr Gly Lys Pro Asp Glu Ile Arg Val Glu Leu Ala Arg Glu Leu Lys
                725                 730                 735

Lys Asn Ala Lys Glu Arg Glu Glu Leu Thr Lys Ser Ile Ala Gln Thr
            740                 745                 750

Thr Lys Ala Asn Glu Glu Tyr Lys Thr Leu Leu Gln Thr Glu Phe Gly
        755                 760                 765

Leu Thr Asn Val Ser Arg Thr Asp Ile Leu Arg Tyr Lys Leu Tyr Lys
    770                 775                 780

Glu Leu Glu Ser Cys Gly Tyr Lys Thr Leu Tyr Ser Asn Thr Tyr Ile
785                 790                 795                 800

Ser Arg Glu Lys Leu Phe Ser Lys Glu Phe Asp Ile Glu His Ile Ile
                805                 810                 815

Pro Gln Ala Arg Leu Phe Asp Asp Ser Phe Ser Asn Lys Thr Leu Glu
            820                 825                 830

Ala Arg Ser Val Asn Ile Glu Lys Gly Asn Lys Thr Ala Tyr Asp Phe
        835                 840                 845
```

```
Val Lys Glu Lys Phe Gly Glu Ser Gly Ala Asp Asn Ser Leu Glu His
    850                 855                 860

Tyr Leu Asn Asn Ile Glu Asp Leu Phe Lys Ser Gly Lys Ile Ser Lys
865                 870                 875                 880

Thr Lys Tyr Asn Lys Leu Lys Met Ala Glu Gln Asp Ile Pro Asp Gly
                885                 890                 895

Phe Ile Glu Arg Asp Leu Arg Asn Thr Gln Tyr Ile Ala Lys Lys Ala
            900                 905                 910

Leu Ser Met Leu Asn Glu Ile Ser His Arg Val Val Ala Thr Ser Gly
        915                 920                 925

Ser Val Thr Asp Lys Leu Arg Glu Asp Trp Gln Leu Ile Asp Val Met
    930                 935                 940

Lys Glu Leu Asn Trp Glu Lys Tyr Lys Ala Leu Gly Leu Val Glu Tyr
945                 950                 955                 960

Phe Glu Asp Arg Asp Gly Arg Gln Ile Gly Arg Ile Lys Asp Trp Thr
                965                 970                 975

Lys Arg Asn Asp His Arg His His Ala Met Asp Ala Leu Thr Val Ala
            980                 985                 990

Phe Thr Lys Asp Val Phe Ile Gln  Tyr Phe Asn Asn Lys  Asn Ala Ser
        995                 1000                1005

Leu Asp  Pro Asn Ala Asn Glu  His Ala Ile Lys Asn  Lys Tyr Phe
    1010                1015                1020

Gln Asn  Gly Arg Ala Ile Ala  Pro Met Pro Leu Arg  Glu Phe Arg
    1025                1030                1035

Ala Glu  Ala Lys Lys His Leu  Glu Asn Thr Leu Ile  Ser Ile Lys
```

```
    1040                1045                1050

Ala Lys  Asn Lys Val Ile Thr  Gly Asn Ile Asn Lys  Thr Arg Lys
    1055                1060                1065

Lys Gly  Gly Val Asn Lys Asn  Met Gln Gln Thr Pro  Arg Gly Gln
    1070                1075                1080

Leu His  Leu Glu Thr Ile Tyr  Gly Ser Gly Lys Gln  Tyr Leu Thr
    1085                1090                1095

Lys Glu  Glu Lys Val Asn Ala  Ser Phe Asp Met Arg  Lys Ile Glu
    1100                1105                1110

Thr Val  Ser Lys Ser Ala Tyr  Arg Asp Ala Leu Leu  Lys Arg Leu
    1115                1120                1125

Tyr Glu  Asn Asp Asn Asp Pro  Lys Lys Ala Phe Ala  Gly Lys Asn
    1130                1135                1140

Ser Leu  Asp Lys Gln Pro Ile  Trp Leu Asp Lys Glu  Gln Met Arg
    1145                1150                1155

Lys Val  Pro Glu Lys Val Lys  Ile Val Thr Leu Glu  Ala Ile Tyr
    1160                1165                1170

Thr Ile  Arg Lys Glu Ile Ser  Pro Asp Leu Lys Val  Asp Lys Val
    1175                1180                1185

Ile Asp  Val Gly Val Arg Lys  Ile Leu Ile Asp Arg  Leu Asn Glu
    1190                1195                1200

Tyr Gly  Asn Asp Ala Lys Lys  Ala Phe Ser Asn Leu  Asp Lys Asn
    1205                1210                1215

Pro Ile  Trp Leu Asn Lys Glu  Lys Gly Ile Ser Ile  Lys Arg Val
    1220                1225                1230
```

```
Thr Ile  Ser Gly Ile Ser Asn  Ala Gln Ser Leu His  Val Lys Lys
    1235                1240                1245

Asp Lys  Asp Gly Lys Pro Ile  Leu Asp Glu Asn Gly  Arg Asn Ile
    1250                1255                1260

Pro Val  Asp Phe Val Asn Thr  Gly Asn Asn His His  Val Ala Val
    1265                1270                1275

Tyr Tyr  Arg Pro Val Ile Asp  Lys Arg Gly Gln Leu  Val Val Asp
    1280                1285                1290

Glu Ala  Gly Asn Pro Lys Tyr  Glu Leu Glu Glu Val  Val Val Ser
    1295                1300                1305

Phe Phe  Glu Ala Val Thr Arg  Ala Asn Leu Gly Leu  Pro Ile Ile
    1310                1315                1320

Asp Lys  Asp Tyr Lys Thr Thr  Glu Gly Trp Gln Phe  Leu Phe Ser
    1325                1330                1335

Met Lys  Gln Asn Glu Tyr Phe  Val Phe Pro Asn Glu  Lys Ile Gly
    1340                1345                1350

Phe Asn  Pro Lys Glu Ile Asp  Leu Leu Asp Val Glu  Asn Tyr Gly
    1355                1360                1365

Leu Ile  Ser Pro Asn Leu Phe  Arg Val Gln Lys Phe  Ser Leu Lys
    1370                1375                1380

Asn Tyr  Val Phe Arg His His  Leu Glu Thr Thr Ile  Lys Asp Thr
    1385                1390                1395

Ser Ser  Ile Leu Arg Gly Ile  Thr Trp Ile Asp Phe  Arg Ser Ser
    1400                1405                1410

Lys Gly  Leu Asp Thr Ile Val  Lys Val Arg Val Asn  His Ile Gly
```

1415 1420 1425

Gln Ile Val Ser Val Gly Glu Tyr
1430 1435

<210> 301
<211> 1424
<212> PRT
<213> Bacteroides sp.

<400> 301

Met Lys Arg Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1 5 10 15

Ala Leu Val Asn Glu Ala Glu Thr Asp Glu Glu Val Ser Ser Ile Ile
20 25 30

Arg Leu Gly Val Arg Val Asn Pro Leu Thr Val Asp Glu Thr Gln Asn
35 40 45

Phe Glu Lys Gly Lys Ser Ile Thr Thr Asn Ala Glu Arg Thr Leu Lys
50 55 60

Arg Ser Met Arg Arg Asn Leu Gln Arg Tyr Lys Leu Arg Arg Asp Ala
65 70 75 80

Leu Val Glu Phe Leu Lys Glu Leu Gly Phe Ile Thr Asp Glu Thr Ile
85 90 95

Leu Ser Glu Gln Gly Asn Arg Thr Thr Phe Glu Thr Cys Arg Leu Arg
100 105 110

Ala Lys Ala Ala Glu Glu Glu Ile Ser Leu Glu Glu Leu Ser Arg Val
115 120 125

Leu Leu Met Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Val
130 135 140

```
Lys Lys Glu Glu Asp Gly Val Leu Ile Asp Gly Met Glu Ile Ala Lys
145                 150                 155                 160

Lys Leu Tyr Glu Glu Asp Leu Thr Pro Gly Gln Leu Cys Ser Gln Leu
                165                 170                 175

Leu Glu Ser Gly Lys Lys Val Leu Pro Asp Phe Tyr His Ser Asp Leu
            180                 185                 190

Gln Glu Glu Leu Asp Arg Ile Trp Ser Val Gln Lys Gln Phe His Pro
        195                 200                 205

Asp Val Phe Cys Asp Ala Ala Lys Glu Glu Ile Lys Gly Lys Asn Arg
    210                 215                 220

Ser Gln Thr Trp Ala Ile Leu Ala Asn Tyr Phe Val Trp Lys Glu Glu
225                 230                 235                 240

Val Val Gly Trp Asn Asp Arg Glu Ala Lys Asn Glu Thr Ile Glu Lys
                245                 250                 255

Glu Cys Lys Leu Val Gly Leu Lys Arg Thr Thr Lys Gly Tyr Glu Leu
            260                 265                 270

Lys Lys Glu Asn Tyr Arg Trp Arg Ala Gln Ala Leu Thr Glu Gln Leu
        275                 280                 285

Gly Leu Glu Glu Ile Ala Val Val Leu Gln Glu Ile Asn Gly Gln Ile
    290                 295                 300

Asn Ala Ser Ser Gly Tyr Leu Gly Ala Ile Ser Asp Arg Ser Lys Val
305                 310                 315                 320

Leu Tyr Phe Asn His Gln Thr Val Gly Gln Tyr Gln Met Ala Glu Leu
                325                 330                 335

Asp Lys Asn Pro His Ala Ser Leu Arg Asn Met Val Phe Tyr Arg Gln
            340                 345                 350
```

```
Asp Tyr Leu Asp Glu Phe Asp Arg Ile Trp Glu Lys Gln Ala Glu Phe
        355                 360                 365

His Lys Glu Leu Thr Ala Glu Leu Lys Lys Glu Ile Arg Asp Met Ile
    370                 375                 380

Ile Phe Tyr Gln Arg Arg Leu Lys Ser Gln Lys Gly Leu Ile Ser Phe
385                 390                 395                 400

Cys Glu Phe Glu Arg Leu Glu Ile Val Val Glu Lys Asp Gly Lys Lys
                405                 410                 415

Gln Thr Lys Val Ile Gly Cys Lys Val Ile Pro Arg Ser His Pro Leu
            420                 425                 430

Phe Gln Glu Phe Lys Val Trp Gln Thr Leu Asn Asp Ile Lys Val Leu
        435                 440                 445

Gly Arg Glu Lys Lys Arg Asn Ala Leu Ser Ala Ser Glu Ser Arg Ala
    450                 455                 460

Leu Tyr Pro Glu Glu Lys Glu Ile Leu Ala Arg Glu Leu Ala Ile Lys
465                 470                 475                 480

Glu Asn Met Lys Lys Ala Asp Val Leu Lys Leu Leu Phe Glu Asn Pro
                485                 490                 495

Gln Glu Leu Asp Leu Asn Phe Lys Gln Ile Asp Gly Asn Arg Thr Gly
            500                 505                 510

Phe Ser Leu Phe Ser Ala Tyr Ser Lys Met Ile Glu Lys Tyr Gly Tyr
        515                 520                 525

Glu Pro Leu Asp Phe Lys Lys Pro Ala Asp Glu Ile Ile Gly Gln Leu
    530                 535                 540
```

```
Arg Thr Ile Phe Thr Asp Leu Gly Trp Asn Thr Asn Leu Phe Thr Ile
545                 550                 555                 560

Asp Leu Thr Lys Glu Gly Lys Glu Leu Glu Met Gln Pro Tyr Phe Arg
                565                 570                 575

Leu Trp His Leu Leu Tyr Ser Phe Glu Gly Asp Asn Thr Ser Thr Gly
            580                 585                 590

Asn Gly Lys Leu Ile Glu Lys Ile Met Gln Leu Cys Gly Val Glu Lys
        595                 600                 605

Glu Tyr Ala Val Glu Leu Ala Ser Leu Ser Phe Gln Asp Asp Tyr Gly
    610                 615                 620

Ser Leu Ser Ala Lys Ala Ile Lys Arg Ile Leu Pro Tyr Leu Lys Glu
625                 630                 635                 640

Gly Asn Leu Tyr Asp Val Ala Cys Glu Tyr Ala Gly Tyr Arg His Ser
                645                 650                 655

Lys Ser Ser Leu Thr Lys Glu Glu Ile Glu Asn Lys Val Leu Lys Gly
            660                 665                 670

Lys Leu Glu Val Leu Pro Lys Asn Ser Leu Arg Asn Pro Val Val Glu
        675                 680                 685

Lys Ile Leu Ser Gln Met Val Asn Val Ile Asn Thr Ile Ile Asp Thr
    690                 695                 700

Tyr Gly Lys Pro Asp Glu Ile Arg Val Glu Leu Ala Arg Glu Leu Lys
705                 710                 715                 720

Lys Ser Ala Lys Glu Arg Glu Glu Leu Thr Lys Ala Ile Ala Lys Ser
                725                 730                 735

Thr Arg Glu His Glu Glu Ile Arg Lys Leu Leu Gln Asp Glu Phe Gly
            740                 745                 750
```

```
Met Met Asn Val Ser Arg Asn Asp Ile Ile Arg Tyr Lys Leu Tyr Glu
        755                 760                 765

Glu Leu Lys Asp Asn Gly Tyr Lys Thr Leu Tyr Ser Asn Gln Tyr Ile
    770                 775                 780

Pro Lys Glu Lys Ile Phe Ser Lys Glu Ile Asp Ile Glu His Ile Ile
785                 790                 795                 800

Pro Gln Ser Arg Leu Phe Asp Asp Ser Leu Ser Asn Lys Thr Leu Glu
                805                 810                 815

Tyr Lys Ala Ile Asn Ile Glu Lys Gly Asn Lys Thr Ala Tyr Asp Phe
            820                 825                 830

Val Lys Glu Lys Tyr Gly Glu Glu Gly Leu Gln Gln Tyr Ile Asn Arg
        835                 840                 845

Cys Glu Ser Leu Phe Asn Asp Lys Lys Ala Lys Leu Arg Lys Leu Lys
    850                 855                 860

Met Glu Gln Lys Asp Ile Pro Asp Gly Phe Ile Asp Arg Asp Leu Arg
865                 870                 875                 880

Asn Thr Gln Tyr Ile Ala Lys Lys Ala Leu Ala Met Leu Asn Glu Ile
                885                 890                 895

Cys Arg Arg Val Val Ala Thr Thr Gly Ser Ile Thr Asp Gln Leu Arg
            900                 905                 910

Glu Asp Trp Gln Leu Val Asp Val Met Lys Glu Leu Asn Leu Pro Lys
        915                 920                 925

Tyr Glu Ala Leu Gly Phe Val Glu Thr Tyr Glu Asp Lys Asp Gly Arg
    930                 935                 940
```

```
Lys Ile Lys Arg Ile Lys Asp Trp Thr Lys Arg Asn Asp His Arg His
945                 950                 955                 960


His Ala Met Asp Ala Leu Thr Val Ala Phe Thr Lys Asp Ala Phe Ile
               965                 970                 975


Gln Tyr Phe Asn Asn Lys Asn Ala Ala Gln Asp Ser Gly Asn Arg Asn
            980                 985                 990


His Thr Asn Ile Ile Gly Ile Lys  Thr Arg Tyr Phe Asp  Lys Gly Arg
        995                 1000                1005


Ala Leu  Pro Pro Ile Pro Leu  Glu Gln Phe Arg Ile  Glu Ala Lys
    1010                1015                1020


Gln His  Leu Glu Lys Leu Leu  Val Ser Ile Lys Ala  Lys Asn Lys
    1025                1030                1035


Val Val  Thr Val Asn Val Asn  Arg Thr Lys Lys Arg  Lys Gly Glu
    1040                1045                1050


Asn Thr  Lys Ile Gln Gln Thr  Pro Arg Gly Gln Leu  His Leu Glu
    1055                1060                1065


Thr Val  Tyr Gly Ser His Lys  Gln Tyr Val Thr Lys  Ile Glu Lys
    1070                1075                1080


Val Asn  Ala Ser Phe Asp Ala  Ala Lys Ile Ala Thr  Val Ser Lys
    1085                1090                1095


Arg Ala  Tyr Arg Asn Ala Leu  Leu Lys Arg Leu Glu  Thr Phe Gly
    1100                1105                1110


Asn Asp  Pro Lys Lys Ala Phe  Thr Gly Lys Asn Ala  Leu Glu Lys
    1115                1120                1125


Asn Pro  Leu Tyr Ala Asp Lys  Tyr Gln Thr Ile Arg  Val Pro Glu
    1130                1135                1140
```

```
Lys Val  Gln Thr Val Glu Phe  Glu Thr Ile Tyr Thr  Ile Arg Lys
    1145                1150                1155

Pro Val  Asp Pro Ala Leu Asn  Val Asp Lys Val Val  Asp Val Lys
    1160                1165                1170

Val Arg  Ala Ile Leu Glu Arg  Arg Leu Lys Glu Tyr  Gly Gly Asp
    1175                1180                1185

Pro Lys  Lys Ala Phe Val Asn  Phe Trp Glu Asn Pro  Ile Trp Leu
    1190                1195                1200

Asn Lys  Glu Lys Gly Ile Ser  Ile Lys Arg Val Ser  Ile Arg Gly
    1205                1210                1215

Ile Asn  Asn Ala Gln Ser Ile  His Val Lys Lys Asp  Lys Asn Gly
    1220                1225                1230

Asn Pro  Ile Trp Asp Glu Asn  Gly Lys Gln Ile Pro  Val Asp Phe
    1235                1240                1245

Val Asn  Thr Gly Asn Asn His  His Val Ala Ile Tyr  Arg Lys Pro
    1250                1255                1260

Val Leu  Asp Lys Lys Gly Gln  Val Thr Phe Asp Glu  Asp Gly Asn
    1265                1270                1275

Leu Met  Tyr Glu Leu Asp Glu  Val Val Val Pro Phe  Phe Glu Ala
    1280                1285                1290

Val Thr  Arg Ala Asn Leu Gly  Leu Pro Ile Ile Asp  Lys Asp Tyr
    1295                1300                1305

Arg Lys  Ser Glu Gly Trp Gln  Phe Leu Phe Ser Met  Lys Gln Asn
    1310                1315                1320
```

```
Glu Tyr  Phe Val Phe Pro Asn  Glu Lys Thr Gly Phe  Asn Pro Lys
    1325                1330                1335


Glu Val  Asp Leu Leu Asn Pro  Asp Asn Tyr Ala Met  Ile Ser Pro
    1340                1345                1350


Asn Leu  Phe Arg Val Gln Thr  Met Ser Lys Val Met  Tyr Gly Asn
    1355                1360                1365


Asn Val  Val Arg Asp Tyr Lys  Phe Arg His His Leu  Glu Thr Thr
    1370                1375                1380


Val Lys  Asp Met Lys Glu Leu  Lys Asp Ile Ala Tyr  Lys Gln Tyr
    1385                1390                1395


Lys Thr  Leu Ser Phe Gly Asn  Ser Val Val Lys Ile  Arg Ile Asn
    1400                1405                1410


His Ile  Gly Gln Ile Val Ser  Val Gly Glu Tyr
    1415                1420
```

<210> 302
<211> 1055
<212> PRT
<213> Bacteroides sp.

<400> 302

```
Met Arg Ile Tyr Arg Lys Asp Leu Ala Gln Asp Val Asp Val Thr Asn
1               5                   10                  15


Glu Leu Leu Lys Thr Glu Glu Asp Tyr Val Ala Leu Phe Asp Trp Leu
            20                  25                  30


Asn Gly Lys Lys Glu Ile Asp Gln Lys Ala Phe Leu Lys Tyr Pro Leu
        35                  40                  45


Phe Gly Leu Lys Lys Glu Val Glu Asn Tyr Arg Trp Asn Tyr Val Gln
    50                  55                  60
```

```
Asp Lys Pro Tyr Pro Cys Asn Glu Thr Arg Ser Ser Met Leu Ala Arg
65                  70                  75                  80

Leu Glu Lys Cys Asp Ile Ser Ile Glu Phe Leu Thr Lys Glu Asn Glu
                85                  90                  95

Glu Ala Leu Trp His Ile Leu Tyr Ser Val Glu Asp Lys Asn Glu Ile
            100                 105                 110

Val Lys Ala Leu Gln Lys Phe Ala Asp Lys His Asp Leu Asn Ala Ser
        115                 120                 125

Phe Val Asp Val Phe Gln Lys Phe Pro Pro Phe Lys Lys Glu Tyr Gly
    130                 135                 140

Ser Tyr Ser Ala Lys Ala Ile Lys Lys Leu Leu Pro Leu Met Arg Met
145                 150                 155                 160

Gly Lys Tyr Trp Ser Glu Asn Ser Ile Asp Lys Gly Thr Arg Glu Arg
                165                 170                 175

Met Asp Lys Ile Ile Thr Gly Glu Tyr Asp Glu Lys Ile Glu Asn Arg
            180                 185                 190

Val Arg Glu Lys Ala Ile His Leu Ala Asp Val Ser Asp Phe Lys Gly
        195                 200                 205

Leu Pro Leu Trp Leu Val Cys Tyr Ile Val Tyr Gly Arg His Ser Glu
    210                 215                 220

Ala Lys Glu Ile Thr Gln Trp Lys Ser Pro Ala Asp Ile Asp Leu Tyr
225                 230                 235                 240

Leu Arg Ser Phe Lys Gln His Ser Leu Arg Asn Pro Ile Val Glu Gln
                245                 250                 255

Ile Ile Ile Glu Thr Leu Arg Val Val Arg Asp Ile Trp Lys Gln Val
```

```
            260                 265                 270

Gly Asn Ile Asp Glu Ile His Val Glu Leu Gly Arg Glu Met Lys Asn
        275                 280                 285

Pro Ala Asp Lys Arg Lys Lys Met Thr Gln Gln Met Ser Glu Asn Glu
    290                 295                 300

Asn Thr Asn Leu Arg Ile Lys Tyr Leu Leu Thr Glu Phe Leu Asn Pro
305                 310                 315                 320

Glu Tyr Glu Val Glu Asn Val Arg Pro Tyr Ser Pro Ser Gln Gln Asp
                325                 330                 335

Ile Leu Arg Ile Tyr Glu Glu Gly Val Leu Asn Ser Val Ser Asp Leu
            340                 345                 350

Pro Glu Glu Ile Ser Asp Ile Leu Lys Lys Phe Thr Glu Thr Asp Leu
        355                 360                 365

Lys Lys Arg Pro Ser Arg Ser Glu Val Leu Arg Tyr Lys Leu Trp Leu
    370                 375                 380

Glu Gln Lys Tyr Arg Ser Pro Tyr Thr Gly Glu Val Ile Pro Leu Gly
385                 390                 395                 400

Lys Leu Phe Thr Pro Ala Tyr Glu Ile Glu His Val Ile Pro Gln Ser
                405                 410                 415

Cys Tyr Phe Asp Asp Ser Phe Ser Asn Lys Val Ile Cys Glu Ala Glu
            420                 425                 430

Val Asn Lys Leu Lys Ser Asn Leu Leu Gly His Glu Phe Ile Val Lys
        435                 440                 445

His His Gly Glu Ile Val Glu Leu Pro Phe Gly Lys Lys Val Arg Ile
    450                 455                 460
```

```
Phe Thr Val Asp Glu Tyr Glu Gln Phe Val Lys Asp Asn Tyr Ser Arg
465                 470                 475                 480

Thr Arg Ser Lys Met Lys Lys Leu Leu Met Asp Asp Ile Pro Glu Glu
                485                 490                 495

Phe Val Ala Arg Gln Leu Asn Asp Ser Arg Tyr Ile Ser Lys Val Val
            500                 505                 510

Lys Ser Leu Leu Ser Asn Ile Val Arg Glu Lys Gly Glu Glu Glu Ala
        515                 520                 525

Ile Ser Lys Asn Val Ile Pro Cys Thr Gly Gly Val Thr Asp Arg Leu
    530                 535                 540

Lys Lys Asp Trp Gly Ile Asn Glu Val Trp Asn Lys Ile Ile Leu Pro
545                 550                 555                 560

Arg Phe Gln Arg Leu Asn Glu Leu Thr Gly Thr Asn Lys Phe Thr Thr
                565                 570                 575

Lys Asn Val Gly Ile Gln Glu Ile Pro Thr Met Pro Leu Glu Leu Gln
            580                 585                 590

Lys Gly Phe Asn Lys Lys Arg Ile Asp His Arg His His Ala Met Asp
        595                 600                 605

Ala Ile Ile Ile Ala Cys Ala Asn Arg Asn Ile Ile Asn Tyr Leu Asn
    610                 615                 620

Asn Glu Ser Ala Thr Ala Lys Ala Glu Leu Ser Arg Tyr Asp Leu Gln
625                 630                 635                 640

Lys Met Leu Cys Asp Lys Ala Lys Thr Asp Asn Asn Gly Asn Tyr Lys
                645                 650                 655

Trp Val Ile Arg Lys Pro Trp Ala Ser Phe Thr Gln Asp Thr Tyr Leu
```

```
            660                 665                 670

Ala Leu Glu Asn Ile Ile Val Ser Phe Lys Gln Asn Leu Arg Val Ile
        675                 680                 685

Asn Lys Ala Thr Asn His Phe Leu His Tyr Asn Glu Glu Gly Lys Lys
    690                 695                 700

Ile Phe Val Lys Gln Gly Lys Gly Asp Asn Trp Ala Ile Arg Lys Ser
705                 710                 715                 720

Met His Lys Asp Thr Val Phe Gly Glu Val Asn Leu Arg Arg Ile Lys
                725                 730                 735

Thr Val Ala Leu Asn Glu Ala Met Lys Asn Pro Gln Ser Ile Val Val
            740                 745                 750

Lys Asp Phe Lys Arg Lys Leu Leu Glu Leu Trp Asn Leu Gly Phe Asp
        755                 760                 765

Ala Lys Arg Ile Lys Lys Tyr Phe Glu Asp Asn Arg Glu Thr Trp Ser
    770                 775                 780

Asp Ile Asn Leu Ser Lys Ile Glu Val Tyr Tyr Phe Ser Lys Asp Thr
785                 790                 795                 800

Lys Asp Arg Phe Phe Ala Thr Arg Lys Pro Leu Asp Thr Ser Phe Asp
                805                 810                 815

Arg Lys Lys Ile Glu Asn Asn Ile Thr Asp Thr Gly Ile Gln Lys Ile
            820                 825                 830

Leu Leu Arg His Leu Glu Leu Lys Asp Asn Asn Pro Asp Ile Ala Phe
        835                 840                 845

Ser Pro Asp Gly Ile Asp Glu Met Asn Arg Asn Ile Ile Gln Leu Asn
    850                 855                 860
```

```
Asn Gly Lys Tyr His Gln Pro Ile Ile Lys Val Arg Trp Tyr Glu Gln
865                 870                 875                 880


Ala Asp Lys Phe Ala Val Gly Gln Thr Gly Asn Lys Ser Ser Lys Phe
                885                 890                 895


Val Glu Ala Ala Lys Gly Thr Asn Leu Phe Phe Ala Val Tyr Glu Ser
            900                 905                 910


Asn Ile Leu Asp Lys Lys Thr Asn Thr Ile Ile Lys Lys Arg Asn Tyr
        915                 920                 925


Ala Thr Ile Pro Leu Asn Val Ala Ile Glu Arg Gln Lys Gln Gly Leu
    930                 935                 940


Pro Val Ala Pro Glu Asp Glu Asn Gly Asn Asp Pro Ile Phe Val Leu
945                 950                 955                 960


Ser Pro Asn Asp Leu Val Tyr Leu Pro Thr Ala Ala Asp Leu Ala Asn
                965                 970                 975


Gly Ile Ile Ala Gln Pro Leu Asp Arg Gly Arg Ile Tyr Lys Met Val
            980                 985                 990


Ser Cys Thr Gly Asn Glu Gly Tyr  Phe Ile Pro Ala Arg  Ile Ala Asn
        995                 1000                1005


Pro Ile  Leu Gln Thr Ile Glu  Leu Gly Ser Asn Asn  Lys Ala Gln
    1010                1015                1020


Lys Ala  Trp Thr Asp Glu Met  Ile Lys Glu Ile Cys  Met Pro Ile
    1025                1030                1035


Lys Val  Asp Arg Leu Gly Asn  Val Leu Glu Ser Ser  Ser Ser Tyr
    1040                1045                1050


Lys Lys
```

1055

<210> 303
<211> 1055
<212> PRT
<213> Bacteroides sp.

<400> 303

Met Arg Ile Tyr Arg Lys Asp Leu Ala Gln Asp Val Asp Val Thr Asn
1 5 10 15

Glu Leu Leu Lys Thr Glu Glu Asp Tyr Val Ala Leu Phe Asp Trp Leu
20 25 30

Asn Gly Lys Lys Glu Ile Asp Gln Lys Ala Phe Leu Lys Tyr Pro Val
35 40 45

Phe Gly Leu Lys Lys Glu Ile Glu Asn Tyr Arg Trp Asn Tyr Val Gln
50 55 60

Asp Lys Pro Tyr Pro Cys Asn Glu Thr Arg Ser Leu Met Leu Ala Arg
65 70 75 80

Leu Glu Lys Cys Asp Ile Ser Ile Glu Phe Leu Thr Lys Glu Asn Glu
85 90 95

Glu Ala Leu Trp His Ile Leu Tyr Ser Val Glu Asp Lys Asn Glu Ile
100 105 110

Val Lys Ala Leu Gln Lys Phe Ala Asp Lys His Asp Leu Asn Ala Ser
115 120 125

Phe Val Asp Val Phe Gln Lys Phe Pro Pro Phe Lys Lys Glu Tyr Gly
130 135 140

Ser Tyr Ser Ala Lys Ala Ile Lys Lys Leu Leu Pro Leu Met Arg Met
145 150 155 160

```
Gly Lys Tyr Trp Ser Glu Asn Ser Ile Asp Lys Gly Thr Arg Glu Arg
                165                 170                 175

Ile Asp Lys Ile Ile Thr Gly Glu Tyr Asp Glu Lys Ile Glu Asn Arg
            180                 185                 190

Val Arg Glu Lys Ala Ile His Leu Ala Asp Val Ser Asp Phe Lys Gly
        195                 200                 205

Leu Pro Leu Trp Leu Val Cys Tyr Ile Val Tyr Gly Arg His Ser Glu
    210                 215                 220

Ala Lys Glu Ile Ile Gln Trp Lys Ser Pro Ala Asp Ile Asp Ser Tyr
225                 230                 235                 240

Leu Arg Ser Phe Lys Gln His Ser Leu Arg Asn Pro Ile Val Glu Gln
                245                 250                 255

Ile Ile Ile Glu Thr Leu Arg Val Val Arg Asp Ile Trp Lys Gln Val
            260                 265                 270

Gly Asn Ile Asp Glu Ile His Val Glu Leu Gly Arg Glu Met Lys Asn
        275                 280                 285

Pro Ala Asp Lys Arg Lys Lys Met Thr Gln Gln Met Ser Glu Asn Glu
    290                 295                 300

Asn Thr Asn Leu Arg Ile Lys Tyr Leu Leu Thr Glu Phe Leu Asn Pro
305                 310                 315                 320

Glu Tyr Glu Val Glu Asn Val Arg Pro Tyr Ser Pro Ser Gln Gln Asp
                325                 330                 335

Ile Leu Arg Ile Tyr Glu Glu Gly Val Leu Asn Ser Val Ser Asp Leu
            340                 345                 350

Pro Glu Glu Ile Ser Asp Ile Leu Lys Lys Phe Thr Glu Thr Asp Leu
        355                 360                 365
```

```
Lys Lys Arg Pro Ser Arg Ser Glu Val Leu Arg Tyr Lys Leu Trp Leu
    370                 375                 380

Glu Gln Lys Tyr Arg Ser Pro Tyr Thr Gly Glu Val Ile Pro Leu Gly
385                 390                 395                 400

Lys Leu Phe Thr Pro Ala Tyr Glu Ile Glu His Val Ile Pro Gln Ser
                405                 410                 415

Cys Tyr Phe Asp Asp Ser Phe Ser Asn Lys Val Ile Cys Glu Ala Glu
            420                 425                 430

Val Asn Lys Leu Lys Ser Asn Leu Leu Gly His Glu Phe Ile Val Lys
        435                 440                 445

His His Gly Glu Ile Val Glu Leu Pro Phe Gly Lys Lys Val Arg Ile
    450                 455                 460

Phe Thr Val Asp Glu Tyr Glu Gln Phe Val Lys Asp Asn Tyr Ser Arg
465                 470                 475                 480

Thr Arg Ser Lys Met Lys Lys Leu Leu Met Asp Asp Ile Pro Glu Glu
                485                 490                 495

Phe Val Thr Arg Gln Leu Asn Asp Ser Arg Tyr Ile Ser Lys Val Val
            500                 505                 510

Lys Ser Leu Leu Ser Asn Ile Val Arg Glu Lys Gly Glu Glu Glu Ala
        515                 520                 525

Ile Ser Lys Asn Val Ile Pro Cys Thr Gly Gly Val Thr Asp Arg Leu
    530                 535                 540

Lys Lys Asp Trp Gly Ile Asn Glu Val Trp Asn Lys Ile Ile Leu Pro
545                 550                 555                 560
```

```
Arg Phe Gln Arg Leu Asn Glu Leu Thr Gly Thr Asn Lys Phe Thr Thr
                565                 570                 575

Lys Asn Val Gly Ile Gln Glu Ile Pro Thr Met Pro Leu Glu Leu Gln
            580                 585                 590

Lys Gly Phe Asn Lys Lys Arg Ile Asp His Arg His His Ala Met Asp
        595                 600                 605

Ala Ile Ile Ile Ala Cys Ala Asn Arg Asn Ile Ile Asn Tyr Leu Asn
    610                 615                 620

Asn Glu Ser Ala Thr Ala Lys Ala Glu Leu Ser Arg Tyr Asp Leu Gln
625                 630                 635                 640

Lys Met Leu Cys Asp Lys Ala Lys Thr Asp Asn Asn Gly Asn Tyr Lys
                645                 650                 655

Trp Val Ile Arg Lys Pro Trp Ala Ser Phe Thr Gln Asp Thr Tyr Leu
            660                 665                 670

Ala Leu Glu Asn Ile Ile Val Ser Phe Lys Gln Asn Leu Arg Val Ile
        675                 680                 685

Asn Lys Ala Thr Asn Arg Phe Leu His Tyr Asn Glu Glu Gly Lys Lys
    690                 695                 700

Ile Phe Val Lys Gln Gly Lys Gly Asp Asn Trp Ala Ile Arg Lys Ser
705                 710                 715                 720

Met His Lys Asp Thr Val Phe Gly Glu Val Asn Leu Arg Arg Ile Lys
                725                 730                 735

Thr Val Ala Leu Asn Glu Ala Met Lys Asn Pro Gln Ser Ile Val Val
            740                 745                 750

Lys Asp Phe Lys Arg Lys Leu Leu Glu Leu Trp Asn Leu Gly Phe Asp
        755                 760                 765
```

```
Ala Lys Arg Ile Lys Lys Tyr Phe Glu Asp Asn Arg Glu Thr Trp Ser
    770                 775                 780

Asp Ile Asn Leu Ser Lys Ile Glu Val Tyr Tyr Phe Ser Lys Asp Thr
785                 790                 795                 800

Lys Asp Arg Phe Phe Ala Thr Arg Lys Pro Leu Asp Thr Ser Phe Asp
                805                 810                 815

Arg Lys Lys Ile Glu Asn Asn Ile Thr Asp Thr Gly Ile Gln Lys Ile
            820                 825                 830

Leu Leu Arg His Leu Glu Leu Lys Asp Asn Asn Pro Asp Ile Ala Phe
        835                 840                 845

Ser Pro Asp Gly Ile Asp Glu Met Asn Arg Asn Ile Ile Gln Leu Asn
    850                 855                 860

Asn Gly Lys Tyr His Gln Pro Ile Ile Lys Ile Arg Trp Tyr Glu Gln
865                 870                 875                 880

Ala Asp Lys Phe Ala Val Gly Gln Thr Gly Asn Lys Ser Ser Lys Phe
                885                 890                 895

Val Glu Ala Ala Lys Gly Thr Asn Leu Phe Phe Ala Val Tyr Glu Ser
            900                 905                 910

Asn Ile Leu Asp Lys Lys Thr Asn Thr Ile Ile Lys Lys Arg Asn Tyr
        915                 920                 925

Ala Thr Ile Pro Leu Asn Val Ala Ile Glu Arg Gln Lys Gln Gly Leu
    930                 935                 940

Pro Val Ala Pro Glu Asp Glu Asn Gly Asn Asp Pro Ile Phe Val Leu
945                 950                 955                 960
```

```
Ser Pro Asn Asp Leu Val Tyr Leu Pro Thr Asp Asp Glu Leu Ala Asn
                965                 970                 975


Gly Ile Ile Ala Gln Pro Leu Asp Arg Gly Arg Ile Tyr Lys Met Val
            980                 985                 990


Ser Ser Ser Gly Glu Gln Cys Phe  Phe Ile Lys His Ile  Val Ala Asn
        995                 1000                1005


Val Leu  Val Asp Lys Phe Glu  Phe Ser Pro Leu Asn  Lys Met Glu
    1010                1015                1020


Arg Ala  Leu Thr Gly Glu Met  Ile Lys Met Ile Cys  Ile Pro Ile
    1025                1030                1035


Lys Val  Asp Arg Leu Gly Asn  Val Leu Glu Ser Ser  Ser Ser Tyr
    1040                1045                1050


Lys Lys
    1055
```

<210> 304
<211> 286
<212> PRT
<213> Bacteroides uniformis

<400> 304

```
Met Leu Ser Tyr Lys Tyr Asp Lys Lys Lys Ile Glu Lys Tyr Phe Lys
1               5                   10                  15


Glu Asn Ala Phe Leu Trp Lys Glu Leu Asp Ile Ala Lys Val Ala Val
            20                  25                  30


Tyr Tyr Phe Thr Glu Asn Thr Thr Glu Pro Leu Val Ala Val Arg Lys
        35                  40                  45


Ser Leu Asp Ser Thr Phe Asn Glu Lys Lys Ile Ala Ser Val Thr Asp
    50                  55                  60
```

```
Thr Gly Ile Gln Lys Ile Leu Leu Asn His Leu Lys Ser Lys Glu Gly
65                  70                  75                  80

Lys Ala Glu Leu Ala Phe Ser Ala Glu Gly Ile Glu Glu Met Asn Arg
                85                  90                  95

Asn Leu Leu Gln Leu Asn Asp Gly Lys Gly His Gln Pro Ile Tyr Lys
            100                 105                 110

Val Arg Val Tyr Glu Pro Arg Gly Asn Lys Phe Lys Val Gly Val Leu
        115                 120                 125

Gly Asn Lys Gly Ala Lys Trp Val Glu Ala Ala Lys Gly Thr Asn Leu
    130                 135                 140

Phe Phe Ala Ile Tyr Ile Thr Glu Asp Gly Asn Arg Thr Tyr Glu Thr
145                 150                 155                 160

Ile Pro Leu Asn Trp Val Ile Glu Arg Glu Lys Gln Gly Leu Val Pro
                165                 170                 175

Val Pro Asp Arg Asn Glu Lys Gly Asp Lys Leu Leu Phe Trp Leu Ser
            180                 185                 190

Pro Asn Asp Leu Val Tyr Leu Pro Thr Glu Glu Glu Arg Asp Phe Gly
        195                 200                 205

Arg Ile Asn Glu Pro Ile Asp Arg Gly Arg Ile Tyr Lys Met Val Ser
    210                 215                 220

Ser Ser Gly Asn Gln Cys Phe Phe Ile Pro Gln Ser Ile Ser Asn Ala
225                 230                 235                 240

Ile Ile Ser Thr Lys Glu Leu Gly Ser Asn Asn Lys Ala Glu Lys Ser
                245                 250                 255

Trp Asp Gly Glu Met Ile Lys Asn Ile Cys Ile Pro Val Lys Val Asp
```

260 265 270

Arg Leu Gly Arg Ile Ile Glu Val Lys Tyr Arg Val Asn Glu
275 280 285

<210> 305
<211> 1508
<212> PRT
<213> Bacteroides uniformis

<400> 305

Met Arg Thr Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1 5 10 15

Ala Val Ile Asn Ser Val Ile Lys Glu Gln Thr Glu Arg Ile Trp Ile
20 25 30

Glu Met Ala Gly Ser Arg Ile Ile Pro Met Asp Ala Ala Ile Leu Gly
35 40 45

Asp Phe Asp Lys Gly Asn Ser Ile Ser Gln Thr Ala Glu Arg Thr Arg
50 55 60

Phe Arg Gly Val Arg Arg Leu Arg Glu Arg Gln Leu Leu Arg Arg Glu
65 70 75 80

Arg Leu His Lys Val Leu Lys Ile Leu Gly Phe Leu Pro Glu His Tyr
85 90 95

Leu Lys Gly Ile Asp Phe Glu Lys His Thr Gly Lys Phe Leu Ser Gly
100 105 110

Ser Glu Pro Lys Leu Pro Trp Val Lys Asp Arg Trp Gly Lys Tyr Ser
115 120 125

Phe Leu Phe Gln Thr Ala Phe Asn Glu Met Leu Ala Asp Phe Ala Lys
130 135 140

```
His Gln Pro Ser Leu Val Phe Asp Gly Lys Lys Ile Pro Tyr Asp Trp
145                 150                 155                 160

Thr Val Tyr Tyr Leu Arg Lys Lys Ala Leu Thr Glu Met Ile Ser Lys
                165                 170                 175

Glu Glu Leu Ala Trp Ile Leu Leu Asn Phe Asn Gln Lys Arg Gly Tyr
            180                 185                 190

Tyr Gln Leu Arg Gly Glu Glu Glu Glu Asp Asn Ala Gly Lys Ser Val
        195                 200                 205

Glu Phe Tyr Ala Leu Lys Val Leu Ser Val Glu Ala Thr Asp Glu Lys
    210                 215                 220

Lys Gly Arg Asp Ile Trp Tyr Asn Val His Leu Glu Asn Gly Trp Val
225                 230                 235                 240

Tyr Arg Arg Ser Ser Asn Val Pro Leu Asp Trp Glu Gly Arg Val Lys
                245                 250                 255

Glu Phe Ile Val Thr Thr Asp Leu Asn Pro Asp Gly Thr Pro Lys Leu
            260                 265                 270

Asp Lys Tyr Gly Glu Val Lys Arg Ser Phe Arg Ala Pro Lys Glu Asp
        275                 280                 285

Asp Trp Met Leu Ile Lys Lys Arg Thr Glu Ala Asp Ile Thr Gly Thr
    290                 295                 300

His Lys Thr Ile Gly Ser Tyr Ile Tyr Asp Ala Leu Leu Gln Glu Pro
305                 310                 315                 320

Gln Gln Lys Ile Ile Gly Lys Leu Val Lys Thr Val Glu Arg Lys Phe
                325                 330                 335

Tyr Lys Glu Glu Leu Asn Phe Ile Leu Gln Lys Gln Cys Ala Phe His
            340                 345                 350
```

```
Ala Glu Leu Gln Asp Arg Asp Leu Tyr Met Arg Cys Ile Glu Ala Leu
        355                 360                 365

Tyr Pro Gly Asn Glu Val Gln Arg Arg Asn Ile Ala Asn Arg Asp Phe
    370                 375                 380

Ile Tyr Leu Leu Ile Asp Asp Val Leu Phe Tyr Gln Arg Pro Leu Lys
385                 390                 395                 400

Thr Lys Lys Ser Leu Ile Ala Asn Cys Pro Tyr Glu Glu Asn Glu Tyr
                405                 410                 415

Val Asn Arg Lys Thr Gly Glu Ile Lys Thr Ala Pro Leu Lys Cys Ile
            420                 425                 430

Ala Lys Ser His Pro Leu Phe Gln Glu Phe Arg Leu Trp Tyr Phe Leu
        435                 440                 445

Ser Asn Ile Arg Val Tyr Gln Lys Glu Arg Glu Val Asn Gly Thr Leu
    450                 455                 460

His Leu Asp Val Asp Val Thr Thr Glu Phe Leu Lys Thr Glu Asp Asp
465                 470                 475                 480

Tyr Val Ala Leu Phe Asp Trp Leu Asn Ser Arg Lys Glu Ile Asp Gln
                485                 490                 495

Lys Ala Phe Leu Arg Tyr Pro Ala Phe Gly Leu Lys Lys Glu Ile Asn
            500                 505                 510

Asn Tyr Arg Trp Asn Tyr Val Glu Asp Lys Phe Tyr Pro Cys Asn Glu
        515                 520                 525

Thr Arg His Ala Ile Leu Ser Arg Leu Glu Lys Ala Gly Ile Gly Ile
    530                 535                 540
```

```
Asp Phe Leu Ser Asp Glu Lys Glu Thr Ala Leu Trp His Ile Leu Tyr
545                 550                 555                 560

Ser Val Ser Asp Lys Gln Glu Ile Glu Lys Ala Leu Ala Thr Phe Ala
                565                 570                 575

Val Lys Asn Gly Leu Asn Glu Ser Phe Val Glu Val Phe Lys Lys Phe
            580                 585                 590

Pro Pro Phe Lys Ser Glu Tyr Gly Ala Tyr Ser Ala Lys Ala Ile Lys
        595                 600                 605

Lys Leu Leu Pro Leu Met Arg Cys Gly Lys Tyr Trp Asp Met Ser Leu
    610                 615                 620

Ile Asp Gly Thr Thr Lys Glu Arg Ile Glu Arg Ile Ile Ala Gly Glu
625                 630                 635                 640

Cys Asp Glu Ser Ile Gly Ala Lys Val Arg Glu Lys Ala Met Asn Leu
                645                 650                 655

Ser Asp Ile Ser Cys Phe Lys Arg Leu Pro Leu Trp Leu Ala Cys Tyr
            660                 665                 670

Val Val Tyr Asn Arg His Ser Glu Asp Lys Glu Ile Thr Lys Trp Glu
        675                 680                 685

Thr Pro Ala Asp Ile Asp Ala Tyr Leu Ala Ala Phe Lys Gln His Ser
    690                 695                 700

Leu Arg Asn Pro Ile Val Glu Gln Val Ile Thr Glu Thr Leu Arg Val
705                 710                 715                 720

Val Arg Asp Ile Trp Lys Gln Val Gly Lys Ile Asp Glu Ile Arg Ile
                725                 730                 735

Glu Leu Gly Arg Glu Met Lys Asn Pro Ala Asp Lys Arg Lys Arg Met
            740                 745                 750
```

```
Thr Thr Gln Ile Leu Glu Asn Glu Asn Ala Asn Leu Arg Ile Lys Ala
        755                 760                 765

Leu Leu Ala Glu Phe Val Asn Pro Glu Tyr Gly Val Glu Asn Val Arg
    770                 775                 780

Pro Tyr Ser Pro Ser Gln Gln Glu Ile Leu Arg Ile Tyr Glu Asp Ala
785                 790                 795                 800

Val Leu Lys Gly Glu Glu Gln Ile Pro Glu Asp Ile Asp Val Ile Leu
                805                 810                 815

Lys Lys Phe Asn Thr Ser Lys Leu Pro Thr Lys Ser Glu Phe Leu Arg
            820                 825                 830

Tyr Lys Leu Trp Leu Glu Gln Lys Tyr Arg Ser Pro Tyr Thr Gly Glu
        835                 840                 845

Leu Ile Pro Leu Ala Lys Leu Phe Thr Ala Ala Tyr Glu Ile Glu His
    850                 855                 860

Val Ile Pro Gln Ser Arg Tyr Phe Asp Asp Ser Phe Ser Asn Lys Val
865                 870                 875                 880

Ile Cys Glu Ser Ala Val Asn Lys Leu Lys Asp Asn Gln Leu Gly Tyr
                885                 890                 895

Glu Phe Ile Lys Asn His His Gly Gln Lys Val Glu Val Gly Phe Gly
            900                 905                 910

Lys Thr Val Glu Ile Phe Ser Val Asp Ser Tyr Glu Arg Phe Val Lys
        915                 920                 925

Glu Gln Tyr Ala Lys Ser Gly Ile Lys Met Lys Lys Leu Leu Met Asp
    930                 935                 940
```

```
Asp Ile Pro Glu Gln Phe Ile Glu Arg Gln Leu Asn Asp Ser Arg Tyr
945                 950                 955                 960


Ile Ser Lys Val Val Lys Gly Leu Leu Ser Asn Ile Val Arg Glu Lys
                965                 970                 975


Asn Asp Ser Gly Glu Tyr Glu Pro Glu Ala Val Ser Lys Asn Ile Leu
            980                 985                 990


Val Cys Thr Gly Ser Val Thr Asp  Arg Leu Lys Lys Asp  Trp Gly Met
        995                 1000                1005


Asn Asp  Val Trp Asn Ser Ile  Val Ser Pro Arg Phe  Glu Arg Leu
    1010                1015                1020


Asn Ala  Leu Thr Glu Thr Gln  Cys Phe Gly His Trp  Glu Asn Lys
    1025                1030                1035


Asp Gly  Lys Lys Val Phe Gln  Thr Ala Val Pro Leu  Glu Tyr Gln
    1040                1045                1050


Lys Gly  Phe Ser Lys Lys Arg  Ile Asp His Arg His  His Ala Met
    1055                1060                1065


Asp Ala  Ile Val Ile Ala Cys  Ala Thr Arg Asn His  Val Asn Tyr
    1070                1075                1080


Leu Asn  Asn Glu Ser Ala Ser  Arg Asn Ala Lys Ile  Ser Arg Tyr
    1085                1090                1095


Asp Leu  Gln Arg Leu Leu Cys  Asp Lys Ser Arg Gly  Asp Gly Asn
    1100                1105                1110


Gly Asn  Tyr Arg Trp Ile Ile  Lys Lys Pro Trp Thr  Thr Phe Thr
    1115                1120                1125


Gln Asp  Ala Arg Glu Ala Leu  Ser Gly Ile Ile Val  Ser Leu Lys
    1130                1135                1140
```

```
Gln Asn  Leu Arg Ile Ile Asn  Lys Thr Thr Asn Ile  Tyr Gln His
    1145                1150                1155

Phe Asp  Ala Asn Gly Thr Arg  Val Tyr Glu Lys Gln  Lys Ile Gly
    1160                1165                1170

Asp Ser  Trp Ala Ile Arg Lys  Pro Met His Lys Asp  Thr Val Phe
    1175                1180                1185

Gly Ala  Val Asn Leu Arg Lys  Val Lys Val Val Arg  Leu Ser Val
    1190                1195                1200

Ala Leu  Asp Thr Pro Ser Met  Ile Val Asn Lys Arg  Val Lys Asn
    1205                1210                1215

Lys Val  Leu Glu Leu Leu Ser  Tyr Lys Tyr Asp Lys  Lys Lys Ile
    1220                1225                1230

Glu Lys  Tyr Phe Lys Glu Asn  Ala Phe Leu Trp Lys  Glu Leu Asp
    1235                1240                1245

Ile Ala  Lys Val Ala Val Tyr  Tyr Phe Thr Glu Asn  Thr Thr Glu
    1250                1255                1260

Pro Leu  Val Ala Val Arg Lys  Ser Leu Asp Ser Thr  Phe Asn Glu
    1265                1270                1275

Lys Lys  Ile Ala Ser Val Thr  Asp Thr Gly Ile Gln  Lys Ile Leu
    1280                1285                1290

Leu Asn  His Leu Lys Ser Lys  Glu Gly Lys Ala Glu  Leu Ala Phe
    1295                1300                1305

Ser Ala  Glu Gly Ile Glu Glu  Met Asn Arg Asn Leu  Leu Gln Leu
    1310                1315                1320
```

```
Asn Asp  Gly Lys Gly His Gln  Pro Ile Tyr Lys Val  Arg Val Tyr
    1325                 1330                 1335

Glu Pro  Arg Gly Asn Lys Phe  Lys Val Gly Val Leu  Gly Asn Lys
    1340                 1345                 1350

Gly Ala  Lys Trp Val Glu Ala  Ala Lys Gly Thr Asn  Leu Phe Phe
    1355                 1360                 1365

Ala Ile  Tyr Ile Thr Glu Asp  Gly Asn Arg Thr Tyr  Glu Thr Ile
    1370                 1375                 1380

Pro Leu  Asn Trp Val Ile Glu  Arg Glu Lys Gln Gly  Leu Val Pro
    1385                 1390                 1395

Val Pro  Asp Arg Asn Glu Lys  Gly Asp Lys Leu Leu  Phe Trp Leu
    1400                 1405                 1410

Ser Pro  Asn Asp Leu Val Tyr  Leu Pro Thr Glu Glu  Glu Arg Asp
    1415                 1420                 1425

Phe Gly  Arg Ile Asn Glu Pro  Ile Asp Arg Gly Arg  Ile Tyr Lys
    1430                 1435                 1440

Met Val  Ser Ser Ser Gly Asn  Gln Cys Phe Phe Ile  Pro Gln Ser
    1445                 1450                 1455

Ile Ser  Asn Ala Ile Ile Ser  Thr Lys Glu Leu Gly  Ser Asn Asn
    1460                 1465                 1470

Lys Ala  Glu Lys Ser Trp Asp  Gly Glu Met Ile Lys  Asn Ile Cys
    1475                 1480                 1485

Ile Pro  Val Lys Val Asp Arg  Leu Gly Arg Ile Ile  Glu Val Lys
    1490                 1495                 1500

Tyr Arg  Val Asn Glu
    1505
```

<210> 306
<211> 1210
<212> PRT
<213> Bacteroides uniformis

<400> 306

```
Met Arg Thr Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                  10                  15


Ala Val Ile Asn Ser Val Ile Lys Glu Gln Thr Glu Arg Ile Trp Ile
            20                  25                  30


Glu Met Ala Gly Ser Arg Ile Ile Pro Met Asp Ala Ala Ile Leu Gly
        35                  40                  45


Asp Phe Asp Lys Gly Asn Ser Ile Ser Gln Thr Ala Glu Arg Thr Arg
    50                  55                  60


Phe Arg Gly Val Arg Arg Leu Arg Glu Arg Gln Leu Leu Arg Arg Glu
65                  70                  75                  80


Arg Leu His Lys Val Leu Lys Ile Leu Gly Phe Leu Pro Glu His Tyr
                85                  90                  95


Leu Lys Gly Ile Asp Phe Glu Lys His Thr Gly Lys Phe Leu Ser Gly
            100                 105                 110


Ser Glu Pro Lys Leu Pro Trp Val Lys Asp Arg Trp Gly Lys Tyr Ser
        115                 120                 125


Phe Leu Phe Gln Thr Ala Phe Asn Glu Met Leu Ala Asp Phe Ala Lys
    130                 135                 140


His Gln Pro Ser Leu Val Phe Asp Gly Lys Lys Ile Pro Tyr Asp Trp
145                 150                 155                 160


Thr Val Tyr Tyr Leu Arg Lys Lys Ala Leu Thr Glu Met Ile Ser Lys
```

```
                165                 170                 175

Glu Glu Leu Ala Trp Ile Leu Leu Asn Phe Asn Gln Lys Arg Gly Tyr
            180                 185                 190

Tyr Gln Leu Arg Gly Glu Glu Glu Glu Asp Asn Ala Gly Lys Ser Val
        195                 200                 205

Glu Phe Tyr Ala Leu Lys Val Leu Ser Val Glu Ala Thr Asp Glu Lys
    210                 215                 220

Lys Gly Arg Asp Ile Trp Tyr Asn Val His Leu Glu Asn Gly Trp Val
225                 230                 235                 240

Tyr Arg Arg Ser Ser Asn Val Pro Leu Asp Trp Glu Gly Arg Val Lys
                245                 250                 255

Glu Phe Ile Val Thr Thr Asp Leu Asn Pro Asp Gly Thr Pro Lys Leu
            260                 265                 270

Asp Lys Tyr Gly Glu Val Lys Arg Ser Phe Arg Ala Pro Lys Glu Asp
        275                 280                 285

Asp Trp Met Leu Ile Lys Lys Arg Thr Glu Ala Asp Ile Thr Gly Thr
    290                 295                 300

His Lys Thr Ile Gly Ser Tyr Ile Tyr Asp Ala Leu Leu Gln Glu Pro
305                 310                 315                 320

Gln Gln Lys Ile Ile Gly Lys Leu Val Lys Thr Val Glu Arg Lys Phe
                325                 330                 335

Tyr Lys Glu Glu Leu Asn Phe Ile Leu Gln Lys Gln Cys Ala Phe His
            340                 345                 350

Ala Glu Leu Gln Asp Arg Asp Leu Tyr Met Arg Cys Ile Glu Ala Leu
        355                 360                 365
```

```
Tyr Pro Gly Asn Glu Val Gln Arg Arg Asn Ile Ala Asn Arg Asp Phe
    370                 375                 380

Ile Tyr Leu Leu Ile Asp Asp Val Leu Phe Tyr Gln Arg Pro Leu Lys
385                 390                 395                 400

Thr Lys Lys Ser Leu Ile Ala Asn Cys Pro Tyr Glu Glu Asn Glu Tyr
                405                 410                 415

Val Asn Arg Lys Thr Gly Glu Ile Lys Thr Ala Pro Leu Lys Cys Ile
            420                 425                 430

Ala Lys Ser His Pro Leu Phe Gln Glu Phe Arg Leu Trp Tyr Phe Leu
        435                 440                 445

Ser Asn Ile Arg Val Tyr Gln Lys Glu Arg Glu Val Asn Gly Thr Leu
    450                 455                 460

His Leu Asp Val Asp Val Thr Thr Glu Phe Leu Lys Thr Glu Asp Asp
465                 470                 475                 480

Tyr Val Ala Leu Phe Asp Trp Leu Asn Ser Arg Lys Glu Ile Asp Gln
                485                 490                 495

Lys Ala Phe Leu Arg Tyr Pro Ala Phe Gly Leu Lys Lys Glu Ile Asn
            500                 505                 510

Asn Tyr Arg Trp Asn Tyr Val Glu Asp Lys Phe Tyr Pro Cys Asn Glu
        515                 520                 525

Thr Arg His Ala Ile Leu Ser Arg Leu Glu Lys Ala Gly Ile Gly Ile
    530                 535                 540

Asp Phe Leu Ser Asp Glu Lys Glu Thr Ala Leu Trp His Ile Leu Tyr
545                 550                 555                 560

Ser Val Ser Asp Lys Gln Glu Ile Glu Lys Ala Leu Ala Thr Phe Ala
```

```
                565                 570                 575

Val Lys Asn Gly Leu Asn Glu Ser Phe Val Glu Val Phe Lys Lys Phe
            580                 585                 590

Pro Pro Phe Lys Ser Glu Tyr Gly Ala Tyr Ser Ala Lys Ala Ile Lys
        595                 600                 605

Lys Leu Leu Pro Leu Met Arg Cys Gly Lys Tyr Trp Asp Met Ser Leu
    610                 615                 620

Ile Asp Gly Thr Thr Lys Glu Arg Ile Glu Arg Ile Ile Ala Gly Glu
625                 630                 635                 640

Cys Asp Glu Ser Ile Gly Ala Lys Val Arg Glu Lys Ala Met Asn Leu
                645                 650                 655

Ser Asp Ile Ser Cys Phe Lys Arg Leu Pro Leu Trp Leu Ala Cys Tyr
            660                 665                 670

Val Val Tyr Asn Arg His Ser Glu Asp Lys Glu Ile Thr Lys Trp Glu
        675                 680                 685

Thr Pro Ala Asp Ile Asp Ala Tyr Leu Ala Ala Phe Lys Gln His Ser
    690                 695                 700

Leu Arg Asn Pro Ile Val Glu Gln Val Ile Thr Glu Thr Leu Arg Val
705                 710                 715                 720

Val Arg Asp Ile Trp Lys Gln Val Gly Lys Ile Asp Glu Ile Arg Ile
                725                 730                 735

Glu Leu Gly Arg Glu Met Lys Asn Pro Ala Asp Lys Arg Lys Arg Met
            740                 745                 750

Thr Thr Gln Ile Leu Glu Asn Glu Asn Ala Asn Leu Arg Ile Lys Ala
        755                 760                 765
```

```
Leu Leu Ala Glu Phe Val Asn Pro Glu Tyr Gly Val Glu Asn Val Arg
    770                 775                 780

Pro Tyr Ser Pro Ser Gln Gln Glu Ile Leu Arg Ile Tyr Glu Asp Ala
785                 790                 795                 800

Val Leu Lys Gly Glu Glu Gln Ile Pro Glu Asp Ile Asp Val Ile Leu
                805                 810                 815

Lys Lys Phe Asn Thr Ser Lys Leu Pro Thr Lys Ser Glu Phe Leu Arg
            820                 825                 830

Tyr Lys Leu Trp Leu Glu Gln Lys Tyr Arg Ser Pro Tyr Thr Gly Glu
        835                 840                 845

Leu Ile Pro Leu Ala Lys Leu Phe Thr Ala Ala Tyr Glu Ile Glu His
    850                 855                 860

Val Ile Pro Gln Ser Arg Tyr Phe Asp Asp Ser Phe Ser Asn Lys Val
865                 870                 875                 880

Ile Cys Glu Ser Ala Val Asn Lys Leu Lys Asp Asn Gln Leu Gly Tyr
                885                 890                 895

Glu Phe Ile Lys Asn His His Gly Gln Lys Val Glu Val Gly Phe Gly
            900                 905                 910

Lys Thr Val Glu Ile Phe Ser Val Asp Ser Tyr Glu Arg Phe Val Lys
        915                 920                 925

Glu Gln Tyr Ala Lys Ser Gly Ile Lys Met Lys Lys Leu Leu Met Asp
    930                 935                 940

Asp Ile Pro Glu Gln Phe Ile Glu Arg Gln Leu Asn Asp Ser Arg Tyr
945                 950                 955                 960

Ile Ser Lys Val Val Lys Gly Leu Leu Ser Asn Ile Val Arg Glu Lys
```

```
               965                 970                 975

Asn Asp Ser Gly Glu Tyr Glu Pro Glu Ala Val Ser Lys Asn Ile Leu
            980                 985                 990

Val Cys Thr Gly Ser Val Thr Asp  Arg Leu Lys Lys Asp  Trp Gly Met
        995                 1000                1005

Asn Asp  Val Trp Asn Ser Ile  Val Ser Pro Arg Phe  Glu Arg Leu
    1010                1015                1020

Asn Ala  Leu Thr Glu Thr Gln  Cys Phe Gly His Trp  Glu Asn Lys
    1025                1030                1035

Asp Gly  Lys Lys Val Phe Gln  Thr Ala Val Pro Leu  Glu Tyr Gln
    1040                1045                1050

Lys Gly  Phe Ser Lys Lys Arg  Ile Asp His Arg His  His Ala Met
    1055                1060                1065

Asp Ala  Ile Val Ile Ala Cys  Ala Thr Arg Asn His  Val Asn Tyr
    1070                1075                1080

Leu Asn  Asn Glu Ser Ala Ser  Arg Asn Ala Lys Ile  Ser Arg Tyr
    1085                1090                1095

Asp Leu  Gln Arg Leu Leu Cys  Asp Lys Ser Arg Gly  Asp Gly Asn
    1100                1105                1110

Gly Asn  Tyr Arg Trp Ile Ile  Lys Lys Pro Trp Thr  Thr Phe Thr
    1115                1120                1125

Gln Asp  Ala Arg Glu Ala Leu  Ser Gly Ile Ile Val  Ser Leu Lys
    1130                1135                1140

Gln Asn  Leu Arg Ile Ile Asn  Lys Thr Thr Asn Ile  Tyr Gln His
    1145                1150                1155
```

```
Phe Asp  Ala Asn Gly Thr Arg  Val Tyr Glu Lys Gln  Lys Ile Gly
    1160                1165                1170


Asp Ser  Trp Ala Ile Arg Lys  Pro Met His Lys Asp  Thr Val Phe
    1175                1180                1185


Gly Ala  Val Asn Leu Arg Lys  Ala Leu Ile Pro Gln  His Tyr Asn
    1190                1195                1200


Leu Thr  Leu Phe Ile Ser Ser
    1205                1210
```

<210> 307
<211> 1504
<212> PRT
<213> Bacteroides vulgatus

<400> 307

```
Met Lys Asn Ile Val Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Val Val Asn Gly Ser Val Asn Asp Asp Gly Ser Glu Gln Leu Val
            20                  25                  30


Lys Ile Gln Ala Ser Gly Ser Arg Ile Ile Pro Met Asp Ala Ala Met
        35                  40                  45


Ile Gly Asp Phe Asn Lys Gly Asn Ser Ile Ser Gln Thr Ala Glu Arg
    50                  55                  60


Thr Arg Leu Arg Gly Val Arg Arg Leu Ser Glu Arg Tyr Leu Leu Arg
65                  70                  75                  80


Arg Glu Arg Leu His Arg Ile Leu Asp Ile Leu Gly Phe Leu Pro Phe
                85                  90                  95


His Phe Ala Gln Asp Leu Asp Arg His Gly Lys Ile Val Lys Gly Lys
            100                 105                 110
```

```
Glu Pro Lys Leu Ala Trp Arg Lys Asn Glu Ala Gly Gln Phe Glu Phe
        115                 120                 125

Ile Phe Gln Asp Ser Phe Lys Glu Met Leu Glu Asp Phe Lys Leu Asn
    130                 135                 140

His Pro Asn Leu Ile Thr Asp Asp Lys Lys Val Pro Tyr Asp Trp Thr
145                 150                 155                 160

Ile Tyr Tyr Leu Arg Lys Lys Gly Leu Thr Ser Lys Ile Ser Lys Glu
                165                 170                 175

Glu Leu Ala Trp Ile Leu Leu Asn Phe Asn Gln Lys Arg Gly Tyr Tyr
            180                 185                 190

Gln Leu Arg Gly Glu Glu Glu Glu Glu Asn Lys Asn Lys Leu Val Glu
        195                 200                 205

Phe Tyr Ala Leu Lys Val Val Ala Val Glu Asp Ser Gly Glu Lys Lys
    210                 215                 220

Gly Lys Asp Ile Trp Tyr Asn Val His Leu Glu Asn Gly Trp Val Tyr
225                 230                 235                 240

Arg Arg Thr Ser Asn Met Pro Leu Asp Trp Val Gly Lys Thr Lys Glu
                245                 250                 255

Phe Ile Val Thr Thr Asp Leu Glu Lys Asp Gly Thr Pro Lys Lys Asp
            260                 265                 270

Lys Glu Gly Asn Val Lys Arg Ser Phe Arg Ala Pro Lys Glu Asp Asp
        275                 280                 285

Trp Ser Leu Leu Lys Lys Lys Thr Glu Ala Asp Ile Asp Gln Thr His
    290                 295                 300
```

```
Lys Thr Val Gly Val Tyr Ile Tyr Asp Thr Leu Leu Gly Asn Pro Ser
305                 310                 315                 320

Gln Lys Ile Arg Gly Arg Leu Val Arg Thr Ile Glu Arg Lys Tyr Tyr
                325                 330                 335

Lys Glu Glu Leu Lys Gln Ile Leu Glu Lys Gln Lys Glu Phe His Leu
            340                 345                 350

Glu Leu Gln Asp Arg Ala Leu Tyr Ala Ala Cys Ile Glu Glu Leu Tyr
        355                 360                 365

Pro Ile Asn Glu Ala His Arg Asn Asn Val Gly Asn Arg Asp Phe Thr
    370                 375                 380

Tyr Leu Phe Leu Glu Asp Ile Leu Phe Tyr Gln Arg Pro Leu Lys Ser
385                 390                 395                 400

Lys Lys Ser Leu Ile Asp Asn Cys Pro Tyr Glu Glu Asn Gln Gly Leu
                405                 410                 415

Asp Lys Glu Thr Gly Glu Ile Lys Ser Phe Pro Val Lys Cys Ile Ala
            420                 425                 430

Lys Ser His Pro Leu Phe Gln Glu Phe Arg Leu Trp Gln Phe Ile Val
        435                 440                 445

Asn Leu Arg Ile Tyr Arg Lys Asp Leu Ala Gln Asp Val Asp Val Thr
    450                 455                 460

Asn Glu Leu Leu Lys Thr Glu Glu Asp Tyr Val Ala Leu Phe Asp Trp
465                 470                 475                 480

Leu Asn Gly Lys Lys Glu Ile Asp Gln Lys Ala Phe Leu Lys Tyr Pro
                485                 490                 495

Val Phe Gly Leu Lys Lys Glu Ile Glu Asn Tyr Arg Trp Asn Tyr Val
            500                 505                 510
```

```
Gln Asp Lys Pro Tyr Pro Cys Asn Glu Thr Arg Ser Leu Met Leu Ala
        515                 520                 525

Arg Leu Glu Lys Cys Asp Ile Ser Ile Glu Phe Leu Thr Lys Glu Asn
    530                 535                 540

Glu Glu Ala Leu Trp His Ile Leu Tyr Ser Val Glu Asp Lys Asn Glu
545                 550                 555                 560

Ile Val Lys Ala Leu Gln Lys Phe Ala Asp Lys His Asp Leu Asn Ala
                565                 570                 575

Ser Phe Val Asp Val Phe Gln Lys Phe Pro Pro Phe Lys Lys Glu Tyr
            580                 585                 590

Gly Ser Tyr Ser Ala Lys Ala Ile Lys Lys Leu Leu Pro Leu Met Arg
        595                 600                 605

Met Gly Lys Tyr Trp Ser Glu Asn Ser Ile Asp Lys Gly Thr Arg Glu
    610                 615                 620

Arg Ile Asp Lys Ile Ile Thr Gly Glu Tyr Asp Glu Lys Ile Glu Asn
625                 630                 635                 640

Arg Val Arg Glu Lys Ala Ile His Leu Ala Asp Val Ser Asp Phe Lys
                645                 650                 655

Gly Leu Pro Leu Trp Leu Val Cys Tyr Ile Val Tyr Gly Arg His Ser
            660                 665                 670

Glu Ala Lys Glu Ile Thr Gln Trp Lys Ser Pro Ala Asp Ile Asp Ser
        675                 680                 685

Tyr Leu Arg Ser Phe Lys Gln His Ser Leu Arg Asn Pro Ile Val Glu
    690                 695                 700
```

```
Gln Ile Ile Ile Glu Thr Leu Arg Val Val Arg Asp Ile Trp Lys Gln
705                 710                 715                 720

Val Gly Asn Ile Asp Glu Ile His Val Glu Leu Gly Arg Glu Met Lys
                725                 730                 735

Asn Pro Ala Asp Lys Arg Lys Lys Met Thr Gln Gln Met Ser Glu Asn
            740                 745                 750

Glu Asn Thr Asn Leu Arg Ile Lys Tyr Leu Leu Thr Glu Phe Leu Asn
        755                 760                 765

Pro Glu Tyr Glu Val Glu Asn Val Arg Pro Tyr Ser Pro Ser Gln Gln
    770                 775                 780

Asp Ile Leu Arg Ile Tyr Glu Glu Gly Val Leu Asn Ser Val Ser Asp
785                 790                 795                 800

Leu Pro Glu Glu Ile Ser Asp Ile Leu Lys Lys Phe Thr Glu Thr Asp
                805                 810                 815

Leu Lys Lys Arg Pro Ser Arg Ser Glu Ile Leu Arg Tyr Lys Leu Trp
            820                 825                 830

Leu Glu Gln Lys Tyr Arg Ser Pro Tyr Thr Gly Glu Val Ile Pro Leu
        835                 840                 845

Gly Lys Leu Phe Thr Pro Ala Tyr Glu Ile Glu His Val Ile Pro Gln
    850                 855                 860

Ser Cys Tyr Phe Asp Asp Ser Phe Ser Asn Lys Val Ile Cys Glu Ala
865                 870                 875                 880

Glu Val Asn Lys Leu Lys Ser Asn Leu Leu Gly His Glu Phe Ile Val
                885                 890                 895

Lys His His Gly Glu Ile Val Glu Leu Pro Phe Gly Lys Lys Val Arg
            900                 905                 910
```

```
Ile Phe Thr Val Asp Glu Tyr Glu Gln Phe Val Lys Asp Asn Tyr Ser
        915                 920                 925

Arg Thr Arg Ser Lys Met Lys Lys Leu Leu Met Asp Asp Ile Pro Glu
    930                 935                 940

Glu Phe Val Thr Arg Gln Leu Asn Asp Ser Arg Tyr Ile Ser Lys Val
945                 950                 955                 960

Val Lys Ser Leu Leu Ser Asn Ile Val Arg Glu Lys Gly Glu Glu Glu
                965                 970                 975

Ala Ile Ser Lys Asn Val Ile Pro Cys Thr Gly Gly Val Thr Asp Arg
            980                 985                 990

Leu Lys Lys Asp Trp Gly Ile Asn  Glu Val Trp Asn Lys  Ile Ile Leu
        995                 1000                1005

Pro Arg  Phe Gln Arg Leu Asn  Glu Leu Thr Gly Thr  Asn Lys Phe
    1010                1015                1020

Thr Thr  Lys Asn Val Gly Ile  Gln Glu Ile Pro Thr  Met Pro Leu
    1025                1030                1035

Glu Leu  Gln Lys Gly Phe Asn  Lys Lys Arg Ile Asp  His Arg His
    1040                1045                1050

His Ala  Met Asp Ala Ile Ile  Ile Ala Cys Ala Asn  Arg Asn Ile
    1055                1060                1065

Ile Asn  Tyr Leu Asn Asn Glu  Ser Ala Thr Ala Lys  Ala Glu Leu
    1070                1075                1080

Ser Arg  Tyr Asp Leu Gln Lys  Met Leu Cys Asp Lys  Ala Lys Thr
    1085                1090                1095
```

```
Asp Asn  Asn Gly Asn Tyr Lys  Trp Val Ile Arg Lys  Pro Trp Ala
    1100                1105                1110

Ser Phe  Thr Gln Asp Thr Tyr  Leu Ala Leu Glu Asn  Ile Ile Val
    1115                1120                1125

Ser Phe  Lys Gln Asn Leu Arg  Val Ile Asn Lys Ala  Thr Asn Arg
    1130                1135                1140

Phe Leu  His Tyr Asn Glu Glu  Gly Lys Lys Ile Phe  Val Lys Gln
    1145                1150                1155

Gly Lys  Gly Asp Asn Trp Ala  Ile Arg Lys Ser Met  His Lys Asp
    1160                1165                1170

Thr Val  Phe Gly Glu Val Asn  Leu Arg Arg Ile Lys  Thr Val Ala
    1175                1180                1185

Leu Asn  Glu Ala Met Lys Asn  Pro Gln Ser Ile Val  Val Lys Asp
    1190                1195                1200

Phe Lys  Arg Lys Leu Leu Glu  Leu Trp Asn Leu Gly  Phe Asp Ala
    1205                1210                1215

Lys Arg  Ile Lys Lys Tyr Phe  Glu Asp Asn Arg Glu  Thr Trp Ser
    1220                1225                1230

Asp Ile  Asn Leu Ser Lys Ile  Glu Val Tyr Tyr Phe  Ser Lys Asp
    1235                1240                1245

Thr Lys  Asp Arg Phe Phe Ala  Thr Arg Lys Pro Leu  Asp Thr Ser
    1250                1255                1260

Phe Asp  Arg Lys Lys Ile Glu  Asn Asn Ile Thr Asp  Thr Gly Ile
    1265                1270                1275

Gln Lys  Ile Leu Leu Arg His  Leu Glu Leu Lys Asp  Asn Asn Pro
    1280                1285                1290
```

```
Asp Ile  Ala Phe Ser Pro Asp  Gly Ile Asp Glu Met  Asn Arg Asn
    1295                1300                1305

Ile Ile  Gln Leu Asn Asn Gly  Lys Tyr His Gln Pro  Ile Ile Lys
    1310                1315                1320

Ile Arg  Trp Tyr Glu Gln Ala  Asp Lys Phe Ala Val  Gly Gln Thr
    1325                1330                1335

Gly Asn  Lys Phe Ser Lys Phe  Val Glu Ala Ala Lys  Gly Thr Asn
    1340                1345                1350

Leu Phe  Phe Ala Val Tyr Glu  Ser Asn Ile Leu Asp  Lys Lys Thr
    1355                1360                1365

Asn Thr  Ile Ile Lys Lys Arg  Asn Tyr Ala Thr Ile  Pro Leu Asn
    1370                1375                1380

Val Ala  Ile Glu Arg Gln Lys  Gln Gly Leu Pro Val  Ala Pro Glu
    1385                1390                1395

Asp Glu  Asn Gly Asn Asp Pro  Ile Phe Val Leu Ser  Pro Asn Asp
    1400                1405                1410

Leu Val  Tyr Leu Pro Thr Asp  Asp Glu Leu Ala Asn  Gly Ile Ile
    1415                1420                1425

Ala Gln  Pro Leu Asp Arg Gly  Arg Ile Tyr Lys Met  Val Ser Cys
    1430                1435                1440

Thr Gly  Asn Glu Gly His Phe  Ile Pro Ala Arg Ile  Ala Asn Pro
    1445                1450                1455

Ile Leu  Gln Thr Ile Glu Leu  Gly Ser Asn Asn Lys  Ala Gln Lys
    1460                1465                1470
```

```
Ala Trp  Thr Asp Glu Met Ile  Lys Glu Ile Cys Met  Pro Ile Lys
    1475                1480                1485


Val Asp  Arg Leu Gly Asn Val  Leu Glu Ser Ser Ser  Ser Tyr Lys
    1490                1495                1500


Lys
```

<210> 308
<211> 1153
<212> PRT
<213> Barnesiella intestinihominis

<400> 308

```
Met Lys Asn Ile Leu Gly Leu Asp Leu Gly Leu Ser Ser Ile Gly Trp
1               5                   10                  15


Ser Val Ile Arg Glu Asn Ser Glu Glu Gln Glu Leu Val Ala Met Gly
            20                  25                  30


Ser Arg Val Val Ser Leu Thr Ala Ala Glu Leu Ser Ser Phe Thr Gln
        35                  40                  45


Gly Asn Gly Val Ser Ile Asn Ser Gln Arg Thr Gln Lys Arg Thr Gln
    50                  55                  60


Arg Lys Gly Tyr Asp Arg Tyr Gln Leu Arg Arg Thr Leu Leu Arg Asn
65                  70                  75                  80


Lys Leu Asp Thr Leu Gly Met Leu Pro Asp Asp Ser Leu Ser Tyr Leu
                85                  90                  95


Pro Lys Leu Gln Leu Trp Gly Leu Arg Ala Lys Ala Val Thr Gln Arg
            100                 105                 110


Ile Glu Leu Asn Glu Leu Gly Arg Val Leu Leu His Leu Asn Gln Lys
        115                 120                 125
```

```
Arg Gly Tyr Lys Ser Ile Lys Ser Asp Phe Ser Gly Asp Lys Lys Ile
    130                 135                 140

Thr Asp Tyr Val Lys Thr Val Lys Thr Arg Tyr Asp Glu Leu Lys Glu
145                 150                 155                 160

Met Arg Leu Thr Ile Gly Glu Leu Phe Phe Arg Arg Leu Thr Glu Asn
                165                 170                 175

Ala Phe Phe Arg Cys Lys Glu Gln Val Tyr Pro Arg Gln Ala Tyr Val
            180                 185                 190

Glu Glu Phe Asp Cys Ile Met Asn Cys Gln Arg Lys Phe Tyr Pro Asp
        195                 200                 205

Ile Leu Thr Asp Glu Thr Ile Arg Cys Ile Arg Asp Glu Ile Ile Tyr
    210                 215                 220

Tyr Gln Arg Pro Leu Lys Ser Cys Lys Tyr Leu Val Ser Arg Cys Glu
225                 230                 235                 240

Phe Glu Lys Arg Phe Tyr Leu Asn Ala Ala Gly Lys Lys Thr Glu Ala
                245                 250                 255

Gly Pro Lys Val Ser Pro Arg Thr Ser Pro Leu Phe Gln Val Cys Arg
            260                 265                 270

Leu Trp Glu Ser Ile Asn Asn Ile Val Val Lys Asp Arg Arg Asn Glu
        275                 280                 285

Ile Val Phe Ile Ser Ala Glu Gln Arg Ala Ala Leu Phe Asp Phe Leu
    290                 295                 300

Asn Thr His Glu Lys Leu Lys Gly Ser Asp Leu Leu Lys Leu Leu Gly
305                 310                 315                 320

Leu Ser Lys Thr Tyr Gly Tyr Arg Leu Gly Glu Gln Phe Lys Thr Gly
```

```
                325                 330                 335

Ile Gln Gly Asn Lys Thr Arg Val Glu Ile Glu Arg Ala Leu Gly Asn
            340                 345                 350

Tyr Pro Asp Lys Lys Arg Leu Leu Gln Phe Asn Leu Gln Glu Glu Ser
        355                 360                 365

Ser Ser Met Val Asn Thr Glu Thr Gly Glu Ile Ile Pro Met Ile Ser
    370                 375                 380

Leu Ser Phe Glu Gln Glu Pro Leu Tyr Arg Leu Trp His Val Leu Tyr
385                 390                 395                 400

Ser Ile Asp Asp Arg Glu Gln Leu Gln Ser Val Leu Arg Gln Lys Phe
                405                 410                 415

Gly Ile Asp Asp Asp Glu Val Leu Glu Arg Leu Ser Ala Ile Asp Leu
            420                 425                 430

Val Lys Ala Gly Phe Gly Asn Lys Ser Ser Lys Ala Ile Arg Arg Ile
        435                 440                 445

Leu Pro Phe Leu Gln Leu Gly Met Asn Tyr Ala Glu Ala Cys Glu Ala
    450                 455                 460

Ala Gly Tyr Asn His Ser Asn Asn Tyr Thr Lys Ala Glu Asn Glu Ala
465                 470                 475                 480

Arg Ala Leu Leu Asp Arg Leu Pro Ala Ile Lys Lys Asn Glu Leu Arg
                485                 490                 495

Gln Pro Val Val Glu Lys Ile Leu Asn Gln Met Val Asn Val Val Asn
            500                 505                 510

Ala Leu Met Glu Lys Tyr Gly Arg Phe Asp Glu Ile Arg Val Glu Leu
        515                 520                 525
```

```
Ala Arg Glu Leu Lys Gln Ser Lys Glu Glu Arg Ser Asn Thr Tyr Lys
    530                 535                 540

Ser Ile Asn Lys Asn Gln Arg Glu Asn Glu Gln Ile Ala Lys Arg Ile
545                 550                 555                 560

Val Glu Tyr Gly Val Pro Thr Arg Ser Arg Ile Gln Lys Tyr Lys Met
                565                 570                 575

Trp Glu Glu Ser Lys His Cys Cys Ile Tyr Cys Gly Gln Pro Val Asp
            580                 585                 590

Val Gly Asp Phe Leu Arg Gly Phe Asp Val Glu Val Glu His Ile Ile
        595                 600                 605

Pro Lys Ser Leu Tyr Phe Asp Asp Ser Phe Ala Asn Lys Val Cys Ser
    610                 615                 620

Cys Arg Ser Cys Asn Lys Glu Lys Asn Asn Arg Thr Ala Tyr Asp Tyr
625                 630                 635                 640

Met Lys Ser Lys Gly Glu Lys Ala Leu Ser Asp Tyr Val Glu Arg Val
                645                 650                 655

Asn Thr Met Tyr Thr Asn Asn Gln Ile Ser Lys Thr Lys Trp Gln Asn
            660                 665                 670

Leu Leu Thr Pro Val Asp Lys Ile Ser Ile Asp Phe Ile Asp Arg Gln
        675                 680                 685

Leu Arg Glu Ser Gln Tyr Ile Ala Arg Lys Ala Lys Glu Ile Leu Thr
    690                 695                 700

Ser Ile Cys Tyr Asn Val Thr Ala Thr Ser Gly Ser Val Thr Ser Phe
705                 710                 715                 720

Leu Arg His Val Trp Gly Trp Asp Thr Val Leu His Asp Leu Asn Phe
```

```
                725                 730                 735

Asp Arg Tyr Lys Lys Val Gly Leu Thr Glu Val Ile Glu Val Asn His
            740                 745                 750

Arg Gly Ser Val Ile Arg Arg Glu Gln Ile Lys Asp Trp Ser Lys Arg
        755                 760                 765

Phe Asp His Arg His His Ala Ile Asp Ala Leu Thr Ile Ala Cys Thr
    770                 775                 780

Lys Gln Ala Tyr Ile Gln Arg Leu Asn Asn Leu Arg Ala Glu Glu Gly
785                 790                 795                 800

Pro Asp Phe Asn Lys Met Ser Leu Glu Arg Tyr Ile Gln Ser Gln Pro
                805                 810                 815

His Phe Ser Val Ala Gln Val Arg Glu Ala Val Asp Arg Ile Leu Val
            820                 825                 830

Ser Phe Arg Ala Gly Lys Arg Ala Val Thr Pro Gly Lys Arg Tyr Ile
        835                 840                 845

Arg Lys Asn Arg Lys Arg Ile Ser Val Gln Ser Val Leu Ile Pro Arg
    850                 855                 860

Gly Ala Leu Ser Glu Glu Ser Val Tyr Gly Val Ile His Val Trp Glu
865                 870                 875                 880

Lys Asp Glu Gln Gly His Val Ile Gln Lys Gln Arg Ala Val Met Lys
                885                 890                 895

Tyr Pro Ile Thr Ser Ile Asn Arg Glu Met Leu Asp Lys Glu Lys Val
            900                 905                 910

Val Asp Lys Arg Ile His Arg Ile Leu Ser Gly Arg Leu Ala Gln Tyr
        915                 920                 925
```

```
Asn Asp Asn Pro Lys Glu Ala Phe Ala Lys Pro Val Tyr Ile Asp Lys
    930                 935                 940

Glu Cys Arg Ile Pro Ile Arg Thr Val Arg Cys Phe Ala Lys Pro Ala
945                 950                 955                 960

Ile Asn Thr Leu Val Pro Leu Lys Lys Asp Asp Lys Gly Asn Pro Val
                965                 970                 975

Ala Trp Val Asn Pro Gly Asn Asn His His Val Ala Ile Tyr Arg Asp
            980                 985                 990

Glu Asp Gly Lys Tyr Lys Glu Arg  Thr Val Thr Phe Trp  Glu Ala Val
        995                 1000                1005

Asp Arg  Cys Arg Val Gly Ile  Pro Ala Ile Val Thr  Gln Pro Asp
    1010                1015                1020

Thr Ile  Trp Asp Asn Ile Leu  Gln Arg Asn Asp Ile  Ser Glu Asn
    1025                1030                1035

Val Leu  Glu Ser Leu Pro Asp  Val Lys Trp Gln Phe  Val Leu Ser
    1040                1045                1050

Leu Gln  Gln Asn Glu Met Phe  Ile Leu Gly Met Asn  Glu Glu Asp
    1055                1060                1065

Tyr Arg  Tyr Ala Met Asp Gln  Gln Asp Tyr Ala Leu  Leu Asn Lys
    1070                1075                1080

Tyr Leu  Tyr Arg Val Gln Lys  Leu Ser Lys Ser Asp  Tyr Ser Phe
    1085                1090                1095

Arg Tyr  His Thr Glu Thr Ser  Val Glu Asp Lys Tyr  Asp Gly Lys
    1100                1105                1110

Pro Asn  Leu Lys Leu Ser Met  Gln Met Gly Lys Leu  Lys Arg Val
```

```
    1115                1120                1125


Ser Ile  Lys Ser Leu Leu Gly  Leu Asn Pro His Lys  Val His Ile
    1130                1135                1140


Ser Val  Leu Gly Glu Ile Lys  Glu Ile Ser
    1145                1150


<210>  309
<211>  1352
<212>  PRT
<213>  Belliella baltica

<400>  309

Met Lys Lys Ile Leu Gly Leu Asp Leu Gly Thr Thr Ser Ile Gly Trp
1               5                   10                  15


Ala Phe Ile Lys Glu Pro Glu Lys Asp Val Val Gly Ser Glu Ile Val
            20                  25                  30


Asp Met Gly Val Arg Ile Val Pro Leu Ser Ser Asp Glu Glu Asn Asp
        35                  40                  45


Phe Ala Lys Gly Asn Thr Ile Ser Ile Asn Ala Asp Arg Thr Leu Lys
    50                  55                  60


Arg Gly Ala Arg Arg Asn Leu Gln Arg Phe Lys Gln Arg Arg Asn Ala
65                  70                  75                  80


Leu Leu Glu Ile Phe Lys Glu Lys Lys Leu Ile Ser Thr Asn Phe Lys
                85                  90                  95


Tyr Ala Glu Asp Gly Pro Ser Ser Thr Phe Ser Thr Leu Asn Leu Arg
            100                 105                 110


Ala Lys Ala Ala Lys Glu Lys Ile Glu Leu Gln Asp Leu Val Lys Val
        115                 120                 125
```

```
Leu Leu Gln Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Ala
    130                 135                 140

Lys Ser Glu Glu Asp Asp Gly Ser Ala Ile Asp Ser Met Gly Ile Ala
145                 150                 155                 160

Lys Glu Leu Tyr Glu Asn Asp Leu Thr Pro Gly Gln Trp Val Tyr Glu
                165                 170                 175

Ala Leu Gln Lys Gly Arg Lys Asn Val Pro Asp Phe Tyr Arg Ser Asp
            180                 185                 190

Leu Gln Glu Glu Phe Lys Lys Ile Val Asn Tyr Gln Ser Glu Phe Phe
        195                 200                 205

Pro Asp Ile Phe Asn Ala Ser Phe Val Glu Asp Trp Met Gly Lys Ala
    210                 215                 220

Ser Thr Pro Thr Lys Gln Tyr Phe Asn Lys Lys Gly Val Gln Leu Ala
225                 230                 235                 240

Glu Asn Lys Gly Lys Arg Glu Glu Arg Arg Leu Gln Glu Tyr Lys Trp
                245                 250                 255

Arg Ala Glu Ala Val Asn Phe Lys Ile Asp Leu Ser Glu Ile Ala Leu
            260                 265                 270

Ile Leu Ser Gln Ile Asn Ser Gln Ile Ser Asn Ser Ser Gly Tyr Leu
        275                 280                 285

Gly Ala Ile Ser Asp Arg Ser Lys Glu Leu Tyr Phe Lys Asn Leu Thr
    290                 295                 300

Val Gly Gln Tyr Leu Tyr Gln Gln Ile Lys Lys Asn Pro His Thr Arg
305                 310                 315                 320

Leu Lys Gly Gln Val Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe Glu
                325                 330                 335
```

```
Arg Ile Trp Ser Val Gln Ser Ser Phe Tyr Pro Gln Leu Asn Asp Ala
            340                 345                 350

Leu Lys Arg Glu Val Arg Asp Ile Thr Ile Phe Phe Gln Arg Arg Leu
        355                 360                 365

Lys Ser Gln Lys His Leu Ile Ser Asn Cys Glu Phe Glu Asp His His
    370                 375                 380

Lys Val Val Pro Lys Ser His Pro Val Phe Gln Glu Phe Arg Ile Trp
385                 390                 395                 400

Gln Asn Leu Asn Asn Leu Leu Leu Ile Lys Lys Asp Asn Leu Asn Glu
                405                 410                 415

Lys Phe Asp Leu Glu Leu Glu Ser Lys Ile Ala Leu Ala Asn Glu Leu
            420                 425                 430

Ala Phe Lys Arg Glu Leu Asn Val Lys Asp Ala Leu Lys Ile Leu Gly
        435                 440                 445

Leu Lys Pro Asn Glu Trp Glu Phe Asn Phe Thr Lys Ile Glu Gly Asn
    450                 455                 460

Arg Thr Asn Gln Ala Phe Phe Asp Ala Phe Ala Lys Ile Ile Glu Leu
465                 470                 475                 480

Glu Asp Gly Glu Pro Ile Asp Leu Gly Asp Leu Lys Ala Asp Asp Ile
                485                 490                 495

Leu Asp Gln Phe Ser Glu Ala Phe Leu Arg Ile Gly Ile Asp Thr Glu
            500                 505                 510

Leu Leu Gln Val Asn Ser Asp Ile Glu Gly Ala Glu Tyr Glu Lys Gln
        515                 520                 525
```

```
Ser Tyr Ile Gln Phe Trp His Leu Leu Tyr Ser Ser Glu Asp Asp Gln
    530                 535                 540

Lys Leu Lys Leu Asn Leu Ile Arg Lys Phe Gly Phe Lys Pro Glu His
545                 550                 555                 560

Ala Lys Ile Leu Ala Ser Ile Ser Leu Gln Asp Asp His Ala Ser Leu
                565                 570                 575

Ser Ser Arg Ala Ile Lys Lys Ile Leu Pro His Leu Gln Ser Gly Leu
            580                 585                 590

Ile Tyr Asp Lys Ala Cys Thr Tyr Ala Gly Tyr Asn His Ser Ser Ser
        595                 600                 605

Phe Thr Lys Asp Glu Asn Glu Lys Arg Glu Leu Arg Ala Glu Leu Glu
    610                 615                 620

Leu Leu Lys Lys Asn Ser Leu Arg Asn Pro Val Val Glu Lys Ile Leu
625                 630                 635                 640

Asn Gln Met Ile Asn Val Val Asn Ala Ile Leu Lys Asp Pro Glu Leu
                645                 650                 655

Gly Arg Pro Asp Glu Ile Arg Val Glu Met Ala Arg Glu Leu Lys Ala
            660                 665                 670

Asn Ala Glu Gln Arg Lys Asn Met Thr Ser Asn Ile Ala Ser Ala Thr
        675                 680                 685

Arg Asp His Asp Lys Tyr Arg Glu Ile Leu Lys Ser Glu Phe Gly Leu
    690                 695                 700

Lys Arg Val Thr Lys Asn Asp Leu Leu Arg Tyr Lys Leu Trp Leu Glu
705                 710                 715                 720

Thr Asp Gly Ile Ser Leu Tyr Thr Gly Lys Pro Ile Glu Ala Ser Lys
                725                 730                 735
```

```
Leu Phe Ser Lys Glu Tyr Asp Ile Glu His Ile Ile Pro Lys Ala Arg
            740                 745                 750

Leu Phe Asp Asp Ser Phe Ser Asn Lys Thr Ile Cys Glu Arg Gln Leu
        755                 760                 765

Asn Ile Asp Lys Ala Asn Val Thr Ala Phe Ser Phe Leu Gln Asn Lys
    770                 775                 780

Leu Ser Ala Asp Glu Phe Glu Gln Tyr Gln Ser Arg Val Lys Ser Leu
785                 790                 795                 800

Tyr Gly Lys Leu Ser Lys Ala Lys Ile Gln Lys Leu Leu Met Ala Asn
                805                 810                 815

Asp Lys Ile Pro Glu Asp Phe Ile Ala Arg Gln Leu Gln Glu Thr Arg
            820                 825                 830

Tyr Ile Ser Lys Lys Ala Lys Glu Ile Leu Phe Glu Ile Ser Arg Arg
        835                 840                 845

Val Ser Val Thr Thr Gly Thr Ile Thr Asp Lys Leu Arg Glu Asp Trp
    850                 855                 860

Gly Leu Val Glu Ile Met Lys Glu Leu Asn Trp Glu Lys Tyr Asp Lys
865                 870                 875                 880

Leu Gly Leu Thr Tyr Thr Ile Glu Gly Lys His Gly Glu Arg Leu Asn
                885                 890                 895

Lys Ile Lys Asp Trp Ser Lys Arg Asn Asp His Arg His His Ala Met
            900                 905                 910

Asp Ala Leu Thr Val Ala Leu Thr Lys Pro Ala Tyr Ile Gln Tyr Leu
        915                 920                 925
```

```
Asn Asn Leu Asn Ala Lys Gly Leu Asn Asn Lys Lys Gly Thr Glu Val
    930                 935                 940


Phe Ala Ile Glu Gln Lys Tyr Leu Lys Arg Glu Asn Gly Lys Leu Cys
945                 950                 955                 960


Phe Ile Pro Pro Ile Glu Asn Ile Arg Ser Glu Ala Lys Lys His Leu
                965                 970                 975


Ser Arg Ile Leu Val Ser Tyr Lys Ala Lys Asn Lys Val Val Thr Ile
            980                 985                 990


Asn Lys Asn Lys Thr Lys Ser Lys  Ala Gly Leu Asn Glu  Gln Ile Ala
        995                 1000                1005


Leu Thr  Pro Arg Gly Gln Leu  His Lys Glu Thr Val  Tyr Gly Lys
    1010                1015                1020


Ser Phe  His Tyr Ser Thr Lys  Phe Glu Lys Ile Gly  Ala Ser Phe
    1025                1030                1035


Asn Val  Gln Lys Ile Asn Thr  Val Ala Lys Lys Glu  Glu Arg Glu
    1040                1045                1050


Ala Leu  Leu Lys Arg Leu Ala  Glu Asn Gly Asn Asp  Pro Lys Lys
    1055                1060                1065


Ala Phe  Thr Gly Lys Asn Thr  Leu Asn Lys Met Pro  Ile Tyr Leu
    1070                1075                1080


Asp Leu  Gly Lys Asn Ile Lys  Leu Ser Glu Lys Val  Lys Thr Val
    1085                1090                1095


Val Leu  Glu Gln Asn Tyr Thr  Ile Arg Lys Asn Ile  Asp Pro Asp
    1100                1105                1110


Leu Lys  Val Asp Lys Val Ile  Asp Val Gly Ile Lys  Arg Ile Leu
    1115                1120                1125
```

```
Glu Ser  Arg Leu Glu Glu Phe  Gly Gly Asn Ala Lys  Leu Ala Phe
    1130                1135                1140

Ser Asn  Leu Glu Glu Asn Pro  Ile Trp Leu Asn Lys  Glu Lys Gly
    1145                1150                1155

Ile Ser  Ile Lys Arg Val Lys  Ile Ser Gly Val Ser  Asn Val Glu
    1160                1165                1170

Ser Leu  His Val Lys Lys Asp  His Phe Gly Glu Pro  Ile Leu Asp
    1175                1180                1185

Gln Glu  Gly Asn Glu Ile Pro  Val Asp Phe Val Ser  Thr Gly Asn
    1190                1195                1200

Asn His  His Val Ala Ile Tyr  Glu Asp Glu Asn Gly  Asn Leu Gln
    1205                1210                1215

Glu Glu  Val Val Ser Phe Phe  Glu Ala Val Val Arg  Gln Asn Gln
    1220                1225                1230

Gly Leu  Pro Ile Ile Lys Lys  Asn His Thr Leu Gly  Trp Lys Phe
    1235                1240                1245

Leu Phe  Thr Leu Lys Gln Asn  Glu Tyr Phe Val Phe  Pro Ser Asp
    1250                1255                1260

Asp Phe  Val Pro Ala Asp Val  Asp Leu Met Asp Glu  Gln Asn Tyr
    1265                1270                1275

His Leu  Ile Ser Pro Asn Leu  Phe Arg Val Gln Lys  Ile Ala Arg
    1280                1285                1290

Lys Asn  Tyr Val Phe Asn Asn  His Leu Glu Thr Lys  Ala Val Asp
    1295                1300                1305
```

```
Asn Asp  Leu Leu Lys Ser Lys  Lys Glu Leu Ser Lys  Ile Thr Tyr
    1310                1315                1320


His Phe  Tyr Gln Thr Pro Glu  His Leu Arg Gly Ile  Ile Lys Ile
    1325                1330                1335


Arg Ile  Asn His Leu Gly Lys  Ile Ile Gln Ile Gly  Glu Tyr
    1340                1345                1350
```

<210> 310
<211> 1415
<212> PRT
<213> Bergeyella zoohelcum

<400> 310

```
Met Lys His Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Leu Ile Glu Arg Asn Ile Glu Glu Lys Tyr Gly Lys Ile Ile Gly
            20                  25                  30


Met Gly Ser Arg Ile Val Pro Met Gly Ala Glu Leu Ser Lys Phe Glu
        35                  40                  45


Gln Gly Gln Ala Gln Thr Lys Asn Ala Asp Arg Arg Thr Asn Arg Gly
    50                  55                  60


Ala Arg Arg Leu Asn Lys Arg Tyr Lys Gln Arg Arg Asn Lys Leu Ile
65                  70                  75                  80


Tyr Ile Leu Gln Lys Leu Asp Met Leu Pro Ser Gln Ile Lys Leu Lys
                85                  90                  95


Glu Asp Phe Ser Asp Pro Asn Lys Ile Asp Lys Ile Thr Ile Leu Pro
            100                 105                 110


Ile Ser Lys Lys Gln Glu Gln Leu Thr Ala Phe Asp Leu Val Ser Leu
        115                 120                 125
```

```
Arg Val Lys Ala Leu Thr Glu Lys Val Gly Leu Glu Asp Leu Gly Lys
    130                 135                 140

Ile Ile Tyr Lys Tyr Asn Gln Leu Arg Gly Tyr Ala Gly Gly Ser Leu
145                 150                 155                 160

Glu Pro Glu Lys Glu Asp Ile Phe Asp Glu Glu Gln Ser Lys Asp Lys
                165                 170                 175

Lys Asn Lys Ser Phe Ile Ala Phe Ser Lys Ile Val Phe Leu Gly Glu
            180                 185                 190

Pro Gln Glu Glu Ile Phe Lys Asn Lys Lys Leu Asn Arg Arg Ala Ile
        195                 200                 205

Ile Val Glu Thr Glu Glu Gly Asn Phe Glu Gly Ser Thr Phe Leu Glu
    210                 215                 220

Asn Ile Lys Val Gly Asp Ser Leu Glu Leu Leu Ile Asn Ile Ser Ala
225                 230                 235                 240

Ser Lys Ser Gly Asp Thr Ile Thr Ile Lys Leu Pro Asn Lys Thr Asn
                245                 250                 255

Trp Arg Lys Lys Met Glu Asn Ile Glu Asn Gln Leu Lys Glu Lys Ser
            260                 265                 270

Lys Glu Met Gly Arg Glu Phe Tyr Ile Ser Glu Phe Leu Leu Glu Leu
        275                 280                 285

Leu Lys Glu Asn Arg Trp Ala Lys Ile Arg Asn Asn Thr Ile Leu Arg
    290                 295                 300

Ala Arg Tyr Glu Ser Glu Phe Glu Ala Ile Trp Asn Glu Gln Val Lys
305                 310                 315                 320

His Tyr Pro Phe Leu Glu Asn Leu Asp Lys Lys Thr Leu Ile Glu Ile
```

```
                325                 330                 335

Val Ser Phe Ile Phe Pro Gly Glu Lys Glu Ser Gln Lys Lys Tyr Arg
            340                 345                 350

Glu Leu Gly Leu Glu Lys Gly Leu Lys Tyr Ile Ile Lys Asn Gln Val
        355                 360                 365

Val Phe Tyr Gln Arg Glu Leu Lys Asp Gln Ser His Leu Ile Ser Asp
    370                 375                 380

Cys Arg Tyr Glu Pro Asn Glu Lys Ala Ile Ala Lys Ser His Pro Val
385                 390                 395                 400

Phe Gln Glu Tyr Lys Val Trp Glu Gln Ile Asn Lys Leu Ile Val Asn
                405                 410                 415

Thr Lys Ile Glu Ala Gly Thr Asn Arg Lys Gly Glu Lys Lys Tyr Lys
            420                 425                 430

Tyr Ile Asp Arg Pro Ile Pro Thr Ala Leu Lys Glu Trp Ile Phe Glu
        435                 440                 445

Glu Leu Gln Asn Lys Lys Glu Ile Thr Phe Ser Ala Ile Phe Lys Lys
    450                 455                 460

Leu Lys Ala Glu Phe Asp Leu Arg Glu Gly Ile Asp Phe Leu Asn Gly
465                 470                 475                 480

Met Ser Pro Lys Asp Lys Leu Lys Gly Asn Glu Thr Lys Leu Gln Leu
                485                 490                 495

Gln Lys Ser Leu Gly Glu Leu Trp Asp Val Leu Gly Leu Asp Ser Ile
            500                 505                 510

Asn Arg Gln Ile Glu Leu Trp Asn Ile Leu Tyr Asn Glu Lys Gly Asn
        515                 520                 525
```

```
Glu Tyr Asp Leu Thr Ser Asp Arg Thr Ser Lys Val Leu Glu Phe Ile
    530                 535                 540

Asn Lys Tyr Gly Asn Asn Ile Val Asp Asp Asn Ala Glu Glu Thr Ala
545                 550                 555                 560

Ile Arg Ile Ser Lys Ile Lys Phe Ala Arg Ala Tyr Ser Ser Leu Ser
                565                 570                 575

Leu Lys Ala Val Glu Arg Ile Leu Pro Leu Val Arg Ala Gly Lys Tyr
            580                 585                 590

Phe Asn Asn Asp Phe Ser Gln Gln Leu Gln Ser Lys Ile Leu Lys Leu
        595                 600                 605

Leu Asn Glu Asn Val Glu Asp Pro Phe Ala Lys Ala Ala Gln Thr Tyr
    610                 615                 620

Leu Asp Asn Asn Gln Ser Val Leu Ser Glu Gly Gly Val Gly Asn Ser
625                 630                 635                 640

Ile Ala Thr Ile Leu Val Tyr Asp Lys His Thr Ala Lys Glu Tyr Ser
                645                 650                 655

His Asp Glu Leu Tyr Lys Ser Tyr Lys Glu Ile Asn Leu Leu Lys Gln
            660                 665                 670

Gly Asp Leu Arg Asn Pro Leu Val Glu Gln Ile Ile Asn Glu Ala Leu
        675                 680                 685

Val Leu Ile Arg Asp Ile Trp Lys Asn Tyr Gly Ile Lys Pro Asn Glu
    690                 695                 700

Ile Arg Val Glu Leu Ala Arg Asp Leu Lys Asn Ser Ala Lys Glu Arg
705                 710                 715                 720

Ala Thr Ile His Lys Arg Asn Lys Asp Asn Gln Thr Ile Asn Asn Lys
```

```
                725                 730                 735

Ile Lys Glu Thr Leu Val Lys Asn Lys Lys Glu Leu Ser Leu Ala Asn
            740                 745                 750

Ile Glu Lys Val Lys Leu Trp Glu Ala Gln Arg His Leu Ser Pro Tyr
        755                 760                 765

Thr Gly Gln Pro Ile Pro Leu Ser Asp Leu Phe Asp Lys Glu Lys Tyr
    770                 775                 780

Asp Val Asp His Ile Ile Pro Ile Ser Arg Tyr Phe Asp Asp Ser Phe
785                 790                 795                 800

Thr Asn Lys Val Ile Ser Glu Lys Ser Val Asn Gln Glu Lys Ala Asn
                805                 810                 815

Arg Thr Ala Met Glu Tyr Phe Glu Val Gly Ser Leu Lys Tyr Ser Ile
            820                 825                 830

Phe Thr Lys Glu Gln Phe Ile Ala His Val Asn Glu Tyr Phe Ser Gly
        835                 840                 845

Val Lys Arg Lys Asn Leu Leu Ala Thr Ser Ile Pro Glu Asp Pro Val
    850                 855                 860

Gln Arg Gln Ile Lys Asp Thr Gln Tyr Ile Ala Ile Arg Val Lys Glu
865                 870                 875                 880

Glu Leu Asn Lys Ile Val Gly Asn Glu Asn Val Lys Thr Thr Thr Gly
                885                 890                 895

Ser Ile Thr Asp Tyr Leu Arg Asn His Trp Gly Leu Thr Asp Lys Phe
            900                 905                 910

Lys Leu Leu Leu Lys Glu Arg Tyr Glu Ala Leu Leu Glu Ser Glu Lys
        915                 920                 925
```

```
Phe Leu Glu Ala Glu Tyr Asp Asn Tyr Lys Lys Asp Phe Asp Ser Arg
    930                 935                 940

Lys Lys Glu Tyr Glu Glu Lys Glu Val Leu Phe Glu Glu Gln Glu Leu
945                 950                 955                 960

Thr Arg Glu Glu Phe Ile Lys Glu Tyr Lys Glu Asn Tyr Ile Arg Tyr
                965                 970                 975

Lys Lys Asn Lys Leu Ile Ile Lys Gly Trp Ser Lys Arg Ile Asp His
            980                 985                 990

Arg His His Ala Ile Asp Ala Leu  Ile Val Ala Cys Thr  Glu Pro Ala
        995                 1000                1005

His Ile  Lys Arg Leu Asn Asp  Leu Asn Lys Val Leu  Gln Asp Trp
    1010                1015                1020

Leu Val  Glu His Lys Ser Glu  Phe Met Pro Asn Phe  Glu Gly Ser
    1025                1030                1035

Asn Ser  Glu Leu Leu Glu Glu  Ile Leu Ser Leu Pro  Glu Asn Glu
    1040                1045                1050

Arg Thr  Glu Ile Phe Thr Gln  Ile Glu Lys Phe Arg  Ala Ile Glu
    1055                1060                1065

Met Pro  Trp Lys Gly Phe Pro  Glu Gln Val Glu Gln  Lys Leu Lys
    1070                1075                1080

Glu Ile  Ile Ile Ser His Lys  Pro Lys Asp Lys Leu  Leu Leu Gln
    1085                1090                1095

Tyr Asn  Lys Ala Gly Asp Arg  Gln Ile Lys Leu Arg  Gly Gln Leu
    1100                1105                1110

His Glu  Gly Thr Leu Tyr Gly  Ile Ser Gln Gly Lys  Glu Ala Tyr
```

```
    1115                1120                1125

Arg Ile  Pro Leu Thr Lys Phe  Gly Gly Ser Lys Phe  Ala Thr Glu
    1130                1135                1140

Lys Asn  Ile Gln Lys Ile Val  Ser Pro Phe Leu Ser  Gly Phe Ile
    1145                1150                1155

Ala Asn  His Leu Lys Glu Tyr  Asn Asn Lys Lys Glu  Glu Ala Phe
    1160                1165                1170

Ser Ala  Glu Gly Ile Met Asp  Leu Asn Asn Lys Leu  Ala Gln Tyr
    1175                1180                1185

Arg Asn  Glu Lys Gly Glu Leu  Lys Pro His Thr Pro  Ile Ser Thr
    1190                1195                1200

Val Lys  Ile Tyr Tyr Lys Asp  Pro Ser Lys Asn Lys  Lys Lys Lys
    1205                1210                1215

Asp Glu  Glu Asp Leu Ser Leu  Gln Lys Leu Asp Arg  Glu Lys Ala
    1220                1225                1230

Phe Asn  Glu Lys Leu Tyr Val  Lys Thr Gly Asp Asn  Tyr Leu Phe
    1235                1240                1245

Ala Val  Leu Glu Gly Glu Ile  Lys Thr Lys Lys Thr  Ser Gln Ile
    1250                1255                1260

Lys Arg  Leu Tyr Asp Ile Ile  Ser Phe Phe Asp Ala  Thr Asn Phe
    1265                1270                1275

Leu Lys  Glu Glu Phe Arg Asn  Ala Pro Asp Lys Lys  Thr Phe Asp
    1280                1285                1290

Lys Asp  Leu Leu Phe Arg Gln  Tyr Phe Glu Glu Arg  Asn Lys Ala
    1295                1300                1305
```

```
Lys Leu  Leu Phe Thr Leu Lys  Gln Gly Asp Phe Val  Tyr Leu Pro
    1310                1315                1320


Asn Glu  Asn Glu Glu Val Ile  Leu Asp Lys Glu Ser  Pro Leu Tyr
    1325                1330                1335


Asn Gln  Tyr Trp Gly Asp Leu  Lys Glu Arg Gly Lys  Asn Ile Tyr
    1340                1345                1350


Val Val  Gln Lys Phe Ser Lys  Lys Gln Ile Tyr Phe  Ile Lys His
    1355                1360                1365


Thr Ile  Ala Asp Ile Ile Lys  Lys Asp Val Glu Phe  Gly Ser Gln
    1370                1375                1380


Asn Cys  Tyr Glu Thr Val Glu  Gly Arg Ser Ile Lys  Glu Asn Cys
    1385                1390                1395


Phe Lys  Leu Glu Ile Asp Arg  Leu Gly Asn Ile Val  Lys Val Ile
    1400                1405                1410


Lys Arg
    1415


<210>  311
<211>  1430
<212>  PRT
<213>  Bergeyella zoohelcum

<400>  311

Met Lys His Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Val Val Lys Glu Ala Gln Asn Asp Asn Glu Gln Ser Glu Ile Val
            20                  25                  30


Asp Val Gly Val Arg Val Asn Pro Leu Thr Thr Asp Glu Lys Thr Asn
        35                  40                  45
```

```
Phe Glu Lys Gly Lys Pro Ile Ser Thr Asn Ala Asp Arg Thr Leu Lys
    50                  55                  60

Arg Ser Ala Arg Arg Asn Leu Gln Arg Tyr Lys Leu Arg Arg Lys Glu
65                  70                  75                  80

Leu Ile Glu Leu Leu Lys Glu His Gln Leu Ile Ser Thr Asp Thr Ile
                85                  90                  95

Leu Thr Glu Asn Gly Lys Gly Thr Thr Phe Gln Thr Leu Glu Leu Arg
            100                 105                 110

Ala Lys Ser Ala Lys Glu Lys Ile Ser Leu Glu Glu Leu Ala Arg Val
        115                 120                 125

Phe Leu Thr Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Ala
    130                 135                 140

Lys Asn Glu Asp Glu Gly Gln Leu Ile Asp Gly Met Glu Ile Ala Lys
145                 150                 155                 160

Arg Leu Tyr Glu Glu Asn Leu Thr Thr Gly Gln Leu Ser Leu Gln Leu
                165                 170                 175

Leu Lys Glu Gly Lys Lys Ser Leu Pro Asp Tyr Tyr Arg Ser Asp Leu
            180                 185                 190

Gln Phe Glu Leu Asp Lys Val Trp Asn Phe Gln Lys Gln Phe His Ser
        195                 200                 205

Asp Ile Leu Thr Asp Glu Phe Tyr Ala Gln Leu Lys Gly Lys Gly Gln
    210                 215                 220

Arg Ala Thr Ser Ala Leu Phe Leu Ala Lys Tyr Gln Ile Tyr Thr Ala
225                 230                 235                 240
```

```
Glu Asn Lys Gly Ser Arg Glu Asp Lys Lys Leu Gln Ala Tyr Gln Trp
                245                 250                 255

Arg Val Asp Ala Leu Ser Lys Glu Leu Thr Arg Glu Gln Leu Ala Phe
            260                 265                 270

Val Ile Thr Glu Ile Asn Asn Asn Leu Asn Asn Ser Ser Gly Tyr Leu
        275                 280                 285

Gly Ala Ile Ser Asp Arg Ser Lys Glu Leu Tyr Phe Asn Asn Glu Thr
    290                 295                 300

Val Gly Glu Tyr Leu Trp Lys Gln Ile Ala Ala Asn Pro His Thr Ser
305                 310                 315                 320

Leu Lys Asn Gln Val Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe Glu
                325                 330                 335

Gln Ile Trp Lys Thr Gln Ser Ala Phe Tyr Pro Glu Ile Leu Thr Asp
            340                 345                 350

Glu Leu Lys Lys Glu Leu Arg Asp Val Val Ile Phe Tyr Gln Arg Lys
        355                 360                 365

Leu Lys Ser Gln Lys Ser Leu Val Ser Phe Cys Glu Phe Glu Asn Lys
    370                 375                 380

Glu Ile Glu Ile Lys Lys Glu Asp Gly Thr Ser Thr Lys Lys Val Ile
385                 390                 395                 400

Gly Leu Lys Val Ala Pro Lys Ser Ser Pro Leu Phe Gln Glu Phe Lys
                405                 410                 415

Ile Trp Gln Asn Leu Asn Asn Val Leu Ile Arg Lys Lys Gly Ser Lys
            420                 425                 430

Thr Lys Lys Val Ala Lys Asn Gln Gln Ala Val Leu Phe Glu Glu Glu
        435                 440                 445
```

```
Lys Thr Ile Ser Glu Leu Asp Leu Glu Ala Lys Gln Ala Leu Phe Asn
    450                 455                 460

Glu Leu Asn Leu Lys Gly Asn Leu Lys Ala Asp Tyr Cys Leu Glu Ile
465                 470                 475                 480

Leu Gly Tyr Ser Pro Lys Glu Trp Glu Met Asn Tyr Ser Val Leu Glu
                485                 490                 495

Gly Asn Arg Thr Asn Lys Ala Leu Tyr Glu Ala Tyr Leu Lys Ile Thr
            500                 505                 510

Asp Leu Glu Gly Tyr Asp Ala Lys Asn His Leu Lys Val Lys Leu Asn
        515                 520                 525

Lys Asp Glu Val Glu Leu Asp Asp Leu Lys Val Pro Ala Ser Glu Ile
    530                 535                 540

Lys Asp Met Val Gln Ala Ile Phe Lys Glu Ala Gly Ile Asn Thr Asp
545                 550                 555                 560

Ile Leu His Phe Asn Ala Glu Leu Asp Gly Lys Asp Phe Glu Asn Gln
                565                 570                 575

Ala Ser Tyr Gln Leu Trp His Leu Leu Tyr Ser Tyr Glu Gly Asp Asp
            580                 585                 590

Ser Lys Ser Gly Asn Glu Leu Leu Tyr Lys Leu Leu Glu Thr Lys Phe
        595                 600                 605

Gly Phe Lys Lys Glu Tyr Ala Gln Ile Leu Ala Asn Val Ser Leu Ser
    610                 615                 620

Asp Asp Tyr Gly Ser Leu Ser Thr Lys Ala Met Arg Lys Ile His Pro
625                 630                 635                 640
```

```
Tyr Ile Lys Glu Asn Lys Phe Ser Thr Ala Cys Glu Leu Ala Gly Tyr
                645                 650                 655

Arg His Ser Lys His Ser Leu Thr Lys Glu Glu Asn Asp Asn Arg Val
            660                 665                 670

Leu Lys Asp Ser Leu Glu Val Leu Lys Lys Asn Ser Leu Arg Gln Pro
        675                 680                 685

Val Val Glu Lys Ile Leu Asn Gln Met Ile Asn Leu Val Asn Ala Leu
    690                 695                 700

Leu Lys Lys Tyr Arg Thr Glu Asn Pro Asn Phe Lys Phe Asp Glu Ile
705                 710                 715                 720

Arg Ile Glu Leu Ala Arg Glu Leu Lys Lys Asn Ala Glu Glu Arg Ala
                725                 730                 735

Asn Met Thr Ala Asn Ile Asn Lys Ala Lys Thr Glu His Glu Lys Ile
            740                 745                 750

Ile Lys Ile Leu Lys Asn Glu Phe Gly Leu Pro Asn Pro Thr Arg Asn
        755                 760                 765

Asp Ile Ile Arg Tyr Arg Leu Tyr Glu Glu Leu Lys Ala Asn Gly Tyr
    770                 775                 780

Lys Asp Leu Tyr Thr Asn Ile Lys Ile Pro Gln Glu Lys Leu Phe Thr
785                 790                 795                 800

Lys Glu Ile Asp Ile Glu His Ile Ile Pro Lys Ser Arg Val Phe Asp
                805                 810                 815

Asp Ser Phe Ser Asn Lys Thr Leu Ser Phe Arg Lys Thr Asn Leu Asp
            820                 825                 830

Lys Gly Glu Arg Thr Ala Phe Asp Tyr Met Glu Ser Lys Phe Gly Ala
        835                 840                 845
```

```
Asp Lys Leu Glu Glu Tyr Val Ala Arg Val Glu Asp Leu Tyr Lys Asn
    850                 855                 860

Asn Ile Ile Ser Lys Ala Lys Tyr Gln Lys Leu Leu Lys Lys Glu Ser
865                 870                 875                 880

Glu Ile Gly Asp Gly Phe Val Glu Arg Asp Leu Arg Glu Thr Gln Tyr
                885                 890                 895

Ile Ala Lys Lys Ala Lys Glu Ile Leu Leu Gln Ile Thr Pro Asn Val
            900                 905                 910

Leu Ser Thr Ser Gly Gly Ile Thr Asp Arg Leu Arg Glu Asp Trp Asp
        915                 920                 925

Leu Ile Asn Val Met Lys Glu Leu Asn Leu Pro Lys Tyr Arg Ala Leu
    930                 935                 940

Gly Leu Thr Gln Met Glu Asp Arg Lys Tyr Gly Gln Gln Val Glu Val
945                 950                 955                 960

Ile Thr Asp Trp Thr Lys Arg Asn Asp His Arg His His Ala Met Asp
                965                 970                 975

Ala Leu Thr Val Ala Phe Thr Lys His Asn His Ile Gln Tyr Leu Asn
            980                 985                 990

Tyr Leu Asn Ala Arg Lys Asn Glu  Lys His Lys Glu His  Ser Asn Ile
        995                 1000                1005

Met Gly  Ile Gln Gln Leu Glu  Thr Ile Lys Val Thr  Asp Lys Asn
    1010                1015                1020

Gly Asn  Glu Lys Arg Val Phe  Lys Ala Pro Met Pro  Asn Phe Arg
    1025                1030                1035
```

```
Gln Val  Thr Lys Ala Phe Leu  Glu Asn Ile Leu Ile  Ser His Lys
    1040                1045                1050

Ala Lys  Asn Lys Val Val Thr  Lys Asn Lys Asn Lys  Val Ala Gly
    1055                1060                1065

Ser Asn  Lys Val Gln Glu Val  Leu Thr Pro Arg Gly  Gln Leu His
    1070                1075                1080

Lys Glu  Thr Val Tyr Gly Lys  Tyr Gln Tyr Tyr Val  Gln Lys Glu
    1085                1090                1095

Glu Lys  Ile Gly Ala Lys Phe  Asp Leu Glu Thr Ile  Lys Lys Val
    1100                1105                1110

Ala Asn  Pro Leu Tyr Gln Ser  Leu Leu Lys Lys Arg  Leu Glu Glu
    1115                1120                1125

Asn Gly  Gly Asp Pro Lys Lys  Ala Phe Thr Gly Lys  Asn Ser Leu
    1130                1135                1140

Ala Lys  Asn Pro Ile Tyr Leu  Asp Asp Thr Gln Thr  Glu Gln Leu
    1145                1150                1155

Pro Glu  Lys Val Lys Leu Val  Trp Leu Glu Asn Ser  Phe Ser Ile
    1160                1165                1170

Arg Lys  Asp Ile Thr Pro Glu  Asn Phe Lys Asp Glu  Lys Leu Ile
    1175                1180                1185

Asp Lys  Ile Leu Asp Glu Gly  Val Lys Arg Ile Leu  Lys Glu Arg
    1190                1195                1200

Leu Gln  Ser Phe Gly Asn Asp  Ala Lys Lys Ala Phe  Ser Asp Leu
    1205                1210                1215

Asp Lys  Asn Pro Ile Trp Leu  Asn Lys Glu Lys Gly  Ile Thr Ile
    1220                1225                1230
```

```
Lys Arg  Val Thr Ile Ser Gly  Val Ala Asn Ala Glu  Pro Leu His
    1235                1240                1245

Thr Lys  Lys Asp His Leu Gly  Lys Glu Ile Leu Asp  Lys Glu Gly
    1250                1255                1260

Lys Pro  Ile Pro Val Asp Phe  Ile Ser Thr Gly Ser  Asn His His
    1265                1270                1275

Val Ala  Val Tyr Arg Asp Glu  Lys Gly Asn Leu Gln  Glu Lys Val
    1280                1285                1290

Val Ser  Val Phe Glu Ala Val  Val Arg Ala Asn Gln  Gly Leu Pro
    1295                1300                1305

Ile Ile  Asp Lys Thr Tyr Asn  Gln His Leu Gly Trp  Glu Phe Leu
    1310                1315                1320

Phe Thr  Met Lys Gln Asn Glu  Met Phe Val Phe Pro  Asn Glu Ser
    1325                1330                1335

Thr Gly  Phe Asn Pro Asn Asp  Ile Asp Leu Leu Asp  Pro Lys Asn
    1340                1345                1350

Lys Arg  Ile Ile Ser Pro Asn  Leu Phe Arg Val Gln  Lys Phe Ser
    1355                1360                1365

Lys Leu  Gln Tyr Gly Asn Ser  Phe Val Arg Glu Phe  Val Phe Arg
    1370                1375                1380

His His  Leu Glu Thr Thr Val  Glu Asp Arg Lys Glu  Leu Gln Gly
    1385                1390                1395

Ile Thr  Tyr Lys Gln Met Lys  Asn Ser Thr Phe Phe  Asn Asp Ile
    1400                1405                1410
```

```
Ile Lys  Val Arg Ile Asn His  Leu Gly Asp Ile Val  Ser Ile Gly
    1415                 1420                 1425


Glu Tyr
    1430


<210>  312
<211>  1281
<212>  PRT
<213>  Bifidobacterium bifidum

<400>  312

Met Glu Asp Asp Ser Gln His Asp Ile Arg Glu Ile Tyr Leu Ala Ile
1               5                   10                  15


His His Met Val Lys Tyr Arg Gly Asn Phe Leu Val Glu Gly Thr Leu
            20                  25                  30


Glu Ser Ser Asn Ala Phe Lys Glu Asp Glu Leu Leu Lys Leu Leu Gly
        35                  40                  45


Arg Ile Thr Arg Tyr Glu Met Ser Glu Gly Glu Gln Asn Ser Asp Ile
    50                  55                  60


Glu Gln Asp Asp Glu Asn Lys Leu Val Ala Pro Ala Asn Gly Gln Leu
65                  70                  75                  80


Ala Asp Ala Leu Cys Ala Thr Arg Gly Ser Arg Ser Met Arg Val Asp
                85                  90                  95


Asn Ala Leu Glu Ala Leu Ser Ala Val Asn Asp Leu Ser Arg Glu Gln
            100                 105                 110


Arg Ala Ile Val Lys Ala Ile Phe Ala Gly Leu Glu Gly Asn Lys Leu
        115                 120                 125


Asp Leu Ala Lys Ile Phe Val Ser Lys Glu Phe Ser Ser Glu Asn Lys
    130                 135                 140
```

```
Lys Ile Leu Gly Ile Tyr Phe Asn Lys Ser Asp Tyr Glu Glu Lys Cys
145                 150                 155                 160


Val Gln Ile Val Asp Ser Gly Leu Leu Asp Asp Glu Glu Arg Glu Phe
                165                 170                 175


Leu Asp Arg Met Gln Gly Gln Tyr Asn Ala Ile Ala Leu Lys Gln Leu
            180                 185                 190


Leu Gly Arg Ser Thr Ser Val Ser Asp Ser Lys Cys Ala Ser Tyr Asp
        195                 200                 205


Ala His Arg Ala Asn Trp Asn Leu Ile Lys Leu Gln Leu Arg Thr Lys
    210                 215                 220


Glu Asn Glu Lys Asp Ile Asn Glu Asn Tyr Gly Ile Leu Val Gly Trp
225                 230                 235                 240


Lys Ile Asp Ser Gly Gln Arg Lys Ser Val Arg Gly Glu Ser Ala Tyr
                245                 250                 255


Glu Asn Met Arg Lys Lys Ala Asn Val Phe Phe Lys Lys Met Ile Glu
            260                 265                 270


Thr Ser Asp Leu Ser Glu Thr Asp Lys Asn Arg Leu Ile His Asp Ile
        275                 280                 285


Glu Glu Asp Lys Leu Phe Pro Ile Gln Arg Asp Ser Asp Asn Gly Val
    290                 295                 300


Ile Pro His Gln Leu His Gln Asn Glu Leu Lys Gln Ile Ile Lys Lys
305                 310                 315                 320


Gln Gly Lys Tyr Tyr Pro Phe Leu Leu Asp Ala Phe Glu Lys Asp Gly
                325                 330                 335


Lys Gln Ile Asn Lys Ile Glu Gly Leu Leu Ala Phe Arg Val Pro Tyr
```

```
            340                 345                 350

Phe Val Gly Pro Leu Val Val Pro Glu Asp Leu Gln Lys Ser Asp Asn
        355                 360                 365

Ser Glu Asn His Trp Met Val Arg Lys Lys Lys Gly Glu Ile Thr Pro
    370                 375                 380

Trp Asn Phe Asp Glu Met Val Asp Lys Asp Ala Ser Gly Arg Lys Phe
385                 390                 395                 400

Ile Glu Arg Leu Val Gly Thr Asp Ser Tyr Leu Leu Gly Glu Pro Thr
                405                 410                 415

Leu Pro Lys Asn Ser Leu Leu Tyr Gln Glu Tyr Glu Val Leu Asn Glu
            420                 425                 430

Leu Asn Asn Val Arg Leu Ser Val Arg Thr Gly Asn His Trp Asn Asp
        435                 440                 445

Lys Arg Arg Met Arg Leu Gly Arg Glu Glu Lys Thr Leu Leu Cys Gln
    450                 455                 460

Arg Leu Phe Met Lys Gly Gln Thr Val Thr Lys Arg Thr Ala Glu Asn
465                 470                 475                 480

Leu Leu Arg Lys Glu Tyr Gly Arg Thr Tyr Glu Leu Ser Gly Leu Ser
                485                 490                 495

Asp Glu Ser Lys Phe Thr Ser Ser Leu Ser Thr Tyr Gly Lys Met Cys
            500                 505                 510

Arg Ile Phe Gly Glu Lys Tyr Val Asn Glu His Arg Asp Leu Met Glu
        515                 520                 525

Lys Ile Val Glu Leu Gln Thr Val Phe Glu Asp Lys Glu Thr Leu Leu
    530                 535                 540
```

```
His Gln Leu Arg Gln Leu Glu Gly Ile Ser Glu Ala Asp Cys Ala Leu
545                 550                 555                 560

Leu Val Asn Thr His Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
                565                 570                 575

Leu Thr Thr Lys Ala Gly Glu Cys Lys Ile Ser Asp Asp Phe Ala Pro
            580                 585                 590

Arg Lys His Ser Ile Ile Glu Ile Met Arg Ala Glu Asp Arg Asn Leu
        595                 600                 605

Met Glu Ile Ile Thr Asp Lys Gln Leu Gly Phe Ser Asp Trp Ile Glu
    610                 615                 620

Gln Glu Asn Leu Gly Ala Glu Asn Gly Ser Ser Leu Met Glu Val Val
625                 630                 635                 640

Asp Asp Leu Arg Val Ser Pro Lys Val Lys Arg Gly Ile Ile Gln Ser
                645                 650                 655

Ile Arg Leu Ile Asp Asp Ile Ser Lys Ala Val Gly Lys Arg Pro Ser
            660                 665                 670

Arg Ile Phe Leu Glu Leu Ala Asp Asp Ile Gln Pro Ser Gly Arg Thr
        675                 680                 685

Ile Ser Arg Lys Ser Arg Leu Gln Asp Leu Tyr Arg Asn Ala Asn Leu
    690                 695                 700

Gly Lys Glu Phe Lys Gly Ile Ala Asp Glu Leu Asn Ala Cys Ser Asp
705                 710                 715                 720

Lys Asp Leu Gln Asp Asp Arg Leu Phe Leu Tyr Tyr Thr Gln Leu Gly
                725                 730                 735

Lys Asp Met Tyr Thr Gly Glu Glu Leu Asp Leu Asp Arg Leu Ser Ser
```

```
            740                 745                 750

Ala Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Val Thr Gln Asn Asp
        755                 760                 765

Ser Ile Asp Asn Arg Val Leu Val Ala Arg Ala Glu Asn Ala Arg Lys
    770                 775                 780

Thr Asp Ser Phe Thr Tyr Met Pro Gln Ile Ala Asp Arg Met Arg Asn
785                 790                 795                 800

Phe Trp Gln Ile Leu Leu Asp Asn Gly Leu Ile Ser Arg Val Lys Phe
                805                 810                 815

Glu Arg Leu Thr Arg Gln Asn Glu Phe Ser Glu Arg Glu Lys Glu Arg
            820                 825                 830

Phe Val Gln Arg Ser Leu Val Glu Thr Arg Gln Ile Met Lys Asn Val
        835                 840                 845

Ala Thr Leu Met Arg Gln Arg Tyr Gly Asn Ser Ala Ala Val Ile Gly
    850                 855                 860

Leu Asn Ala Glu Leu Thr Lys Glu Met His Arg Tyr Leu Gly Phe Ser
865                 870                 875                 880

His Lys Asn Arg Asp Ile Asn Asp Tyr His His Ala Gln Asp Ala Leu
                885                 890                 895

Cys Val Gly Ile Ala Gly Gln Phe Ala Ala Asn Arg Gly Phe Phe Ala
            900                 905                 910

Asp Gly Glu Val Ser Asp Gly Ala Gln Asn Ser Tyr Asn Gln Tyr Leu
        915                 920                 925

Arg Asp Tyr Leu Arg Gly Tyr Arg Glu Lys Leu Ser Ala Glu Asp Arg
    930                 935                 940
```

```
Lys Gln Gly Arg Ala Phe Gly Phe Ile Val Gly Ser Met Arg Ser Gln
945                 950                 955                 960


Asp Glu Gln Lys Arg Val Asn Pro Arg Thr Gly Glu Val Val Trp Ser
                965                 970                 975


Glu Glu Asp Lys Asp Tyr Leu Arg Lys Val Met Asn Tyr Arg Lys Met
            980                 985                 990


Leu Val Thr Gln Lys Val Gly Asp  Asp Phe Gly Ala Leu  Tyr Asp Glu
        995                 1000                1005


Thr Arg  Tyr Ala Ala Thr Asp  Pro Lys Gly Ile Lys  Gly Ile Pro
    1010                1015                1020


Phe Asp  Gly Ala Lys Gln Asp  Thr Ser Leu Tyr Gly  Gly Phe Ser
    1025                1030                1035


Ser Ala  Lys Pro Ala Tyr Ala  Val Leu Ile Glu Ser  Lys Gly Lys
    1040                1045                1050


Thr Arg  Leu Val Asn Val Thr  Met Gln Glu Tyr Ser  Leu Leu Gly
    1055                1060                1065


Asp Arg  Pro Ser Asp Asp Glu  Leu Arg Lys Val Leu  Ala Lys Lys
    1070                1075                1080


Lys Ser  Glu Tyr Ala Lys Ala  Asn Ile Leu Leu Arg  His Val Pro
    1085                1090                1095


Lys Met  Gln Leu Ile Arg Tyr  Gly Gly Gly Leu Met  Val Ile Lys
    1100                1105                1110


Ser Ala  Gly Glu Leu Asn Asn  Ala Gln Gln Leu Trp  Leu Pro Tyr
    1115                1120                1125


Glu Glu  Tyr Cys Tyr Phe Asp  Asp Leu Ser Gln Gly  Lys Gly Ser
```

```
    1130                1135                1140

Leu Glu  Lys Asp Asp Leu Lys  Lys Leu Leu Asp Ser  Ile Leu Gly
    1145                1150                1155

Ser Val  Gln Cys Leu Tyr Pro  Trp His Arg Phe Thr  Glu Glu Glu
    1160                1165                1170

Leu Ala  Asp Leu His Val Ala  Phe Asp Lys Leu Pro  Glu Asp Glu
    1175                1180                1185

Lys Lys  Asn Val Ile Thr Gly  Ile Val Ser Ala Leu  His Ala Asp
    1190                1195                1200

Ala Lys  Thr Ala Asn Leu Ser  Ile Val Gly Met Thr  Gly Ser Trp
    1205                1210                1215

Arg Arg  Met Asn Asn Lys Ser  Gly Tyr Thr Phe Ser  Asp Glu Asp
    1220                1225                1230

Glu Phe  Ile Phe Gln Ser Pro  Ser Gly Leu Phe Glu  Lys Arg Val
    1235                1240                1245

Thr Val  Gly Glu Leu Lys Arg  Lys Ala Lys Lys Glu  Val Asn Ser
    1250                1255                1260

Lys Tyr  Arg Thr Asn Glu Lys  Arg Leu Pro Thr Leu  Ser Gly Ala
    1265                1270                1275

Ser Gln  Pro
    1280
```

<210> 313
<211> 1121
<212> PRT
<213> Bifidobacterium dentium

<400> 313

```
Met Ser Val Gly Leu Ala Ala Ile Glu Val Asp Glu Thr Gly Phe Pro
1               5                  10                  15

Ile Arg Ile Leu Asn Ile Gln Ser Val Ile His Asp Gly Gly Ile Asp
            20                  25                  30

Pro Gln Leu Gly Lys Lys Lys Ser Ile Ser Arg Lys Ala Ile Ser Gly
        35                  40                  45

Val Ala Arg Arg Thr Arg Arg Met Arg Arg Arg Lys Val Val Arg Leu
    50                  55                  60

Arg Gln Leu Asp Ala Thr Leu Glu Ser Leu Gly Phe Pro Ile Val Glu
65                  70                  75                  80

Pro Asp Ser Leu Asp Thr Trp Glu Ile Trp Leu Thr Arg Ala Lys Leu
                85                  90                  95

Ala Ser Ser Tyr Ile Gln Asp Asp Glu Thr Arg Lys Glu Asp Val Ser
            100                 105                 110

Ile Ala Leu Arg His Ile Ala Arg His Arg Gly Trp Arg Asn Pro Tyr
        115                 120                 125

Ser Asn Val Glu Ser Leu Phe Val Asp Val Ala Pro Ser Glu Gln Tyr
    130                 135                 140

Glu Glu Leu Arg Arg Lys Ala Glu Glu Lys Leu Gly Thr Ser Leu Ser
145                 150                 155                 160

Gly Asn Pro Thr Ser Ala Glu Ile Val Glu Cys Ile Leu Lys Arg Gln
                165                 170                 175

Val Gly Glu Val Gln Leu Arg Thr Arg Ser Arg Lys Gly Val Asn Gly
            180                 185                 190

Asn Ala Val Glu Lys Glu Gly Leu Leu Pro Thr Lys Leu Met Gln Ser
        195                 200                 205
```

```
Asp Asn Ala Ala Glu Ile Arg Arg Ile Phe Lys Val Gln Arg Ile Asp
    210                 215                 220

Asp Glu Thr Gly Arg Lys Leu Leu Arg Ala Val Phe Lys Ala Cys Ser
225                 230                 235                 240

Pro Lys Gly Ser Val Glu Arg Arg Val Gly Arg Asp Ala Leu Ala Pro
                245                 250                 255

Gly Leu Pro Arg Ala Leu Lys Ala Ser Leu Ala Phe Gln Glu Tyr Arg
            260                 265                 270

Ile Ala Asn Val Leu Thr Asn Leu Val Ile Ser Glu Asp Gly Thr Lys
        275                 280                 285

Arg Lys Leu Thr Ile Ala Glu Lys Gln Arg Val Phe Gly Phe Leu Ser
    290                 295                 300

Ser Asn Glu Thr Asp Asp Ile Thr Trp Ile Asp Val Ala Glu Lys Leu
305                 310                 315                 320

Gly Leu Glu Arg Arg Gln Ile Gln Gly Val Gly Cys Leu Thr Ala Asp
                325                 330                 335

Gly Glu Glu Arg Ile Ser Ser Thr Pro Pro Arg Asn Ile Thr Ala Leu
            340                 345                 350

His Ile His Ser Ala Lys Pro Val Ile Arg Glu Lys Leu Val Ala Trp
        355                 360                 365

Trp Lys Ala Ala Ser Pro Thr Val Arg Glu Thr Met Val Glu Leu Leu
    370                 375                 380

Ser Asn Thr Val Asp Ile Asp Arg Val Arg Glu Asp Met Asp Tyr Ser
385                 390                 395                 400
```

```
Ser Ala Val Ala Phe Ile Asp Ser Leu Gly Asp Glu Glu Leu Thr Ala
                405                 410                 415

Leu Asp Ser Val Asp Leu Leu Ser Gly Arg Ala Ala Tyr Ser Arg Gln
            420                 425                 430

Thr Leu Lys Gln Leu Thr Glu Arg Met Leu Asn Thr Asp Asp Asp Leu
        435                 440                 445

His Glu Ala Arg Lys Ala Val Phe Gly Val Asp Asp Asn Trp Lys Pro
    450                 455                 460

Pro Val Asp Ala Ile Ser Thr Ser Val Gly Asn Pro Ala Val Asp Arg
465                 470                 475                 480

Val Leu Lys Ile Val Asn Arg Tyr Leu Leu Ala Cys Gln Lys Arg Trp
                485                 490                 495

Arg Asn Pro Gln Ser Val Gln Ile Glu His Val Arg Glu Ser Phe Ser
            500                 505                 510

Ser Val Ala Lys Ala Lys Glu Thr Glu Arg Val Gln Gly Glu Arg Ala
        515                 520                 525

Arg Tyr Arg Asn Asp Leu Arg Arg Glu Leu Cys Glu Gln Glu Gly Leu
    530                 535                 540

Asn Lys Ile Arg Glu Ser Asp Ile Arg Arg Trp Glu Ser Val Gln Arg
545                 550                 555                 560

Gln Asn Gly Thr Cys Leu Tyr Cys Gly Ser Pro Ile Thr Phe Arg Thr
                565                 570                 575

Cys Glu Met Asp His Ile Val Pro Arg Lys Gly Val Gly Ser Thr Asn
            580                 585                 590

Thr Arg Val Asn Leu Ala Ala Ala Cys Ala Ala Cys Asn Lys Leu Lys
        595                 600                 605
```

```
Ser Asn Thr Ala Phe Ser Val Trp Ala Arg Thr Glu Gly Ala Ala Asn
    610                 615                 620

Arg Lys Val Ser Gln Arg Asp Ala Ile Glu Arg Val Lys Thr Phe Ile
625                 630                 635                 640

Phe Asn Lys Ser Val Pro Pro Arg Glu Gln Arg Ala Phe Lys Gln Ala
                645                 650                 655

Val Ile Ser Arg Leu Arg Gln Ala Glu Ser Asp Pro Ala Ile Asp Asn
            660                 665                 670

Arg Ser Ile Glu Ser Val Ala Trp Met Ala Asp Glu Leu His Arg Arg
        675                 680                 685

Ile Glu Ala Tyr Phe Asn Gln Asp Ala Asp Val Ser Gly Asn Thr Pro
    690                 695                 700

Ala Thr Gln Val Trp Val Phe Gln Gly Arg Val Thr Ala Leu Ala Arg
705                 710                 715                 720

Lys Ala Ser Gly Ile Glu Gly Arg Ile His Phe Ala Gly Glu Trp Lys
                725                 730                 735

Lys Thr Arg Leu Asp Arg Arg His His Ala Val Asp Ala Ala Val Ile
            740                 745                 750

Ala Met Met Asn His Ser Ala Ala Gln Thr Leu Val Glu Arg Asp Ser
        755                 760                 765

Leu Arg Leu Ser Gln Trp Ile Thr Arg Lys Pro Glu Thr Trp Lys Asn
    770                 775                 780

Tyr Pro Phe Ser Glu Gly Gln Lys Lys Thr Arg Phe Lys Glu Trp Leu
785                 790                 795                 800
```

```
Asp Cys Met Asn Ala Leu Leu Asp Leu Leu Asn Asp Ala Leu Asp Ser
                805                 810                 815

Asp Arg Val Pro Val Thr Arg Cys Gln Arg Met Ser Leu Gly Asn Ser
            820                 825                 830

Gln Ala His Ala Ala Thr Ile Arg Lys Met Lys Arg Val Glu Leu Phe
        835                 840                 845

Ser Pro Met Asp Ala Asp Leu Ile Arg Arg Ala Ser Thr Pro Ala Leu
    850                 855                 860

Tyr Cys Ala Leu Thr Arg Leu Pro Glu Tyr Ser Pro Glu Lys Gly Leu
865                 870                 875                 880

Pro Glu Asn Arg Gly Arg Glu Ile Val Leu Asn Gly Arg His Ile Arg
                885                 890                 895

Ser Thr Glu Thr Val Asp Phe Phe Ala Ser Gly Ala Ala Gln Leu Met
            900                 905                 910

Val Arg Asn Gly Ser Ala Glu Ile Gly Asp Ser Ile His His Met Arg
        915                 920                 925

Ile Tyr Arg Tyr Arg Lys Thr Gly Ala Lys Ser Gln Glu Tyr Val Tyr
    930                 935                 940

Gly Met Ile Arg Val Phe Gln Ile Asp Leu Leu His Ala Ser Ser Glu
945                 950                 955                 960

Asn Leu Phe Ala Val Gln Leu Pro Ser Gln Ser Val Ser Val Arg Tyr
                965                 970                 975

Gly Asp Lys Asn Val Val Gln Ala Ile Gln Glu Gly Arg Ala Glu Tyr
            980                 985                 990

Leu Gly His Ile Val Pro Asn Asp  Glu Ile Leu Ile Ser  Tyr Glu Gly
        995                 1000                1005
```

```
Val Arg  Met Lys Asp Ser Glu  Lys Ile Gly Ala Tyr  Ala Asn Asp
    1010                1015                1020


Phe Ser  Gly Thr Ala Ser Glu  Leu Ala Gln Arg Arg  His Trp Val
    1025                1030                1035


Val Val  Gly Ser Asp Val Ser  Lys Leu Ala Leu Arg  Pro Ser Tyr
    1040                1045                1050


Leu Ser  Glu Glu Gly Leu Glu  Asn Ser Gly Ser Glu  Ser Glu Arg
    1055                1060                1065


Leu Ser  Lys Gln Thr Arg Lys  Val Ile Glu Gly Lys  Gly Trp Val
    1070                1075                1080


Val Ala  Val Asn Ile Leu Ala  Lys Tyr His Pro Val  Val Ile Arg
    1085                1090                1095


Arg Asn  Ala Leu Gly Glu Pro  Arg Phe Arg Thr Asn  Ser Gly Met
    1100                1105                1110


Pro Val  Ser Trp Arg Trp Asp  Arg
    1115                1120


<210>  314
<211>  354
<212>  PRT
<213>  Bifidobacterium longum

<400>  314

Ala Lys Gln Tyr Val Asn Ser Ala Ser Ile Asp Asp Ala Glu Ala Glu
1               5                  10                  15


Thr Met Lys Thr Thr Val Ser Val Phe Gln Gly Arg Val Thr Ala Ser
            20                  25                  30


Ala Arg Arg Ala Ala Gly Ile Glu Gly Lys Ile His Phe Ile Gly Gln
```

```
        35                  40                  45

Gln Ser Lys Thr Arg Leu Asp Arg Arg His His Ala Val Asp Ala Ser
    50                  55                  60

Val Ile Ala Met Met Asn Thr Ala Ala Ala Gln Thr Leu Met Glu Arg
65                  70                  75                  80

Glu Ser Leu Arg Glu Ser Gln Arg Leu Ile Gly Leu Met Pro Gly Glu
                85                  90                  95

Arg Ser Trp Lys Glu Tyr Pro Tyr Glu Gly Thr Ser Arg Tyr Glu Ser
            100                 105                 110

Phe His Leu Trp Leu Asp Asn Met Asp Val Leu Leu Glu Leu Leu Asn
        115                 120                 125

Asp Ala Leu Asp Asn Asp Arg Ile Ala Val Met Gln Ser Gln Arg Tyr
    130                 135                 140

Val Leu Gly Asn Ser Ile Ala His Asp Ala Thr Ile His Pro Leu Glu
145                 150                 155                 160

Lys Val Pro Leu Gly Ser Ala Met Ser Ala Asp Leu Ile Arg Arg Ala
                165                 170                 175

Ser Thr Pro Ala Leu Trp Cys Ala Leu Thr Arg Leu Pro Asp Tyr Asp
            180                 185                 190

Glu Lys Glu Gly Leu Pro Glu Asp Ser His Arg Glu Ile Arg Val His
        195                 200                 205

Asp Thr Arg Tyr Ser Ala Asp Asp Glu Met Gly Phe Phe Ala Ser Gln
    210                 215                 220

Ala Ala Gln Ile Ala Val Gln Glu Gly Ser Ala Asp Ile Gly Ser Ala
225                 230                 235                 240
```

```
Ile His His Ala Arg Val Tyr Arg Cys Trp Lys Thr Asn Ala Lys Gly
                245                 250                 255

Val Arg Lys Tyr Phe Tyr Gly Met Ile Arg Val Phe Gln Thr Asp Leu
            260                 265                 270

Leu Arg Ala Cys His Asp Asp Leu Phe Thr Val Pro Leu Pro Pro Gln
        275                 280                 285

Ser Ile Ser Met Arg Tyr Gly Glu Pro Arg Val Val Gln Ala Leu Gln
    290                 295                 300

Ser Gly Asn Ala Gln Tyr Leu Gly Ser Leu Val Val Gly Asp Glu Ile
305                 310                 315                 320

Glu Met Asp Phe Ser Ser Leu Asp Val Asp Gly Gln Ile Gly Glu Tyr
                325                 330                 335

Leu Gln Phe Phe Ser Gln Phe Ser Gly Gly Asn Leu Ala Trp Lys His
            340                 345                 350

Trp Val
```

<210> 315
<211> 1124
<212> PRT
<213> Bifidobacterium longum

<400> 315

```
Leu Thr Gly His Ser Gly His Thr Phe Trp Pro Thr Ser Ser Ser Pro
1               5                   10                  15

Pro Ile Gln Leu Glu Gln Glu Lys Arg Pro Leu Pro Gln Arg Asn Thr
            20                  25                  30

Ser Gln Asn Gly His Thr Phe Trp Pro Ile Thr Arg Glu Arg Cys Phe
        35                  40                  45
```

```
Met Arg Gly Lys Arg Tyr Arg Ile Gly Ile Asp Val Gly Leu Asn Ser
    50                  55                  60

Val Gly Leu Ala Ala Val Glu Val Ser Asp Glu Asn Ser Pro Val Arg
65                  70                  75                  80

Leu Leu Asn Ala Gln Ser Val Ile His Asp Gly Gly Val Asp Pro Gln
                85                  90                  95

Lys Asn Lys Glu Ala Ile Thr Arg Lys Asn Met Ser Gly Val Ala Arg
            100                 105                 110

Arg Thr Arg Arg Met Arg Arg Arg Lys Arg Glu Arg Leu His Lys Leu
        115                 120                 125

Asp Met Leu Leu Gly Lys Phe Gly Tyr Pro Val Ile Glu Pro Glu Ser
    130                 135                 140

Leu Asp Lys Pro Phe Glu Glu Trp His Val Arg Ala Glu Leu Ala Thr
145                 150                 155                 160

Arg Tyr Ile Glu Asp Asp Glu Leu Arg Arg Glu Ser Ile Ser Ile Ala
                165                 170                 175

Leu Arg His Met Ala Arg His Arg Gly Trp Arg Asn Pro Tyr Arg Gln
            180                 185                 190

Val Asp Ser Leu Ile Ser Asp Asn Pro Tyr Ser Lys Gln Tyr Gly Glu
        195                 200                 205

Leu Lys Glu Lys Ala Lys Ala Tyr Asn Asp Asp Ala Thr Ala Ala Glu
    210                 215                 220

Glu Glu Ser Thr Pro Ala Gln Leu Val Val Ala Met Leu Asp Ala Gly
225                 230                 235                 240
```

```
Tyr Ala Glu Ala Pro Arg Leu Arg Trp Arg Thr Gly Ser Lys Lys Pro
                245                 250                 255

Asp Ala Glu Gly Tyr Leu Pro Val Arg Leu Met Gln Glu Asp Asn Ala
            260                 265                 270

Asn Glu Leu Lys Gln Ile Phe Arg Val Gln Arg Val Pro Ala Asp Glu
        275                 280                 285

Trp Lys Pro Leu Phe Arg Ser Val Phe Tyr Ala Val Ser Pro Lys Gly
    290                 295                 300

Ser Ala Glu Gln Arg Val Gly Gln Asp Pro Leu Ala Pro Glu Gln Ala
305                 310                 315                 320

Arg Ala Leu Lys Ala Ser Leu Ala Phe Gln Glu Tyr Arg Ile Ala Asn
                325                 330                 335

Val Ile Thr Asn Leu Arg Ile Lys Asp Ala Ser Ala Glu Leu Arg Lys
            340                 345                 350

Leu Thr Val Asp Glu Lys Gln Ser Ile Tyr Asp Gln Leu Val Ser Pro
        355                 360                 365

Ser Ser Glu Asp Ile Thr Trp Ser Asp Leu Cys Asp Phe Leu Gly Phe
    370                 375                 380

Lys Arg Ser Gln Leu Lys Gly Val Gly Ser Leu Thr Glu Asp Gly Glu
385                 390                 395                 400

Glu Arg Ile Ser Ser Arg Pro Pro Arg Leu Thr Ser Val Gln Arg Ile
                405                 410                 415

Tyr Glu Ser Asp Asn Lys Ile Arg Lys Pro Leu Val Ala Trp Trp Lys
            420                 425                 430

Ser Ala Ser Asp Asn Glu His Glu Ala Met Ile Arg Leu Leu Ser Asn
        435                 440                 445
```

```
Thr Val Asp Ile Asp Lys Val Arg Glu Asp Val Ala Tyr Ala Ser Ala
    450                 455                 460

Ile Glu Phe Ile Asp Gly Leu Asp Asp Asp Ala Leu Thr Lys Leu Asp
465                 470                 475                 480

Ser Val Asp Leu Pro Ser Gly Arg Ala Ala Tyr Ser Val Glu Thr Leu
                485                 490                 495

Gln Lys Leu Thr Arg Gln Met Leu Thr Thr Asp Asp Asp Leu His Glu
            500                 505                 510

Ala Arg Lys Thr Leu Phe Asn Val Thr Asp Ser Trp Arg Pro Pro Ala
        515                 520                 525

Asp Pro Ile Gly Glu Pro Leu Gly Asn Pro Ser Val Asp Arg Val Leu
    530                 535                 540

Lys Asn Val Asn Arg Tyr Leu Met Asn Cys Gln Gln Arg Trp Gly Asn
545                 550                 555                 560

Pro Val Ser Val Asn Ile Glu His Val Arg Ser Ser Phe Ser Ser Val
                565                 570                 575

Ala Phe Ala Arg Lys Asp Lys Arg Glu Tyr Glu Lys Asn Asn Glu Lys
            580                 585                 590

Arg Ser Ile Phe Arg Ser Ser Leu Ser Glu Gln Leu Arg Ala Asp Glu
        595                 600                 605

Gln Met Glu Lys Val Arg Glu Ser Asp Leu Arg Arg Leu Glu Ala Ile
    610                 615                 620

Gln Arg Gln Asn Gly Gln Cys Leu Tyr Cys Gly Arg Thr Ile Thr Phe
625                 630                 635                 640
```

```
Arg Thr Cys Glu Met Asp His Ile Val Pro Arg Lys Gly Val Gly Ser
                645                 650                 655

Thr Asn Thr Arg Thr Asn Phe Ala Ala Val Cys Ala Glu Cys Asn Arg
            660                 665                 670

Met Lys Ser Asn Thr Pro Phe Ala Ile Trp Ala Arg Ser Glu Asp Ala
        675                 680                 685

Gln Thr Arg Gly Val Ser Leu Ala Glu Ala Lys Lys Arg Val Thr Met
    690                 695                 700

Phe Thr Phe Asn Pro Lys Ser Tyr Ala Pro Arg Glu Val Lys Ala Phe
705                 710                 715                 720

Lys Gln Ala Val Ile Ala Arg Leu Gln Gln Thr Glu Asp Asp Ala Ala
                725                 730                 735

Ile Asp Asn Arg Ser Ile Glu Ser Val Ala Trp Met Ala Asp Glu Leu
            740                 745                 750

His Arg Arg Ile Asp Trp Tyr Phe Asn Ala Lys Gln Tyr Val Asn Ser
        755                 760                 765

Ala Ser Ile Asp Asp Ala Glu Ala Glu Thr Met Lys Thr Thr Val Ser
    770                 775                 780

Val Phe Gln Gly Arg Val Thr Ala Ser Ala Arg Arg Ala Ala Gly Ile
785                 790                 795                 800

Glu Gly Lys Ile His Phe Ile Gly Gln Gln Ser Lys Thr Arg Leu Asp
                805                 810                 815

Arg Arg His His Ala Val Asp Ala Ser Val Ile Ala Met Met Asn Thr
            820                 825                 830

Ala Ala Ala Gln Thr Leu Met Glu Arg Glu Ser Leu Arg Glu Ser Gln
        835                 840                 845
```

```
Arg Leu Ile Gly Leu Met Pro Gly Glu Arg Ser Trp Lys Glu Tyr Pro
    850                 855                 860

Tyr Glu Gly Thr Ser Arg Tyr Glu Ser Phe His Leu Trp Leu Asp Asn
865                 870                 875                 880

Met Asp Val Leu Leu Glu Leu Leu Asn Asp Ala Leu Asp Asn Asp Arg
                885                 890                 895

Ile Ala Val Met Gln Ser Gln Arg Tyr Val Leu Gly Asn Ser Ile Ala
            900                 905                 910

His Asp Ala Thr Ile His Pro Leu Glu Lys Val Pro Leu Gly Ser Ala
        915                 920                 925

Met Ser Ala Asp Leu Ile Arg Arg Ala Ser Thr Pro Ala Leu Trp Cys
    930                 935                 940

Ala Leu Thr Arg Leu Pro Asp Tyr Asp Glu Lys Glu Gly Leu Pro Glu
945                 950                 955                 960

Asp Ser His Arg Glu Ile Arg Val His Asp Thr Arg Tyr Ser Ala Asp
                965                 970                 975

Asp Glu Met Gly Phe Phe Ala Ser Gln Ala Ala Gln Ile Ala Val Gln
            980                 985                 990

Glu Gly Ser Ala Asp Ile Gly Ser  Ala Ile His His Ala  Arg Val Tyr
        995                 1000                1005

Arg Cys  Trp Lys Thr Asn Ala  Lys Gly Val Arg Lys  Tyr Phe Tyr
    1010                1015                1020

Gly Met  Ile Arg Val Phe Gln  Thr Asp Leu Leu Arg  Ala Cys His
    1025                1030                1035
```

```
Asp Asp  Leu Phe Thr Val Pro  Leu Pro Pro Gln Ser  Ile Ser Met
    1040                1045                1050


Arg Tyr  Gly Glu Pro Arg Val  Val Gln Ala Leu Gln  Ser Gly Asn
    1055                1060                1065


Ala Gln  Tyr Leu Gly Ser Leu  Val Val Gly Asp Glu  Ile Glu Met
    1070                1075                1080


Asp Phe  Pro Val Ser Met Leu  Met Val Arg Leu Ala  Ser Ile Tyr
    1085                1090                1095


Asn Ser  Ser Arg Ser Leu Val  Glu Gly Thr Leu His  Gly Asn Ile
    1100                1105                1110


Gly Leu  Leu Met Asp Ser Leu  Thr Arg Arg Ser
    1115                1120
```

<210> 316
<211> 166
<212> PRT
<213> Bifidobacterium longum

<400> 316

```
Met Gly Leu Ala Ala Val Glu Val Ser Asp Glu Asn Ser Pro Val Arg
1               5                   10                  15


Leu Leu Asn Ala Gln Ser Val Ile His Asp Gly Gly Val Asp Pro Gln
            20                  25                  30


Lys Asn Lys Glu Ala Ile Thr Arg Lys Asn Met Ser Gly Val Ala Arg
        35                  40                  45


Arg Thr Arg Arg Met Arg Arg Arg Lys Arg Glu Arg Leu His Lys Leu
    50                  55                  60


Asp Met Leu Leu Gly Lys Phe Gly Tyr Pro Val Ile Glu Pro Glu Ser
65                  70                  75                  80
```

```
Leu Asp Lys Pro Phe Glu Glu Trp His Val Arg Ala Glu Leu Ala Thr
                85                  90                  95

Arg Tyr Ile Glu Asp Asp Glu Leu Arg Arg Glu Ser Ile Ser Ile Ala
            100                 105                 110

Leu Arg His Met Ala Arg His Arg Gly Trp Arg Asn Pro Tyr Arg Gln
        115                 120                 125

Val Asp Ser Leu Ile Ser Asp Asn Pro Tyr Ser Lys Gln Tyr Gly Glu
    130                 135                 140

Leu Lys Glu Lys Ala Lys Ala Tyr Asn Asp Asp Ala Thr Ala Ala Glu
145                 150                 155                 160

Glu Glu Ser Thr Pro Ala
                165
```

<210> 317
<211> 1138
<212> PRT
<213> Bifidobacterium longum

<400> 317

```
Met Asn Ser Val Gly Leu Ala Ala Val Glu Val Ser Asp Glu Asn Ser
1               5                   10                  15

Pro Val Arg Leu Leu Asn Ala Gln Ser Val Ile His Asp Gly Gly Val
            20                  25                  30

Asp Pro Gln Lys Asn Lys Glu Ala Ile Thr Arg Lys Asn Met Ser Gly
        35                  40                  45

Val Ala Arg Arg Thr Arg Arg Met Arg Arg Arg Lys Arg Glu Arg Leu
    50                  55                  60

His Lys Leu Asp Met Leu Leu Gly Lys Phe Gly Tyr Pro Val Ile Glu
65                  70                  75                  80
```

```
Pro Glu Ser Leu Asp Lys Pro Phe Glu Glu Trp His Val Arg Ala Glu
                85                  90                  95

Leu Ala Thr Arg Tyr Ile Glu Asp Asp Glu Leu Arg Arg Glu Ser Ile
            100                 105                 110

Ser Ile Ala Leu Arg His Met Ala Arg His Arg Gly Trp Arg Asn Pro
        115                 120                 125

Tyr Arg Gln Val Asp Ser Leu Ile Ser Asp Asn Pro Tyr Ser Lys Gln
    130                 135                 140

Tyr Gly Glu Leu Lys Glu Lys Ala Lys Ala Tyr Asn Asp Asp Ala Thr
145                 150                 155                 160

Ala Ala Glu Glu Glu Ser Thr Pro Ala Gln Leu Val Val Ala Met Leu
                165                 170                 175

Asp Ala Gly Tyr Ala Glu Ala Pro Arg Leu Arg Trp Arg Thr Gly Ser
            180                 185                 190

Lys Lys Pro Asp Ala Glu Gly Tyr Leu Pro Val Arg Leu Met Gln Glu
        195                 200                 205

Asp Asn Ala Asn Glu Leu Lys Gln Ile Phe Arg Val Gln Arg Val Pro
    210                 215                 220

Ala Asp Glu Trp Lys Pro Leu Phe Arg Ser Val Phe Tyr Ala Val Ser
225                 230                 235                 240

Pro Lys Gly Ser Ala Glu Gln Arg Val Gly Gln Asp Pro Leu Ala Pro
                245                 250                 255

Glu Gln Ala Arg Ala Leu Lys Ala Ser Leu Ala Phe Gln Glu Tyr Arg
            260                 265                 270
```

```
Ile Ala Asn Val Ile Thr Asn Leu Arg Ile Lys Asp Ala Ser Ala Glu
        275                 280                 285

Leu Arg Lys Leu Thr Val Asp Glu Lys Gln Ser Ile Tyr Asp Gln Leu
    290                 295                 300

Val Ser Pro Ser Ser Glu Asp Ile Thr Trp Ser Asp Leu Cys Asp Phe
305                 310                 315                 320

Leu Gly Phe Lys Arg Ser Gln Leu Lys Gly Val Gly Ser Leu Thr Glu
                325                 330                 335

Asp Gly Glu Glu Arg Ile Ser Ser Arg Pro Pro Arg Leu Thr Ser Val
            340                 345                 350

Gln Arg Ile Tyr Glu Ser Asp Asn Lys Ile Arg Lys Pro Leu Val Ala
        355                 360                 365

Trp Trp Lys Ser Ala Ser Asp Asn Glu His Glu Ala Met Ile Arg Leu
    370                 375                 380

Leu Ser Asn Thr Val Asp Ile Asp Lys Val Arg Glu Asp Val Ala Tyr
385                 390                 395                 400

Ala Ser Ala Ile Glu Phe Ile Asp Gly Leu Asp Asp Asp Ala Leu Thr
                405                 410                 415

Lys Leu Asp Ser Val Asp Leu Pro Ser Gly Arg Ala Ala Tyr Ser Val
            420                 425                 430

Glu Thr Leu Gln Lys Leu Thr Arg Gln Met Leu Thr Thr Asp Asp Asp
        435                 440                 445

Leu His Glu Ala Arg Lys Thr Leu Phe Asn Val Thr Asp Ser Trp Arg
    450                 455                 460

Pro Pro Ala Asp Pro Ile Gly Glu Pro Leu Gly Asn Pro Ser Val Asp
465                 470                 475                 480
```

```
Arg Val Leu Lys Asn Val Asn Arg Tyr Leu Met Asn Cys Gln Gln Arg
                485                 490                 495

Trp Gly Asn Pro Val Ser Val Asn Ile Glu His Val Arg Ser Ser Phe
            500                 505                 510

Ser Ser Val Ala Phe Ala Arg Lys Asp Lys Arg Glu Tyr Glu Lys Asn
        515                 520                 525

Asn Glu Lys Arg Ser Ile Phe Arg Ser Ser Leu Ser Glu Gln Leu Arg
    530                 535                 540

Ala Asp Glu Gln Met Glu Lys Val Arg Glu Ser Asp Leu Arg Arg Leu
545                 550                 555                 560

Glu Ala Ile Gln Arg Gln Asn Gly Gln Cys Leu Tyr Cys Gly Arg Thr
                565                 570                 575

Ile Thr Phe Arg Thr Cys Glu Met Asp His Ile Val Pro Arg Lys Gly
            580                 585                 590

Val Gly Ser Thr Asn Thr Arg Thr Asn Phe Ala Ala Val Cys Ala Glu
        595                 600                 605

Cys Asn Arg Met Lys Ser Asn Thr Pro Phe Ala Ile Trp Ala Arg Ser
    610                 615                 620

Glu Asp Ala Gln Thr Arg Gly Val Ser Leu Ala Glu Ala Lys Lys Arg
625                 630                 635                 640

Val Thr Met Phe Thr Phe Asn Pro Lys Ser Tyr Ala Pro Arg Glu Val
                645                 650                 655

Lys Ala Phe Lys Gln Ala Val Ile Ala Arg Leu Gln Gln Thr Glu Asp
            660                 665                 670
```

```
Asp Ala Ala Ile Asp Asn Arg Ser Ile Glu Ser Val Ala Trp Met Ala
        675                 680                 685

Asp Glu Leu His Arg Arg Ile Asp Trp Tyr Phe Asn Ala Lys Gln Tyr
    690                 695                 700

Val Asn Ser Ala Ser Ile Asp Asp Ala Glu Ala Glu Thr Met Lys Thr
705                 710                 715                 720

Thr Val Ser Val Phe Gln Gly Arg Val Thr Ala Ser Ala Arg Arg Ala
                725                 730                 735

Ala Gly Ile Glu Gly Lys Ile His Phe Ile Gly Gln Gln Ser Lys Thr
            740                 745                 750

Arg Leu Asp Arg Arg His His Ala Val Asp Ala Ser Val Ile Ala Met
        755                 760                 765

Met Asn Thr Ala Ala Ala Gln Thr Leu Met Glu Arg Glu Ser Leu Arg
    770                 775                 780

Glu Ser Gln Arg Leu Ile Gly Leu Met Pro Gly Glu Arg Ser Trp Lys
785                 790                 795                 800

Glu Tyr Pro Tyr Glu Gly Thr Ser Arg Tyr Glu Ser Phe His Leu Trp
                805                 810                 815

Leu Asp Asn Met Asp Val Leu Leu Glu Leu Leu Asn Asp Ala Leu Asp
            820                 825                 830

Asn Asp Arg Ile Ala Val Met Gln Ser Gln Arg Tyr Val Leu Gly Asn
        835                 840                 845

Ser Ile Ala His Asp Ala Thr Ile His Pro Leu Glu Lys Val Pro Leu
    850                 855                 860

Gly Ser Ala Met Ser Ala Asp Leu Ile Arg Arg Ala Ser Thr Pro Ala
865                 870                 875                 880
```

```
Leu Trp Cys Ala Leu Thr Arg Leu Pro Asp Tyr Asp Glu Lys Glu Gly
                885                 890                 895


Leu Pro Glu Asp Ser His Arg Glu Ile Arg Val His Asp Thr Arg Tyr
            900                 905                 910


Ser Ala Asp Asp Glu Met Gly Phe Phe Ala Ser Gln Ala Ala Gln Ile
        915                 920                 925


Ala Val Gln Glu Gly Ser Ala Asp Ile Gly Ser Ala Ile His His Ala
    930                 935                 940


Arg Val Tyr Arg Cys Trp Lys Thr Asn Ala Lys Gly Val Arg Lys Tyr
945                 950                 955                 960


Phe Tyr Gly Met Ile Arg Val Phe Gln Thr Asp Leu Leu Arg Ala Cys
                965                 970                 975


His Asp Asp Leu Phe Thr Val Pro Leu Pro Pro Gln Ser Ile Ser Met
            980                 985                 990


Arg Tyr Gly Glu Pro Arg Val Val  Gln Ala Leu Gln Ser  Gly Asn Ala
        995                 1000                1005


Gln Tyr  Leu Gly Ser Leu Val  Val Gly Asp Glu Ile  Glu Met Asp
    1010                1015                1020


Phe Ser  Ser Leu Asp Val Asp  Gly Gln Ile Gly Glu  Tyr Leu Gln
    1025                1030                1035


Phe Phe  Ser Gln Phe Ser Gly  Gly Asn Leu Ala Trp  Lys His Trp
    1040                1045                1050


Val Val  Asp Gly Phe Phe Asn  Gln Thr Gln Leu Arg  Ile Arg Pro
    1055                1060                1065
```

```
Arg Tyr  Leu Ala Ala Glu Gly  Leu Ala Lys Ala Phe  Ser Asp Asp
    1070                1075                1080


Val Val  Pro Asp Gly Val Gln  Lys Ile Val Thr Lys  Gln Gly Trp
    1085                1090                1095


Leu Pro  Pro Val Asn Thr Ala  Ser Lys Thr Ala Val  Arg Ile Val
    1100                1105                1110


Arg Arg  Asn Ala Phe Gly Glu  Pro Arg Leu Ser Ser  Ala His His
    1115                1120                1125


Met Pro  Cys Ser Trp Gln Trp  Arg His Glu
    1130                1135
```

<210> 318
<211> 182
<212> PRT
<213> Bifidobacterium longum

<400> 318

```
Met Arg Gly Lys Arg Tyr Arg Ile Gly Ile Asp Val Gly Leu Asn Ser
1               5                   10                  15


Val Gly Leu Ala Ala Val Glu Val Ser Asp Glu Asn Ser Pro Val Arg
            20                  25                  30


Leu Leu Asn Ala Gln Ser Val Ile His Asp Gly Gly Val Asp Pro Gln
        35                  40                  45


Lys Asn Lys Glu Ala Ile Thr Arg Lys Asn Met Ser Gly Val Ala Arg
    50                  55                  60


Arg Thr Arg Arg Met Arg Arg Arg Lys Arg Glu Arg Leu His Lys Leu
65                  70                  75                  80


Asp Met Leu Leu Gly Lys Phe Gly Tyr Pro Val Ile Glu Pro Glu Ser
                85                  90                  95
```

```
Leu Asp Lys Pro Phe Glu Glu Trp His Val Arg Ala Glu Leu Ala Thr
            100                 105                 110

Arg Tyr Ile Glu Asp Asp Glu Leu Arg Arg Glu Ser Ile Ser Ile Ala
        115                 120                 125

Leu Arg His Met Ala Arg His Arg Gly Trp Arg Asn Pro Tyr Arg Gln
    130                 135                 140

Val Asp Ser Leu Ile Ser Asp Asn Pro Tyr Ser Lys Gln Tyr Gly Glu
145                 150                 155                 160

Leu Lys Glu Lys Ala Lys Ala Tyr Asn Asp Asp Ala Thr Ala Ala Glu
                165                 170                 175

Glu Glu Ser Thr Pro Ala
            180
```

<210> 319
<211> 441
<212> PRT
<213> Bifidobacterium longum

<400> 319

```
Met Val Ala Met Leu Asp Ala Gly Tyr Ala Glu Ala Pro Arg Leu Arg
1               5                   10                  15

Trp Arg Thr Gly Ser Lys Lys Pro Asp Ala Glu Gly Tyr Leu Pro Val
            20                  25                  30

Arg Leu Met Gln Glu Asp Asn Ala Asn Glu Leu Lys Gln Ile Phe Arg
        35                  40                  45

Val Gln Arg Val Pro Ala Asp Glu Trp Lys Pro Leu Phe Arg Ser Val
    50                  55                  60

Phe Tyr Ala Val Ser Pro Lys Gly Ser Ala Glu Gln Arg Val Gly Gln
65                  70                  75                  80
```

```
Asp Pro Leu Ala Pro Glu Gln Ala Arg Ala Leu Lys Ala Ser Leu Ala
                85                  90                  95

Phe Gln Glu Tyr Arg Ile Ala Asn Val Ile Thr Asn Leu Arg Ile Lys
            100                 105                 110

Asp Ala Ser Ala Glu Leu Arg Lys Leu Thr Val Asp Glu Lys Gln Ser
        115                 120                 125

Ile Tyr Asp Gln Leu Val Ser Pro Ser Ser Glu Asp Ile Thr Trp Ser
    130                 135                 140

Asp Leu Cys Asp Phe Leu Gly Phe Lys Arg Ser Gln Leu Lys Gly Val
145                 150                 155                 160

Gly Ser Leu Thr Glu Asp Gly Glu Glu Arg Ile Ser Ser Arg Pro Pro
                165                 170                 175

Arg Leu Thr Ser Val Gln Arg Ile Tyr Glu Ser Asp Asn Lys Ile Arg
            180                 185                 190

Lys Pro Leu Val Ala Trp Trp Lys Ser Ala Ser Asp Asn Glu His Glu
        195                 200                 205

Ala Met Ile Arg Leu Leu Ser Asn Thr Val Asp Ile Asp Lys Val Arg
    210                 215                 220

Glu Asp Val Ala Tyr Ala Ser Ala Ile Glu Phe Ile Asp Gly Leu Asp
225                 230                 235                 240

Asp Asp Ala Leu Thr Lys Leu Asp Ser Val Asp Leu Pro Ser Gly Arg
                245                 250                 255

Ala Ala Tyr Ser Val Glu Thr Leu Gln Lys Leu Thr Arg Gln Met Leu
            260                 265                 270
```

```
Thr Thr Asp Asp Asp Leu His Glu Ala Arg Lys Thr Leu Phe Asn Val
        275                 280                 285

Thr Asp Ser Trp Arg Pro Pro Ala Asp Pro Ile Gly Glu Pro Leu Gly
    290                 295                 300

Asn Pro Ser Val Asp Arg Val Leu Lys Asn Val Asn Arg Tyr Leu Met
305                 310                 315                 320

Asn Cys Gln Gln Arg Trp Gly Asn Pro Val Ser Val Asn Ile Glu His
                325                 330                 335

Val Arg Ser Ser Phe Ser Ser Val Ala Phe Ala Arg Lys Asp Lys Arg
            340                 345                 350

Glu Tyr Glu Lys Asn Asn Glu Lys Arg Ser Ile Phe Arg Ser Ser Leu
        355                 360                 365

Ser Glu Gln Leu Arg Ala Asp Glu Gln Met Glu Lys Val Arg Glu Ser
    370                 375                 380

Asp Leu Arg Arg Leu Glu Ala Ile Gln Arg Gln Asn Gly Gln Cys Leu
385                 390                 395                 400

Tyr Cys Gly Arg Thr Ile Thr Phe Arg Thr Cys Glu Met Asp His Ile
                405                 410                 415

Val Pro Arg Lys Gly Val Gly Ser Thr Asn Thr Arg Thr Asn Phe Ala
            420                 425                 430

Ala Val Cys Ala Glu Cys Asn Arg Met
        435                 440
```

<210> 320
<211> 967
<212> PRT
<213> Bifidobacterium longum

<400> 320

```
Met Val Ala Met Leu Asp Ala Gly Tyr Ala Glu Ala Pro Arg Leu Arg
1               5                  10                  15

Trp Arg Thr Gly Ser Lys Lys Pro Asp Ala Glu Gly Tyr Leu Pro Val
            20                  25                  30

Arg Leu Met Gln Glu Asp Asn Ala Asn Glu Leu Lys Gln Ile Phe Arg
        35                  40                  45

Val Gln Arg Val Pro Ala Asp Glu Trp Lys Pro Leu Phe Arg Ser Val
    50                  55                  60

Phe Tyr Ala Val Ser Pro Lys Gly Ser Ala Glu Gln Arg Val Gly Gln
65                  70                  75                  80

Asp Pro Leu Ala Pro Glu Gln Ala Arg Ala Leu Lys Ala Ser Leu Ala
                85                  90                  95

Phe Gln Glu Tyr Arg Ile Ala Asn Val Ile Thr Asn Leu Arg Ile Lys
            100                 105                 110

Asp Ala Ser Ala Glu Leu Arg Lys Leu Thr Val Asp Glu Lys Gln Ser
        115                 120                 125

Ile Tyr Asp Gln Leu Val Ser Pro Ser Ser Glu Asp Ile Thr Trp Ser
    130                 135                 140

Asp Leu Cys Asp Phe Leu Gly Phe Lys Arg Ser Gln Leu Lys Gly Val
145                 150                 155                 160

Gly Ser Leu Thr Glu Asp Gly Glu Glu Arg Ile Ser Ser Arg Pro Pro
                165                 170                 175

Arg Leu Thr Ser Val Gln Arg Ile Tyr Glu Ser Asp Asn Lys Ile Arg
            180                 185                 190

Lys Pro Leu Val Ala Trp Trp Lys Ser Ala Ser Asp Asn Glu His Glu
```

```
        195                 200                 205

Ala Met Ile Arg Leu Leu Ser Asn Thr Val Asp Ile Asp Lys Val Arg
    210                 215                 220

Glu Asp Val Ala Tyr Ala Ser Ala Ile Glu Phe Ile Asp Gly Leu Asp
225                 230                 235                 240

Asp Asp Ala Leu Thr Lys Leu Asp Ser Val Asp Leu Pro Ser Gly Arg
                245                 250                 255

Ala Ala Tyr Ser Val Glu Thr Leu Gln Lys Leu Thr Arg Gln Met Leu
            260                 265                 270

Thr Thr Asp Asp Asp Leu His Glu Ala Arg Lys Thr Leu Phe Asn Val
        275                 280                 285

Thr Asp Ser Trp Arg Pro Pro Ala Asp Pro Ile Gly Glu Pro Leu Gly
    290                 295                 300

Asn Pro Ser Val Asp Arg Val Leu Lys Asn Val Asn Arg Tyr Leu Met
305                 310                 315                 320

Asn Cys Gln Gln Arg Trp Gly Asn Pro Val Ser Val Asn Ile Glu His
                325                 330                 335

Val Arg Ser Ser Phe Ser Ser Val Ala Phe Ala Arg Lys Asp Lys Arg
            340                 345                 350

Glu Tyr Glu Lys Asn Asn Glu Lys Arg Ser Ile Phe Arg Ser Ser Leu
        355                 360                 365

Ser Glu Gln Leu Arg Ala Asp Glu Gln Met Glu Lys Val Arg Glu Ser
    370                 375                 380

Asp Leu Arg Arg Leu Glu Ala Ile Gln Arg Gln Asn Gly Gln Cys Leu
385                 390                 395                 400
```

```
Tyr Cys Gly Arg Thr Ile Thr Phe Arg Thr Cys Glu Met Asp His Ile
                405                 410                 415

Val Pro Arg Lys Gly Val Gly Ser Thr Asn Thr Arg Thr Asn Phe Ala
            420                 425                 430

Ala Val Cys Ala Glu Cys Asn Arg Met Lys Ser Asn Thr Pro Phe Ala
        435                 440                 445

Ile Trp Ala Arg Ser Glu Asp Ala Gln Thr Arg Gly Val Ser Leu Ala
    450                 455                 460

Glu Ala Lys Lys Arg Val Thr Met Phe Thr Phe Asn Pro Lys Ser Tyr
465                 470                 475                 480

Ala Pro Arg Glu Val Lys Ala Phe Lys Gln Ala Val Ile Ala Arg Leu
                485                 490                 495

Gln Gln Thr Glu Asp Asp Ala Ala Ile Asp Asn Arg Ser Ile Glu Ser
            500                 505                 510

Val Ala Trp Met Ala Asp Glu Leu His Arg Arg Ile Asp Trp Tyr Phe
        515                 520                 525

Asn Ala Lys Gln Tyr Val Asn Ser Ala Ser Ile Asp Asp Ala Glu Ala
    530                 535                 540

Glu Thr Met Lys Thr Thr Val Ser Val Phe Gln Gly Arg Val Thr Ala
545                 550                 555                 560

Ser Ala Arg Arg Ala Ala Gly Ile Glu Gly Lys Ile His Phe Ile Gly
                565                 570                 575

Gln Gln Ser Lys Thr Arg Leu Asp Arg Arg His His Ala Val Asp Ala
            580                 585                 590

Ser Val Ile Ala Met Met Asn Thr Ala Ala Ala Gln Thr Leu Met Glu
```

```
        595                 600                 605

Arg Glu Ser Leu Arg Glu Ser Gln Arg Leu Ile Gly Leu Met Pro Gly
    610                 615                 620

Glu Arg Ser Trp Lys Glu Tyr Pro Tyr Glu Gly Thr Ser Arg Tyr Glu
625                 630                 635                 640

Ser Phe His Leu Trp Leu Asp Asn Met Asp Val Leu Leu Glu Leu Leu
                645                 650                 655

Asn Asp Ala Leu Asp Asn Asp Arg Ile Ala Val Met Gln Ser Gln Arg
            660                 665                 670

Tyr Val Leu Gly Asn Ser Ile Ala His Asp Ala Thr Ile His Pro Leu
        675                 680                 685

Glu Lys Val Pro Leu Gly Ser Ala Met Ser Ala Asp Leu Ile Arg Arg
    690                 695                 700

Ala Ser Thr Pro Ala Leu Trp Cys Ala Leu Thr Arg Leu Pro Asp Tyr
705                 710                 715                 720

Asp Glu Lys Glu Gly Leu Pro Glu Asp Ser His Arg Glu Ile Arg Val
                725                 730                 735

His Asp Thr Arg Tyr Ser Ala Asp Asp Glu Met Gly Phe Phe Ala Ser
            740                 745                 750

Gln Ala Ala Gln Ile Ala Val Gln Glu Gly Ser Ala Asp Ile Gly Ser
        755                 760                 765

Ala Ile His His Ala Arg Val Tyr Arg Cys Trp Lys Thr Asn Ala Lys
    770                 775                 780

Gly Val Arg Lys Tyr Phe Tyr Gly Met Ile Arg Val Phe Gln Thr Asp
785                 790                 795                 800
```

```
Leu Leu Arg Ala Cys His Asp Asp Leu Phe Thr Val Pro Leu Pro Pro
                805                 810                 815

Gln Ser Ile Ser Met Arg Tyr Gly Glu Pro Arg Val Val Gln Ala Leu
            820                 825                 830

Gln Ser Gly Asn Ala Gln Tyr Leu Gly Ser Leu Val Val Gly Asp Glu
        835                 840                 845

Ile Glu Met Asp Phe Ser Ser Leu Asp Val Asp Gly Gln Ile Gly Glu
    850                 855                 860

Tyr Leu Gln Phe Phe Ser Gln Phe Ser Gly Gly Asn Leu Ala Trp Lys
865                 870                 875                 880

His Trp Val Val Asp Gly Phe Phe Asn Gln Thr Gln Leu Arg Ile Arg
                885                 890                 895

Pro Arg Tyr Leu Ala Ala Glu Gly Leu Ala Lys Ala Phe Ser Asp Asp
            900                 905                 910

Val Val Pro Asp Gly Val Gln Lys Ile Val Thr Lys Gln Gly Trp Leu
        915                 920                 925

Pro Pro Val Asn Thr Ala Ser Lys Thr Ala Val Arg Ile Val Arg Arg
    930                 935                 940

Asn Ala Phe Gly Glu Pro Arg Leu Ser Ser Ala His His Met Pro Cys
945                 950                 955                 960

Ser Trp Gln Trp Arg His Glu
                965
```

<210> 321
<211> 1151
<212> PRT
<213> Bifidobacterium sp.

<400> 321

```
Met Arg Gly Lys Arg Tyr Arg Ile Gly Ile Asp Val Gly Leu Asn Ser
1               5                  10                  15

Val Gly Leu Ala Ala Val Glu Val Ser Asp Glu Asn Ser Pro Val Arg
            20                  25                  30

Leu Leu Asn Ala Gln Ser Val Ile His Asp Gly Gly Val Asp Pro Gln
        35                  40                  45

Lys Asn Lys Glu Ala Ile Thr Arg Lys Asn Met Ser Gly Val Ala Arg
    50                  55                  60

Arg Thr Arg Arg Met Arg Arg Arg Lys Arg Glu Arg Leu His Lys Leu
65                  70                  75                  80

Asp Met Leu Leu Gly Lys Phe Gly Tyr Pro Val Ile Glu Pro Glu Ser
                85                  90                  95

Leu Asp Lys Pro Phe Glu Glu Trp His Val Arg Ala Glu Leu Ala Thr
            100                 105                 110

Arg Tyr Ile Glu Asp Asp Glu Leu Arg Arg Glu Ser Ile Ser Ile Ala
        115                 120                 125

Leu Arg His Met Ala Arg His Arg Gly Trp Arg Asn Pro Tyr Arg Gln
    130                 135                 140

Val Asp Ser Leu Ile Ser Asp Asn Pro Tyr Ser Lys Gln Tyr Gly Glu
145                 150                 155                 160

Leu Lys Glu Lys Ala Lys Ala Tyr Asn Asp Asp Ala Thr Ala Ala Glu
                165                 170                 175

Glu Glu Ser Thr Pro Ala Gln Leu Val Val Ala Met Leu Asp Ala Gly
            180                 185                 190
```

```
Tyr Ala Glu Ala Pro Arg Leu Arg Trp Arg Thr Gly Ser Lys Lys Pro
        195                 200                 205

Asp Ala Glu Gly Tyr Leu Pro Val Arg Leu Met Gln Glu Asp Asn Ala
    210                 215                 220

Asn Glu Leu Lys Gln Ile Phe Arg Val Gln Arg Val Pro Ala Asp Glu
225                 230                 235                 240

Trp Lys Pro Leu Phe Arg Ser Val Phe Tyr Ala Val Ser Pro Lys Gly
                245                 250                 255

Ser Ala Glu Gln Arg Val Gly Gln Asp Pro Leu Ala Pro Glu Gln Ala
            260                 265                 270

Arg Ala Leu Lys Ala Ser Leu Ala Phe Gln Glu Tyr Arg Ile Ala Asn
        275                 280                 285

Val Ile Thr Asn Leu Arg Ile Lys Asp Ala Ser Ala Glu Leu Arg Lys
    290                 295                 300

Leu Thr Val Asp Glu Lys Gln Ser Ile Tyr Asp Gln Leu Val Ser Pro
305                 310                 315                 320

Ser Ser Glu Asp Ile Thr Trp Ser Asp Leu Cys Asp Phe Leu Gly Phe
                325                 330                 335

Lys Arg Ser Gln Leu Lys Gly Val Gly Ser Leu Thr Glu Asp Gly Glu
            340                 345                 350

Glu Arg Ile Ser Ser Arg Pro Pro Arg Leu Thr Ser Val Gln Arg Ile
        355                 360                 365

Tyr Glu Ser Asp Asn Lys Ile Arg Lys Pro Leu Val Ala Trp Trp Lys
    370                 375                 380

Ser Ala Ser Asp Asn Glu His Glu Ala Met Ile Arg Leu Leu Ser Asn
385                 390                 395                 400
```

```
Thr Val Asp Ile Asp Lys Val Arg Glu Asp Val Ala Tyr Ala Ser Ala
                405                 410                 415

Ile Glu Phe Ile Asp Gly Leu Asp Asp Asp Ala Leu Thr Lys Leu Asp
            420                 425                 430

Ser Val Asp Leu Pro Ser Gly Arg Ala Ala Tyr Ser Val Glu Thr Leu
        435                 440                 445

Gln Lys Leu Thr Arg Gln Met Leu Thr Thr Asp Asp Asp Leu His Glu
    450                 455                 460

Ala Arg Lys Thr Leu Phe Asn Val Thr Asp Ser Trp Arg Pro Pro Ala
465                 470                 475                 480

Asp Pro Ile Gly Glu Pro Leu Gly Asn Pro Ser Val Asp Arg Val Leu
                485                 490                 495

Lys Asn Val Asn Arg Tyr Leu Met Asn Cys Gln Gln Arg Trp Gly Asn
            500                 505                 510

Pro Val Ser Val Asn Ile Glu His Val Arg Ser Ser Phe Ser Ser Val
        515                 520                 525

Ala Phe Ala Arg Lys Asp Lys Arg Glu Tyr Glu Lys Asn Asn Glu Lys
    530                 535                 540

Arg Ser Ile Phe Arg Ser Ser Leu Ser Glu Gln Leu Arg Ala Asp Glu
545                 550                 555                 560

Gln Met Glu Lys Val Arg Glu Ser Asp Leu Arg Arg Leu Glu Ala Ile
                565                 570                 575

Gln Arg Gln Asn Gly Gln Cys Leu Tyr Cys Gly Arg Thr Ile Thr Phe
            580                 585                 590
```

```
Arg Thr Cys Glu Met Asp His Ile Val Pro Arg Lys Gly Val Gly Ser
        595                 600                 605

Thr Asn Thr Arg Thr Asn Phe Ala Ala Val Cys Ala Glu Cys Asn Arg
    610                 615                 620

Met Lys Ser Asn Thr Pro Phe Ala Ile Trp Ala Arg Ser Glu Asp Ala
625                 630                 635                 640

Gln Thr Arg Gly Val Ser Leu Ala Glu Ala Lys Lys Arg Val Thr Met
                645                 650                 655

Phe Thr Phe Asn Pro Lys Ser Tyr Ala Pro Arg Glu Val Lys Ala Phe
            660                 665                 670

Lys Gln Ala Val Ile Ala Arg Leu Gln Gln Thr Glu Asp Asp Ala Ala
        675                 680                 685

Ile Asp Asn Arg Ser Ile Glu Ser Val Ala Trp Met Ala Asp Glu Leu
    690                 695                 700

His Arg Arg Ile Asp Trp Tyr Phe Asn Ala Lys Gln Tyr Val Asn Ser
705                 710                 715                 720

Ala Ser Ile Asp Asp Ala Glu Ala Glu Thr Met Lys Thr Thr Val Ser
                725                 730                 735

Val Phe Gln Gly Arg Val Thr Ala Ser Ala Arg Arg Ala Ala Gly Ile
            740                 745                 750

Glu Gly Lys Ile His Phe Ile Gly Gln Gln Ser Lys Thr Arg Leu Asp
        755                 760                 765

Arg Arg His His Ala Val Asp Ala Ser Val Ile Ala Met Met Asn Thr
    770                 775                 780

Ala Ala Ala Gln Thr Leu Met Glu Arg Glu Ser Leu Arg Glu Ser Gln
785                 790                 795                 800
```

```
Arg Leu Ile Gly Leu Met Pro Gly Glu Arg Ser Trp Lys Glu Tyr Pro
                805                 810                 815

Tyr Glu Gly Thr Ser Arg Tyr Glu Ser Phe His Leu Trp Leu Asp Asn
            820                 825                 830

Met Asp Val Leu Leu Glu Leu Leu Asn Asp Ala Leu Asp Asn Asp Arg
        835                 840                 845

Ile Ala Val Met Gln Ser Gln Arg Tyr Val Leu Gly Asn Ser Ile Ala
    850                 855                 860

His Asp Ala Thr Ile His Pro Leu Glu Lys Val Pro Leu Gly Ser Ala
865                 870                 875                 880

Met Ser Ala Asp Leu Ile Arg Arg Ala Ser Thr Pro Ala Leu Trp Cys
                885                 890                 895

Ala Leu Thr Arg Leu Pro Asp Tyr Asp Glu Lys Glu Gly Leu Pro Glu
            900                 905                 910

Asp Ser His Arg Glu Ile Arg Val His Asp Thr Arg Tyr Ser Ala Asp
        915                 920                 925

Asp Glu Met Gly Phe Phe Ala Ser Gln Ala Ala Gln Ile Ala Val Gln
    930                 935                 940

Glu Gly Ser Ala Asp Ile Gly Ser Ala Ile His His Ala Arg Val Tyr
945                 950                 955                 960

Arg Cys Trp Lys Thr Asn Ala Lys Gly Val Arg Lys Tyr Phe Tyr Gly
                965                 970                 975

Met Ile Arg Val Phe Gln Thr Asp Leu Leu Arg Ala Cys His Asp Asp
            980                 985                 990
```

```
Leu Phe Thr Val Pro Leu Pro Pro  Gln Ser Ile Ser Met  Arg Tyr Gly
        995                 1000                1005


Glu Pro  Arg Val Val Gln Ala  Leu Gln Ser Gly Asn  Ala Gln Tyr
    1010                1015                1020


Leu Gly  Ser Leu Val Val Gly  Asp Glu Ile Glu Met  Asp Phe Ser
    1025                1030                1035


Ser Leu  Asp Val Asp Gly Gln  Ile Gly Glu Tyr Leu  Gln Phe Phe
    1040                1045                1050


Ser Gln  Phe Ser Gly Gly Asn  Leu Ala Trp Lys His  Trp Val Val
    1055                1060                1065


Asp Gly  Phe Phe Asn Gln Thr  Gln Leu Arg Ile Arg  Pro Arg Tyr
    1070                1075                1080


Leu Ala  Ala Glu Gly Leu Ala  Lys Ala Phe Ser Asp  Asp Val Val
    1085                1090                1095


Pro Asp  Gly Val Gln Lys Ile  Val Thr Lys Gln Gly  Trp Leu Pro
    1100                1105                1110


Pro Val  Asn Thr Ala Ser Lys  Thr Ala Val Arg Ile  Val Arg Arg
    1115                1120                1125


Asn Ala  Phe Gly Glu Pro Arg  Leu Ser Ser Ala His  His Met Pro
    1130                1135                1140


Cys Ser  Trp Gln Trp Arg His  Glu
    1145                1150


<210>  322
<211>  1092
<212>  PRT
<213>  Brevibacillus laterosporus

<400>  322
```

```
Met Ala Tyr Thr Met Gly Ile Asp Val Gly Ile Ala Ser Cys Gly Trp
1               5                  10                  15

Ala Ile Val Asp Leu Glu Arg Gln Arg Ile Ile Asp Ile Gly Val Arg
            20                  25                  30

Thr Phe Glu Lys Ala Glu Asn Pro Lys Asn Gly Glu Ala Leu Ala Val
        35                  40                  45

Pro Arg Arg Glu Ala Arg Ser Ser Arg Arg Arg Leu Arg Arg Lys Lys
    50                  55                  60

His Arg Ile Glu Arg Leu Lys Tyr Met Phe Val Arg Asn Gly Leu Ala
65                  70                  75                  80

Val Asp Ile Gln His Leu Glu Gln Thr Leu Arg Ser Gln Asn Glu Ile
                85                  90                  95

Asp Val Trp Gln Leu Arg Val Asp Gly Leu Asp Arg Met Leu Thr Gln
            100                 105                 110

Lys Glu Trp Leu Arg Val Leu Ile His Leu Ala Gln Arg Arg Gly Phe
        115                 120                 125

Gln Ser Asn Arg Lys Thr Asp Gly Ser Ser Glu Asp Gly Gln Val Leu
    130                 135                 140

Val Asn Val Thr Glu Asn Asp Arg Leu Met Glu Glu Lys Asp Tyr Arg
145                 150                 155                 160

Thr Val Ala Glu Met Met Val Lys Asp Glu Lys Phe Ser Asp His Lys
                165                 170                 175

Arg Asn Lys Asn Gly Asn Tyr His Gly Val Val Ser Arg Ala Ser Leu
            180                 185                 190

Leu Val Glu Ile His Thr Leu Phe Glu Ser Gln Arg Gln His His Asn
```

```
        195                 200                 205

Phe Leu Ala Ser Lys Asp Phe Glu Leu Glu Tyr Ile Asn Ile Trp Ser
    210                 215                 220

Ser Gln Arg Pro Val Ala Thr Lys Asp Gln Ile Glu Lys Met Ile Gly
225                 230                 235                 240

Thr Cys Thr Phe Leu Pro Lys Glu Lys Arg Ala Pro Lys Ala Ser Trp
                245                 250                 255

His Phe Gln Tyr Phe Met Leu Leu Gln Thr Ile Asn His Ile Arg Ile
            260                 265                 270

Thr Asn Ala Gln Gly Thr Arg Pro Leu Asn Lys Glu Glu Ile Glu Gln
        275                 280                 285

Val Val Asn Met Ala Leu Thr Lys Ser Lys Val Ser Tyr His Asp Ile
    290                 295                 300

Arg Lys Val Leu Asp Leu Ser Glu Glu Tyr Gln Phe Val Gly Leu Asp
305                 310                 315                 320

Tyr Gly Lys Glu Asp Glu Lys Lys Lys Val Glu Ser Lys Glu Thr Ile
                325                 330                 335

Ile Lys Leu Asp Asp Tyr His Lys Leu Asn Lys Ile Phe Asn Glu Val
            340                 345                 350

Glu Leu Ala Lys Gly Glu Thr Trp Glu Ala Val Asp Tyr Asp Thr Val
        355                 360                 365

Ala Tyr Ala Leu Thr Phe Phe Lys Asp Asp Glu Asp Ile Arg Asp Tyr
    370                 375                 380

Leu Gln Asn Lys Tyr Lys Asp Ser Lys Asn Arg Leu Val Lys Asn Val
385                 390                 395                 400
```

```
Ala Asn Lys Glu Tyr Thr Asn Glu Leu Ile Glu Lys Val Ser Thr Leu
               405                 410                 415

Ser Phe Arg Lys Val Gly His Leu Ser Leu Lys Ala Leu Arg Lys Ile
            420                 425                 430

Ile Pro Phe Leu Glu Gln Gly Met Thr Tyr Asp Lys Ala Cys Gln Ala
        435                 440                 445

Ala Gly Phe Asn Phe Gln Gly Ile Ser Lys Lys Lys Arg Ser Val Val
    450                 455                 460

Leu Pro Val Ile Asp Gln Ile Ser Asn Pro Val Val Asn Arg Ala Leu
465                 470                 475                 480

Thr Gln Thr Arg Lys Val Ile Asn Ala Leu Ile Lys Lys Tyr Gly Ser
               485                 490                 495

Pro Glu Thr Ile His Ile Glu Thr Ala Arg Glu Leu Ser Lys Arg Phe
            500                 505                 510

Asp Glu Arg Lys Asn Ile Thr Lys Asp Tyr Lys Glu Asn Arg Asp Lys
        515                 520                 525

Asn Glu Arg Ala Lys Lys His Leu Ser Glu Leu Gly Ile Ile Asn Pro
    530                 535                 540

Thr Gly Leu Asp Ile Val Lys Tyr Lys Leu Trp Cys Glu Gln Gln Gly
545                 550                 555                 560

Arg Cys Met Tyr Ser Asn Gln Pro Ile Ser Phe Glu Arg Leu Arg Glu
               565                 570                 575

Ser Gly Tyr Thr Glu Val Asp His Ile Ile Pro Tyr Ser Arg Ser Met
            580                 585                 590

Asn Asp Ser Tyr Asn Asn Arg Val Leu Val Met Thr Arg Glu Asn Arg
```

```
        595                 600                 605

Glu Lys Ser Asn Gln Thr Pro Tyr Glu Tyr Met Gly Asn Asp Thr Gln
    610                 615                 620

Arg Trp Asp Glu Phe Glu Gln Arg Val Thr Thr Asn Pro Gln Ile Lys
625                 630                 635                 640

Lys Glu Lys Arg Gln Asn Leu Leu Leu Lys Gly Phe Thr Asn Arg Arg
                645                 650                 655

Glu Leu Glu Met Leu Glu Arg Asn Leu Asn Asp Thr Arg His Ile Thr
            660                 665                 670

Lys Tyr Leu Ser His Phe Ile Ser Thr Asn Leu Glu Phe Ser Pro Ser
        675                 680                 685

Asp Lys Lys Lys Lys Val Val Asn Thr Ser Gly Arg Ile Thr Ser His
    690                 695                 700

Leu Arg Ser Arg Trp Gly Leu Glu Lys Asn Arg Glu Gln Asn Asp Leu
705                 710                 715                 720

His His Ala Met Asp Ala Val Val Ile Ala Val Thr Ser Asp Ser Phe
                725                 730                 735

Ile Gln Gln Val Thr Asn Tyr Tyr Lys Arg Lys Glu Arg Arg Glu Leu
            740                 745                 750

Asn Gly Asp Asp Lys Phe Pro Leu Pro Trp Lys Phe Phe Arg Glu Glu
        755                 760                 765

Val Ile Ala Arg Leu Ser Pro Asn Pro Lys Glu Gln Ile Glu Ala Leu
    770                 775                 780

Pro Asn His Phe Tyr Ser Glu Asp Glu Leu Ala Asp Leu Gln Pro Ile
785                 790                 795                 800
```

```
Phe Val Ser Arg Met Pro Lys Arg Ser Ile Thr Gly Glu Ala His Gln
               805                 810                 815

Ala Gln Phe Arg Arg Val Val Gly Lys Thr Lys Glu Gly Lys Asn Ile
            820                 825                 830

Thr Ala Lys Lys Thr Ala Leu Val Asp Ile Ser Tyr Asp Lys Asn Gly
        835                 840                 845

Asp Phe Asn Met Tyr Gly Arg Glu Thr Asp Pro Ala Thr Tyr Glu Ala
    850                 855                 860

Ile Lys Glu Arg Tyr Leu Glu Phe Gly Gly Asn Ala Lys Lys Ala Phe
865                 870                 875                 880

Ser Thr Asp Leu His Lys Pro Lys Lys Asp Gly Thr Lys Gly Pro Leu
               885                 890                 895

Ile Lys Ser Val Arg Ile Met Glu Asn Lys Thr Leu Val His Pro Val
            900                 905                 910

Asn Lys Gly Lys Gly Val Val Tyr Asn Ser Ser Ile Val Arg Thr Asp
        915                 920                 925

Val Phe Gln Arg Lys Glu Lys Tyr Tyr Leu Leu Pro Val Tyr Val Thr
    930                 935                 940

Asp Val Thr Lys Gly Lys Leu Pro Asn Lys Val Ile Ala Ala Lys Lys
945                 950                 955                 960

Gly Tyr Asp Asp Trp Ile Glu Val Asp Asp Ser Phe Thr Phe Leu Tyr
               965                 970                 975

Ser Leu Tyr Pro Asn Asp Leu Ile Phe Ile Arg Gln Asn Pro Lys Lys
            980                 985                 990

Lys Ile Ser Leu Lys Lys Arg Ile  Glu Ser His Ser Ile  Ser Asp Ser
```

995 1000 1005

Lys Glu Val Gln Glu Ile Leu Thr Tyr Tyr Lys Gly Val Asp Ser
1010 1015 1020

Ser Thr Ala Ala Ile Glu Phe Ile Thr His Asp Gly Ser Tyr Tyr
1025 1030 1035

Ala Lys Gly Val Gly Val Gln Asn Leu Asp Cys Phe Glu Lys Tyr
1040 1045 1050

Gln Val Asp Ile Leu Gly Asn Tyr Ser Lys Val Lys Gly Glu Lys
1055 1060 1065

Arg Leu Glu Leu Glu Thr Ser Asp Asn Asn His Lys Gly Lys Asp
1070 1075 1080

Val Asn Ser Ile Lys Ser Thr Ser Arg
1085 1090

<210> 323
<211> 103
<212> PRT
<213> Butyrivibrio fibrisolvens

<400> 323

Met Ile Ser Val Gly Gln Ser Arg Lys Asp Leu Glu Asp Leu Gly Tyr
1 5 10 15

Glu Phe Lys Leu Ser Phe Tyr Lys Glu Asp Ile Ile Glu Tyr Glu Lys
20 25 30

Asn Gly Asp Ile Leu Val Glu Arg Phe Leu Ser Arg Thr Met Pro Gln
35 40 45

Val Arg Asn Tyr Ile Glu Thr Lys Pro Ile Asp Arg Pro Lys Tyr Asp
50 55 60

```
Lys Arg Asn Pro Val Gly Leu Ser Lys Thr Ser Ser Ile Arg Lys Ile
65                  70                  75                  80


Thr Met Asp Ile Leu Gly Asn Arg Phe Tyr Val Asp Lys Met Ser Phe
                85                  90                  95


Asn Asn Val Val Gly Thr Gln
            100
```

<210> 324
<211> 177
<212> PRT
<213> Butyrivibrio fibrisolvens

<400> 324

```
Met Leu Ile Ala Phe Ser Gln Met Gly Tyr Asp Ala Tyr His Glu Leu
1               5                   10                  15


Thr Asn Lys Tyr Ile Asp Phe Glu Thr Gly Glu Ile Ile Asp Lys Glu
            20                  25                  30


Gly Phe Asn Glu Leu Leu Asn Asn Asp Leu Val Tyr Lys Asn Thr Met
        35                  40                  45


Tyr Glu Ser Lys Trp Leu Lys Ile Lys Gly Asn Ile Glu Lys Ala Ala
    50                  55                  60


Glu Lys Asn Lys Tyr Trp Tyr Gln Val Asn Lys Lys Cys Asn Arg Gly
65                  70                  75                  80


Leu Cys Asn Gln Thr Val Tyr Gly Thr Arg Glu Ser Asp Gly Asp Val
                85                  90                  95


Tyr Lys Ile Ser Lys Ile Asp Ile Arg Thr Asp Asp Gly Phe Lys Lys
            100                 105                 110


Phe Lys Asn Ile Val Asp Lys Gly Asn Glu Ser Val Phe Leu Met Tyr
        115                 120                 125
```

```
Glu Asn Asp Pro Lys Thr Phe Glu Leu Ile Met Asp Ile Tyr Lys Asn
    130                 135                 140

Tyr Ser Asp Ser Lys Asn Pro Phe Val Gln Tyr Glu Lys Glu Thr Gly
145                 150                 155                 160

Asp Ile Ile Arg Lys Tyr Ser Lys Lys Ile Thr Gly Gln Arg Phe Leu
                165                 170                 175

Asn
```

<210> 325
<211> 1442
<212> PRT
<213> Caenispirillum salinarum

<400> 325

```
Met Pro Val Leu Ser Pro Leu Ser Pro Asn Ala Ala Gln Gly Arg Arg
1               5                   10                  15

Arg Trp Ser Leu Ala Leu Asp Ile Gly Glu Gly Ser Ile Gly Trp Ala
            20                  25                  30

Val Ala Glu Val Asp Ala Glu Gly Arg Val Leu Gln Leu Thr Gly Thr
        35                  40                  45

Gly Val Thr Leu Phe Pro Ser Ala Trp Ser Asn Glu Asn Gly Thr Tyr
    50                  55                  60

Val Ala His Gly Ala Ala Asp Arg Ala Val Arg Gly Gln Gln Gln Arg
65                  70                  75                  80

His Asp Ser Arg Arg Arg Arg Leu Ala Gly Leu Ala Arg Leu Cys Ala
                85                  90                  95

Pro Val Leu Glu Arg Ser Pro Glu Asp Leu Lys Asp Leu Thr Arg Thr
            100                 105                 110
```

```
Pro Pro Lys Ala Asp Pro Arg Ala Ile Phe Phe Leu Arg Ala Asp Ala
        115                 120                 125

Ala Arg Arg Pro Leu Asp Gly Pro Glu Leu Phe Arg Val Leu His His
    130                 135                 140

Met Ala Ala His Arg Gly Ile Arg Leu Ala Glu Leu Gln Glu Val Asp
145                 150                 155                 160

Pro Pro Pro Glu Ser Asp Ala Asp Asp Ala Ala Pro Ala Ala Thr Glu
                165                 170                 175

Asp Glu Asp Gly Thr Arg Arg Ala Ala Ala Asp Glu Arg Ala Phe Arg
            180                 185                 190

Arg Leu Met Ala Glu His Met His Arg His Gly Thr Gln Pro Thr Cys
        195                 200                 205

Gly Glu Ile Met Ala Gly Arg Leu Arg Glu Thr Pro Ala Gly Ala Gln
    210                 215                 220

Pro Val Thr Arg Ala Arg Asp Gly Leu Arg Val Gly Gly Gly Val Ala
225                 230                 235                 240

Val Pro Thr Arg Ala Leu Ile Glu Gln Glu Phe Asp Ala Ile Arg Ala
                245                 250                 255

Ile Gln Ala Pro Arg His Pro Asp Leu Pro Trp Asp Ser Leu Arg Arg
            260                 265                 270

Leu Val Leu Asp Gln Ala Pro Ile Ala Val Pro Pro Ala Thr Pro Cys
        275                 280                 285

Leu Phe Leu Glu Glu Leu Arg Arg Arg Gly Glu Thr Phe Gln Gly Arg
    290                 295                 300
```

```
Thr Ile Thr Arg Glu Ala Ile Asp Arg Gly Leu Thr Val Asp Pro Leu
305                 310                 315                 320

Ile Gln Ala Leu Arg Ile Arg Glu Thr Val Gly Asn Leu Arg Leu His
                325                 330                 335

Glu Arg Ile Thr Glu Pro Asp Gly Arg Gln Arg Tyr Val Pro Arg Ala
            340                 345                 350

Met Pro Glu Leu Gly Leu Ser His Gly Glu Leu Thr Ala Pro Glu Arg
        355                 360                 365

Asp Thr Leu Val Arg Ala Leu Met His Asp Pro Asp Gly Leu Ala Ala
    370                 375                 380

Lys Asp Gly Arg Ile Pro Tyr Thr Arg Leu Arg Lys Leu Ile Gly Tyr
385                 390                 395                 400

Asp Asn Ser Pro Val Cys Phe Ala Gln Glu Arg Asp Thr Ser Gly Gly
                405                 410                 415

Gly Ile Thr Val Asn Pro Thr Asp Pro Leu Met Ala Arg Trp Ile Asp
            420                 425                 430

Gly Trp Val Asp Leu Pro Leu Lys Ala Arg Ser Leu Tyr Val Arg Asp
        435                 440                 445

Val Val Ala Arg Gly Ala Asp Ser Ala Ala Leu Ala Arg Leu Leu Ala
    450                 455                 460

Glu Gly Ala His Gly Val Pro Pro Val Ala Ala Ala Ala Val Pro Ala
465                 470                 475                 480

Ala Thr Ala Ala Ile Leu Glu Ser Asp Ile Met Gln Pro Gly Arg Tyr
                485                 490                 495

Ser Val Cys Pro Trp Ala Ala Glu Ala Ile Leu Asp Ala Trp Ala Asn
            500                 505                 510
```

```
Ala Pro Thr Glu Gly Phe Tyr Asp Val Thr Arg Gly Leu Phe Gly Phe
        515                 520                 525

Ala Pro Gly Glu Ile Val Leu Glu Asp Leu Arg Arg Ala Arg Gly Ala
    530                 535                 540

Leu Leu Ala His Leu Pro Arg Thr Met Ala Ala Ala Arg Thr Pro Asn
545                 550                 555                 560

Arg Ala Ala Gln Gln Arg Gly Pro Leu Pro Ala Tyr Glu Ser Val Ile
                565                 570                 575

Pro Ser Gln Leu Ile Thr Ser Leu Arg Arg Ala His Lys Gly Arg Ala
            580                 585                 590

Ala Asp Trp Ser Ala Ala Asp Pro Glu Glu Arg Asn Pro Phe Leu Arg
        595                 600                 605

Thr Trp Thr Gly Asn Ala Ala Thr Asp His Ile Leu Asn Gln Val Arg
    610                 615                 620

Lys Thr Ala Asn Glu Val Ile Thr Lys Tyr Gly Asn Arg Arg Gly Trp
625                 630                 635                 640

Asp Pro Leu Pro Ser Arg Ile Thr Val Glu Leu Ala Arg Glu Ala Lys
                645                 650                 655

His Gly Val Ile Arg Arg Asn Glu Ile Ala Lys Glu Asn Arg Glu Asn
            660                 665                 670

Glu Gly Arg Arg Lys Lys Glu Ser Ala Ala Leu Asp Thr Phe Cys Gln
        675                 680                 685

Asp Asn Thr Val Ser Trp Gln Ala Gly Gly Leu Pro Lys Glu Arg Ala
    690                 695                 700
```

```
Ala Leu Arg Leu Arg Leu Ala Gln Arg Gln Glu Phe Phe Cys Pro Tyr
705                 710                 715                 720


Cys Ala Glu Arg Pro Lys Leu Arg Ala Thr Asp Leu Phe Ser Pro Ala
                725                 730                 735


Glu Thr Glu Ile Asp His Val Ile Glu Arg Arg Met Gly Gly Asp Gly
            740                 745                 750


Pro Asp Asn Leu Val Leu Ala His Lys Asp Cys Asn Asn Ala Lys Gly
        755                 760                 765


Lys Lys Thr Pro His Glu His Ala Gly Asp Leu Leu Asp Ser Pro Ala
    770                 775                 780


Leu Ala Ala Leu Trp Gln Gly Trp Arg Lys Glu Asn Ala Asp Arg Leu
785                 790                 795                 800


Lys Gly Lys Gly His Lys Ala Arg Thr Pro Arg Glu Asp Lys Asp Phe
                805                 810                 815


Met Asp Arg Val Gly Trp Arg Phe Glu Glu Asp Ala Arg Ala Lys Ala
            820                 825                 830


Glu Glu Asn Gln Glu Arg Arg Gly Arg Arg Met Leu His Asp Thr Ala
        835                 840                 845


Arg Ala Thr Arg Leu Ala Arg Leu Tyr Leu Ala Ala Ala Val Met Pro
    850                 855                 860


Glu Asp Pro Ala Glu Ile Gly Ala Pro Pro Val Glu Thr Pro Pro Ser
865                 870                 875                 880


Pro Glu Asp Pro Thr Gly Tyr Thr Ala Ile Tyr Arg Thr Ile Ser Arg
                885                 890                 895


Val Gln Pro Val Asn Gly Ser Val Thr His Met Leu Arg Gln Arg Leu
            900                 905                 910
```

```
Leu Gln Arg Asp Lys Asn Arg Asp Tyr Gln Thr His His Ala Glu Asp
        915                 920                 925

Ala Cys Leu Leu Leu Leu Ala Gly Pro Ala Val Val Gln Ala Phe Asn
    930                 935                 940

Thr Glu Ala Ala Gln His Gly Ala Asp Ala Pro Asp Asp Arg Pro Val
945                 950                 955                 960

Asp Leu Met Pro Thr Ser Asp Ala Tyr His Gln Gln Arg Arg Ala Arg
                965                 970                 975

Ala Leu Gly Arg Val Pro Leu Ala Thr Val Asp Ala Ala Leu Ala Asp
            980                 985                 990

Ile Val Met Pro Glu Ser Asp Arg  Gln Asp Pro Glu Thr  Gly Arg Val
        995                 1000                1005

His Trp  Arg Leu Thr Arg Ala  Gly Arg Gly Leu Lys  Arg Arg Ile
    1010                1015                1020

Asp Asp  Leu Thr Arg Asn Cys  Val Ile Leu Ser Arg  Pro Arg Arg
    1025                1030                1035

Pro Ser  Glu Thr Gly Thr Pro  Gly Ala Leu His Asn  Ala Thr His
    1040                1045                1050

Tyr Gly  Arg Arg Glu Ile Thr  Val Asp Gly Arg Thr  Asp Thr Val
    1055                1060                1065

Val Thr  Gln Arg Met Asn Ala  Arg Asp Leu Val Ala  Leu Leu Asp
    1070                1075                1080

Asn Ala  Lys Ile Val Pro Ala  Ala Arg Leu Asp Ala  Ala Ala Pro
    1085                1090                1095
```

```
Gly Asp  Thr Ile Leu Lys Glu  Ile Cys Thr Glu Ile  Ala Asp Arg
    1100                1105                1110

His Asp  Arg Val Val Asp Pro  Glu Gly Thr His Ala  Arg Arg Trp
    1115                1120                1125

Ile Ser  Ala Arg Leu Ala Ala  Leu Val Pro Ala His  Ala Glu Ala
    1130                1135                1140

Val Ala  Arg Asp Ile Ala Glu  Leu Ala Asp Leu Asp  Ala Leu Ala
    1145                1150                1155

Asp Ala  Asp Arg Thr Pro Glu  Gln Glu Ala Arg Arg  Ser Ala Leu
    1160                1165                1170

Arg Gln  Ser Pro Tyr Leu Gly  Arg Ala Ile Ser Ala  Lys Lys Ala
    1175                1180                1185

Asp Gly  Arg Ala Arg Ala Arg  Glu Gln Glu Ile Leu  Thr Arg Ala
    1190                1195                1200

Leu Leu  Asp Pro His Trp Gly  Pro Arg Gly Leu Arg  His Leu Ile
    1205                1210                1215

Met Arg  Glu Ala Arg Ala Pro  Ser Leu Val Arg Ile  Arg Ala Asn
    1220                1225                1230

Lys Thr  Asp Ala Phe Gly Arg  Pro Val Pro Asp Ala  Ala Val Trp
    1235                1240                1245

Val Lys  Thr Asp Gly Asn Ala  Val Ser Gln Leu Trp  Arg Leu Thr
    1250                1255                1260

Ser Val  Val Thr Asp Asp Gly  Arg Arg Ile Pro Leu  Pro Lys Pro
    1265                1270                1275

Ile Glu  Lys Arg Ile Glu Ile  Ser Asn Leu Glu Tyr  Ala Arg Leu
    1280                1285                1290
```

```
Asn Gly  Leu Asp Glu Gly Ala  Gly Val Thr Gly Asn  Asn Ala Pro
    1295                1300                1305

Pro Arg  Pro Leu Arg Gln Asp  Ile Asp Arg Leu Thr  Pro Leu Trp
    1310                1315                1320

Arg Asp  His Gly Thr Ala Pro  Gly Gly Tyr Leu Gly  Thr Ala Val
    1325                1330                1335

Gly Glu  Leu Glu Asp Lys Ala  Arg Ser Ala Leu Arg  Gly Lys Ala
    1340                1345                1350

Met Arg  Gln Thr Leu Thr Asp  Ala Gly Ile Thr Ala  Glu Ala Gly
    1355                1360                1365

Trp Arg  Leu Asp Ser Glu Gly  Ala Val Cys Asp Leu  Glu Val Ala
    1370                1375                1380

Lys Gly  Asp Thr Val Lys Lys  Asp Gly Lys Thr Tyr  Lys Val Gly
    1385                1390                1395

Val Ile  Thr Gln Gly Ile Phe  Gly Met Pro Val Asp  Ala Ala Gly
    1400                1405                1410

Ser Ala  Pro Arg Thr Pro Glu  Asp Cys Glu Lys Phe  Glu Glu Gln
    1415                1420                1425

Tyr Gly  Ile Lys Pro Trp Lys  Ala Lys Gly Ile Pro  Leu Ala
    1430                1435                1440
```

<210> 326
<211> 984
<212> PRT
<213> Campylobacter coli

<400> 326

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
```

```
1               5                   10                  15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Cys Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Asn Gly Asp Glu Glu Lys Ser Glu
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Val Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205
```

```
Gln Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
```

```
               405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
               485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
               565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605
```

```
Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asn Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
```

```
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975

Arg Gln Arg Glu Asp Phe Lys Lys
            980
```

<210> 327
<211> 984
<212> PRT

<213> Campylobacter coli

<400> 327

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                  10                  15


Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30


Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45


Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60


Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80


Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95


Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110


Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125


Arg Gly Tyr Asp Asp Ile Lys Asn Asn Gly Asp Glu Glu Lys Gly Lys
    130                 135                 140


Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Val Asn Tyr Gln
145                 150                 155                 160


Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175


Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190
```

```
Arg Cys Ile Thr Gln Ser Phe Leu Lys Tyr Glu Leu Lys Leu Ile Phe
        195                 200                 205

Gln Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Ser Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380
```

```
Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn Tyr Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590
```

```
Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asn Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780
```

```
Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800


Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815


Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830


Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845


Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860


Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880


Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895


Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910


Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925


Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940


Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960


Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975


Arg Gln Arg Glu Asp Phe Lys Lys
            980
```

<210> 328
<211> 984
<212> PRT
<213> Campylobacter coli

<400> 328

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15


Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30


Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45


Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60


Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80


Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95


Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110


Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125


Arg Gly Tyr Asp Asp Ile Lys Asn Asn Gly Asp Glu Glu Lys Ser Glu
    130                 135                 140


Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Val Asn Tyr Gln
145                 150                 155                 160


Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
```

```
                165                 170                 175

Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Gln Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Thr Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asn Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365
```

```
Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Tyr Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
```

```
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765
```

```
Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Leu Val Tyr Phe Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
```

965 970 975

Arg Gln Arg Glu Asp Phe Lys Lys
980

<210> 329
<211> 984
<212> PRT
<213> Campylobacter coli

<400> 329

Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1 5 10 15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
20 25 30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
35 40 45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
50 55 60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65 70 75 80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
85 90 95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
100 105 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
115 120 125

Arg Gly Tyr Asp Asp Ile Lys Asn Asn Gly Asp Glu Glu Lys Ser Glu
130 135 140

```
Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Val Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Gln Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350
```

```
Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn Tyr Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540
```

```
Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560


Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575


Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590


Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605


Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620


Lys Asp Lys Glu Gln Lys Asn Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640


Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655


Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670


Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685


Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700


Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720


Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735


Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750
```

```
Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940
```

```
Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960


Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975


Arg Gln Arg Glu Asp Phe Lys Lys
            980
```

<210> 330
<211> 987
<212> PRT
<213> Campylobacter coli

<400> 330

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15


Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30


Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45


Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60


Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80


Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95


Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110


Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125
```

```
Arg Gly Tyr Asp Asp Ile Lys Asn Asn Gly Asp Glu Glu Lys Ser Glu
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Val Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Gln Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Thr Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
```

```
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asn Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Tyr Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525
```

```
Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
```

```
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Leu Val Tyr Phe Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925
```

```
Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975

Arg Gln Arg Glu Asp Phe Lys Asn Glu Leu Arg
            980                 985
```

<210> 331
<211> 984
<212> PRT
<213> Campylobacter coli

<400> 331

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110
```

```
Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Asn Gly Asp Glu Glu Lys Ser Glu
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Val Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Gln Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Thr Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300
```

```
Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asn Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Tyr Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510
```

```
Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asn Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700
```

```
Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Leu Val Tyr Phe Asn Ala Phe
            900                 905                 910
```

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
915 920 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
930 935 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945 950 955 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
965 970 975

Arg Gln Arg Glu Asp Phe Lys Lys
980

<210> 332
<211> 987
<212> PRT
<213> Campylobacter coli

<400> 332

Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1 5 10 15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
20 25 30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
35 40 45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
50 55 60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65 70 75 80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly

```
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285
```

```
Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Asp His Ser Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn Tyr Ser Gln Arg Ala Lys Ile Glu Lys
```

```
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Lys Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Thr Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Glu Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685
```

```
Ala Leu Arg His Thr Trp Gly Phe Ser Thr Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
```

```
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975

Arg Gln Arg Glu Asp Phe Lys Asn Glu Leu Arg
            980                 985


<210>  333
<211>  984
<212>  PRT
<213>  Campylobacter coli

<400>  333

Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60
```

```
Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Thr Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270
```

```
Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Asp His Ser Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460
```

```
Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn Tyr Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670
```

```
Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860
```

```
Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880


Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895


Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910


Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925


Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940


Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960


Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975


Arg Gln Arg Glu Asp Phe Lys Lys
            980


<210>  334
<211>  965
<212>  PRT
<213>  Campylobacter coli

<400>  334

Met Lys Ile Ile Gly Phe Asn Leu Gly Ile Ala Asn Ile Gly Trp Ala
1               5                   10                  15


Leu Arg Glu Asn Asp Glu Ile Ile Asp Cys Gly Val Arg Val Phe Asp
            20                  25                  30


Ile Pro Glu Asn Pro Lys Asn Gly Asn Ser Leu Ala Leu Glu Arg Arg
        35                  40                  45
```

```
Glu Asn Lys Ala Arg Met Lys Ile Val Lys Arg Lys Lys Ala Arg Met
    50                  55                  60

Leu Ala Thr Lys Thr Phe Leu Lys Lys Glu Leu Asn Val Asp Leu Ser
65                  70                  75                  80

Lys Leu Phe Leu Ile Gly Ser Thr Gln Ser Ile Tyr Glu Leu Arg Thr
                85                  90                  95

Lys Ala Leu Ser Ser Leu Ile Ser Lys Glu Glu Leu Ser Ala Ile Ile
            100                 105                 110

Leu His Ile Ala Lys His Arg Gly Tyr Asp Asp Ser Ala Leu Lys Asn
        115                 120                 125

Glu Asn Gly Thr Ile Ile Glu Ala Leu Asn Lys Asn Lys Glu Ala Met
    130                 135                 140

Leu Lys Phe Lys Ser Val Gly Glu Tyr Phe Tyr Lys Asn Phe Val Gln
145                 150                 155                 160

Asn Lys Glu Val Lys Lys Ile Arg Asn Thr Thr Glu Asp Tyr Ser Asn
                165                 170                 175

Ser Val Pro Arg Ser Leu Leu Lys Gln Glu Leu Asp Leu Ile Leu Asp
            180                 185                 190

Lys Gln Lys Glu Leu Gly Leu Ile Lys Asn Ala Asp Phe Lys Ala Lys
        195                 200                 205

Leu Phe Glu Ile Ile Phe Phe Lys Arg Pro Leu Lys Asp Phe Ser Asn
    210                 215                 220

Lys Ile Gly Asn Cys Ile Phe Phe Glu Asn Glu Lys Arg Ala Ala Lys
225                 230                 235                 240

Asn Thr Ile Ser Ala Cys Glu Phe Val Ala Leu Gly Lys Val Val Asn
```

```
                245                 250                 255

Leu Leu Lys Ser Ile Glu Lys Asp Ile Gly Ile Val Tyr Glu Lys Asp
            260                 265                 270

Ser Ile Asn Glu Ile Met Ser Ile Ile Leu Asp Lys Thr Ser Ile Ser
        275                 280                 285

Tyr Lys Lys Ile Arg Asp Ile Leu Asn Leu Pro Gln Asp Ile Asn Phe
    290                 295                 300

Lys Gly Leu Asp Tyr Ser Lys Asn Asn Val Glu Asn Ser Lys Leu Val
305                 310                 315                 320

Asp Leu Lys Lys Leu Asn Glu Phe Lys Lys Ala Leu Gly Asp Gly Phe
                325                 330                 335

Thr Asn Leu Asp Lys Asp Ile Leu Asp Ser Ile Ala Thr Asp Ile Thr
            340                 345                 350

Leu Thr Lys Asp Thr Ala Thr Leu Lys Glu Lys Leu Lys Asn Tyr Asn
        355                 360                 365

Val Leu Asn Ala Glu Gln Ile Glu Lys Leu Ser Glu Leu Val Phe Asn
    370                 375                 380

Asp His Ile Asn Leu Ser Leu Lys Ala Leu Lys Gln Ile Ile Pro Leu
385                 390                 395                 400

Met Tyr Glu Gly Lys Arg Tyr Asp Glu Ala Cys Glu Leu Cys Asn Phe
                405                 410                 415

Thr Ile Ala Lys Asn Gln Glu Lys Asn Glu Tyr Leu Pro Leu Phe Glu
            420                 425                 430

Lys Thr Arg Phe Ala Lys Asp Ile Ser Ser Pro Val Val Ile Arg Ala
        435                 440                 445
```

```
Ile Cys Glu Phe Arg Lys Leu Leu Asn Asp Ile Ile Arg Arg Tyr Gly
    450                 455                 460

Ser Val His Lys Ile His Leu Glu Leu Thr Arg Asp Phe Gly Ile Ser
465                 470                 475                 480

Phe Asn Asp Arg Lys Lys Ile Ile Lys Glu Ile Glu Gln Asn Glu Gln
                485                 490                 495

Ser Arg Ile Lys Ala Leu Glu Thr Ile Lys Glu Leu Lys Leu Glu Glu
            500                 505                 510

Thr Ser Lys Asn Ile Gln Ile Val Arg Leu Phe Glu Asp Gln Lys Gly
        515                 520                 525

Ile Cys Pro Tyr Ser Gly Leu Lys Met Asp Leu Lys Cys Leu Asp Glu
    530                 535                 540

Leu Val Ile Asp Tyr Ile Arg Pro Tyr Asn Arg Ser Leu Asp Asp Ser
545                 550                 555                 560

Tyr Ser Asn Lys Val Leu Thr Phe Lys Lys Leu Asn Asp Leu Lys Gln
                565                 570                 575

Gly Lys Thr Pro Phe Glu Ala Phe Gly Glu Asp Glu Lys Leu Trp Ala
            580                 585                 590

Glu Ile Asn Glu Arg Ile Lys Glu Tyr Asn Gly Lys Lys Arg Phe Lys
        595                 600                 605

Ile Phe Asp Lys Phe Phe Lys Asp Lys Lys Pro Phe Asp Phe Thr Glu
    610                 615                 620

Gln Thr Leu Gln Asp Thr Arg Trp Leu Thr Lys Leu Val Ala Ser Tyr
625                 630                 635                 640

Leu Asn Glu Tyr Leu Ser Phe Leu Pro Ile Ser Glu Asp Glu Asn Thr
```

```
                645                 650                 655

Ala Leu Gly Tyr Gly Glu Lys Gly Ser Lys Gln His Val Ile Leu Ser
            660                 665                 670

Ser Gly Met Ile Thr Gln Met Leu Arg Asn Phe Trp Tyr Leu Gly Phe
        675                 680                 685

Lys Asn His Lys Asp Tyr Lys Asn Asn Ala Met Asp Ala Ile Ile Val
    690                 695                 700

Ala Phe Thr Thr Asn Ser Ile Ile Phe Thr Phe Asn Asn Phe Lys Lys
705                 710                 715                 720

Glu Leu Asp Leu Ala Lys Ala Glu Phe Tyr Ala Asn Lys Ile Ser Glu
                725                 730                 735

Ser Asp Tyr Leu Leu Lys Arg Lys Phe Leu Pro Pro Phe Ser Gly Phe
            740                 745                 750

Lys Glu Gln Ala Leu Glu Lys Val Lys Asn Ile Phe Val Ser His Ser
        755                 760                 765

Leu Lys Ile Lys Asn Lys Gly Thr Leu His Glu Leu Thr Pro Leu Lys
    770                 775                 780

Ile Lys Glu Leu Lys Asn Thr Tyr Gly Asp Leu Asp Leu Ala Val Lys
785                 790                 795                 800

Leu Gly Lys Ile Arg Lys Tyr Asn Asp Lys Tyr Tyr Ala Asn Ala Lys
                805                 810                 815

Gly Ser Leu Val Arg Thr Asp Leu Phe Ala Asp Lys Glu Asn Lys Phe
            820                 825                 830

His Ala Val Ser Ile Tyr Lys Ala Asp Phe Ser Thr Lys Lys Leu Pro
        835                 840                 845
```

```
Asn Lys Thr Pro Ala Thr Thr Ser Asn Gly Glu Thr Lys Glu Gly Ile
    850                 855                 860

Glu Met Asn Glu Asn Tyr Asn Phe Cys Met Ser Leu Tyr Lys Asn Thr
865                 870                 875                 880

Pro Ile Ser Val Lys Ile Lys Gly Met Lys Glu Pro Ile Ile Cys Tyr
                885                 890                 895

Tyr His Gly Phe Asn Thr Ser Gly Ser Lys Ile Thr Tyr Lys Lys His
            900                 905                 910

Asp Asn Asn Tyr His Asn Leu Ser Glu Asp Glu Met Val Val Phe Arg
        915                 920                 925

Lys Asn Asp Lys Glu Ser Ile Val Val Gly Lys Ile Leu Glu Ile Lys
    930                 935                 940

Lys Tyr Ser Ile Ser Pro Ser Gly Glu Leu Ser Leu Ile Glu Asn Glu
945                 950                 955                 960

Glu Arg Lys Trp Phe
                965
```

<210> 335
<211> 965
<212> PRT
<213> Campylobacter coli

<400> 335

```
Met Lys Ile Ile Gly Phe Asn Leu Gly Ile Ala Asn Ile Gly Trp Ala
1               5                   10                  15

Leu Arg Glu Asn Asp Glu Ile Ile Asp Cys Gly Val Arg Val Phe Asp
            20                  25                  30

Ile Pro Glu Asn Pro Lys Asn Gly Asn Ser Leu Ala Leu Glu Arg Arg
        35                  40                  45
```

```
Glu Asn Lys Ala Arg Met Lys Ile Val Lys Arg Lys Lys Ala Arg Met
    50                  55                  60

Leu Ala Thr Lys Thr Phe Leu Lys Lys Glu Leu Asn Val Asp Leu Ser
65                  70                  75                  80

Lys Leu Phe Leu Ile Gly Ser Thr Gln Ser Ile Tyr Glu Leu Arg Thr
                85                  90                  95

Lys Ala Leu Ser Ser Leu Ile Ser Lys Glu Glu Leu Ser Ala Ile Ile
            100                 105                 110

Leu His Ile Ala Lys His Arg Gly Tyr Asp Asp Ser Ala Leu Lys Asn
        115                 120                 125

Glu Asn Gly Thr Ile Ile Glu Ala Leu Asn Lys Asn Lys Glu Ala Met
    130                 135                 140

Leu Lys Phe Lys Ser Val Gly Glu Tyr Phe Tyr Lys Asn Phe Val Gln
145                 150                 155                 160

Asn Lys Glu Val Lys Lys Ile Arg Asn Thr Thr Glu Asp Tyr Ser Asn
                165                 170                 175

Ser Val Pro Arg Ser Leu Leu Lys Gln Glu Leu Asp Leu Ile Leu Asp
            180                 185                 190

Lys Gln Lys Glu Leu Gly Leu Ile Lys Asn Ala Asp Phe Lys Ala Lys
        195                 200                 205

Leu Phe Glu Ile Ile Phe Phe Lys Arg Pro Leu Lys Asp Phe Ser Asn
    210                 215                 220

Lys Ile Gly Asn Cys Ile Phe Phe Glu Asn Glu Lys Arg Ala Ala Lys
225                 230                 235                 240
```

```
Asn Thr Ile Ser Ala Cys Glu Phe Val Ala Leu Gly Lys Val Val Asn
                245                 250                 255

Leu Leu Lys Ser Ile Glu Lys Asp Ile Gly Ile Val Tyr Glu Lys Asp
            260                 265                 270

Ser Ile Asn Glu Ile Met Ser Ile Ile Leu Asp Lys Thr Ser Ile Ser
        275                 280                 285

Tyr Lys Lys Ile Arg Asp Ile Leu Asn Leu Pro Gln Asp Ile Asn Phe
    290                 295                 300

Lys Gly Leu Asp Tyr Ser Lys Asn Asn Ala Glu Asn Ser Lys Leu Val
305                 310                 315                 320

Asp Leu Lys Lys Leu Asn Glu Phe Lys Lys Ala Leu Gly Asp Gly Phe
                325                 330                 335

Ala Asn Leu Asp Lys Asp Ile Leu Asp Ser Ile Ala Thr Asp Ile Thr
            340                 345                 350

Leu Thr Lys Asp Thr Ala Thr Leu Lys Glu Lys Leu Lys Asn Tyr Asn
        355                 360                 365

Val Leu Asn Ala Glu Gln Ile Glu Lys Leu Ser Glu Leu Val Phe Asn
    370                 375                 380

Asp His Ile Asn Leu Ser Leu Lys Ala Leu Lys Gln Ile Ile Pro Leu
385                 390                 395                 400

Met Tyr Glu Gly Lys Arg Tyr Asp Glu Ala Cys Glu Leu Cys Asn Phe
                405                 410                 415

Thr Ile Ala Lys Asn Gln Glu Lys Asn Glu Tyr Leu Pro Leu Phe Glu
            420                 425                 430

Lys Thr Arg Phe Ala Lys Asp Ile Ser Ser Pro Val Val Ile Arg Ala
        435                 440                 445
```

```
Ile Cys Glu Phe Arg Lys Leu Leu Asn Asp Ile Ile Arg Arg Tyr Gly
    450                 455                 460

Ser Val His Lys Ile His Leu Glu Leu Thr Arg Asp Phe Gly Ile Ser
465                 470                 475                 480

Phe Asn Asp Arg Lys Lys Ile Ile Lys Glu Ile Glu Gln Asn Glu Gln
                485                 490                 495

Ser Arg Ile Lys Ala Leu Glu Thr Ile Lys Glu Leu Lys Leu Glu Glu
            500                 505                 510

Thr Ser Lys Asn Ile Gln Ile Val Arg Leu Phe Glu Asp Gln Lys Gly
        515                 520                 525

Ile Cys Pro Tyr Ser Gly Leu Lys Met Asp Leu Lys Cys Leu Asp Glu
    530                 535                 540

Leu Val Ile Asp Tyr Ile Arg Pro Tyr Asn Arg Ser Leu Asp Asp Ser
545                 550                 555                 560

Tyr Ser Asn Lys Val Leu Thr Phe Lys Lys Leu Asn Asp Leu Lys Gln
                565                 570                 575

Gly Lys Thr Pro Phe Glu Ala Phe Gly Glu Asp Glu Lys Leu Trp Ala
            580                 585                 590

Glu Ile Asn Glu Arg Ile Lys Glu Tyr Asn Gly Lys Lys Arg Phe Lys
        595                 600                 605

Ile Phe Asp Lys Phe Phe Lys Asp Lys Lys Pro Phe Asp Phe Thr Glu
    610                 615                 620

Gln Thr Leu Gln Asp Thr Arg Trp Leu Thr Lys Leu Val Ala Ser Tyr
625                 630                 635                 640
```

```
Leu Asn Glu Tyr Leu Ser Phe Leu Pro Ile Ser Glu Asp Glu Asn Thr
                645                 650                 655

Ala Leu Gly Tyr Gly Glu Lys Gly Ser Lys Gln His Val Val Leu Ser
            660                 665                 670

Ser Gly Met Ile Thr Gln Met Leu Arg Asn Phe Trp Tyr Leu Gly Phe
        675                 680                 685

Lys Asn His Lys Asn Tyr Lys Asn Asn Ala Met Asp Ala Ile Ile Val
    690                 695                 700

Ala Phe Thr Thr Asn Ser Ile Ile Phe Ala Phe Asn Asn Phe Lys Lys
705                 710                 715                 720

Glu Leu Asp Leu Ala Lys Ala Glu Phe Tyr Ala Asn Lys Ile Ser Glu
                725                 730                 735

Ser Asp Tyr Leu Leu Lys Arg Lys Phe Leu Pro Pro Phe Ser Gly Phe
            740                 745                 750

Lys Glu Gln Ala Leu Glu Lys Val Lys Asn Ile Phe Val Ser His Ser
        755                 760                 765

Leu Lys Ile Lys Asn Lys Gly Thr Leu His Glu Leu Thr Pro Leu Lys
    770                 775                 780

Ile Lys Glu Leu Lys Asn Thr Tyr Gly Asp Leu Asp Leu Ala Val Lys
785                 790                 795                 800

Leu Gly Lys Ile Arg Lys Tyr Asn Asp Lys Tyr Tyr Ala Asn Thr Lys
                805                 810                 815

Gly Ser Leu Val Arg Thr Asp Leu Phe Val Asp Lys Glu Asn Lys Phe
            820                 825                 830

His Ala Val Ser Ile Tyr Lys Ala Asp Phe Ser Thr Lys Lys Leu Pro
        835                 840                 845
```

```
Asn Lys Thr Pro Ala Thr Thr Ser Asn Gly Glu Thr Lys Glu Gly Ile
    850                 855                 860

Glu Met Asn Glu Asn Tyr Asn Phe Cys Met Ser Leu Tyr Lys Asn Thr
865                 870                 875                 880

Pro Val Ser Val Lys Ile Lys Gly Met Lys Glu Pro Ile Ile Cys Tyr
                885                 890                 895

Tyr His Gly Phe Asn Thr Ser Gly Ser Lys Ile Thr Tyr Lys Lys His
            900                 905                 910

Asp Asn Asn Tyr His Asn Leu Ser Glu Asp Glu Met Val Val Phe Arg
        915                 920                 925

Lys Asn Asp Lys Glu Ser Ile Val Val Gly Lys Ile Leu Glu Ile Lys
    930                 935                 940

Lys Tyr Ser Ile Ser Pro Ser Gly Glu Leu Ser Leu Ile Glu Asn Glu
945                 950                 955                 960

Lys Arg Lys Trp Phe
                965
```

<210> 336
<211> 965
<212> PRT
<213> Campylobacter coli

<400> 336

```
Met Lys Ile Ile Gly Phe Asn Leu Gly Ile Ala Asn Ile Gly Trp Ala
1               5                   10                  15

Leu Arg Glu Asn Asp Glu Ile Ile Asp Cys Gly Val Arg Val Phe Asp
            20                  25                  30

Ile Pro Glu Asn Pro Lys Asn Gly Asn Ser Leu Ala Leu Glu Arg Arg
```

```
        35                  40                  45

Glu Asn Lys Ala Arg Met Lys Ile Val Lys Arg Lys Lys Ala Arg Met
    50                  55                  60

Leu Ala Thr Lys Thr Phe Leu Lys Lys Glu Leu Asn Val Asp Leu Ser
65                  70                  75                  80

Lys Leu Phe Leu Ile Gly Ser Thr Gln Ser Ile Tyr Glu Leu Arg Thr
                85                  90                  95

Lys Ala Leu Ser Ser Leu Ile Ser Lys Glu Glu Leu Ser Ala Ile Ile
            100                 105                 110

Leu His Ile Ala Lys His Arg Gly Tyr Asp Asp Ser Ala Leu Lys Asn
        115                 120                 125

Glu Asn Gly Thr Ile Ile Glu Ala Leu Asn Lys Asn Lys Glu Ala Met
    130                 135                 140

Leu Lys Phe Lys Ser Val Gly Glu Tyr Phe Tyr Lys Asn Phe Val Gln
145                 150                 155                 160

Asn Lys Glu Val Lys Lys Ile Arg Asn Thr Thr Glu Asp Tyr Ser Asn
                165                 170                 175

Ser Val Pro Arg Ser Leu Leu Lys Gln Glu Leu Asp Leu Ile Leu Asp
            180                 185                 190

Lys Gln Lys Glu Leu Gly Leu Ile Lys Asn Ala Asp Phe Lys Glu Lys
        195                 200                 205

Leu Phe Glu Ile Ile Phe Phe Lys Arg Pro Leu Lys Asp Phe Ser Asn
    210                 215                 220

Lys Ile Gly Asn Cys Ile Phe Phe Glu Asn Glu Lys Arg Ala Ala Lys
225                 230                 235                 240
```

```
Asn Thr Ile Ser Ala Cys Glu Phe Val Ala Leu Gly Lys Val Val Asn
               245                 250                 255

Leu Leu Lys Ser Ile Glu Lys Asp Ile Gly Ile Val Tyr Glu Lys Asp
            260                 265                 270

Ser Ile Asn Glu Ile Met Ser Ile Ile Leu Asp Lys Thr Ser Ile Ser
        275                 280                 285

Tyr Lys Lys Ile Arg Asp Ile Leu Asn Leu Pro Gln Asp Ile Asn Phe
    290                 295                 300

Lys Gly Leu Asp Tyr Ser Lys Asn Asn Ala Glu Asn Ser Lys Leu Val
305                 310                 315                 320

Asp Leu Lys Lys Leu Asn Glu Phe Lys Lys Ala Leu Gly Asp Gly Phe
               325                 330                 335

Ala Asn Leu Asp Lys Asp Ile Leu Asp Ser Ile Ala Thr Asp Ile Thr
            340                 345                 350

Leu Thr Lys Asp Thr Ala Thr Leu Lys Glu Lys Leu Lys Asn Tyr Asn
        355                 360                 365

Val Leu Asn Ala Glu Gln Ile Glu Lys Leu Ser Glu Leu Val Phe Asn
    370                 375                 380

Asp His Ile Asn Leu Ser Leu Lys Ala Leu Lys Gln Ile Ile Pro Leu
385                 390                 395                 400

Met Tyr Glu Gly Lys Arg Tyr Asp Glu Ala Cys Glu Leu Cys Asn Phe
               405                 410                 415

Thr Ile Ala Lys Asn Gln Glu Lys Asn Glu Tyr Leu Pro Leu Phe Glu
            420                 425                 430

Lys Thr Arg Phe Ala Lys Asp Ile Ser Ser Pro Val Val Ile Arg Ala
```

```
        435                 440                 445

Ile Cys Glu Phe Arg Lys Leu Leu Asn Asp Ile Ile Arg Arg Tyr Gly
    450                 455                 460

Ser Val His Lys Ile His Leu Glu Leu Thr Arg Asp Phe Gly Ile Ser
465                 470                 475                 480

Phe Asn Asp Arg Lys Lys Ile Ile Lys Glu Ile Glu Gln Asn Glu Gln
                485                 490                 495

Ser Arg Ile Lys Ala Leu Glu Thr Ile Lys Glu Leu Lys Leu Glu Glu
            500                 505                 510

Thr Ser Lys Asn Ile Gln Ile Val Arg Leu Phe Glu Asp Gln Lys Gly
        515                 520                 525

Ile Cys Pro Tyr Ser Gly Leu Lys Met Asp Leu Lys Cys Leu Asp Glu
    530                 535                 540

Leu Val Ile Asp Tyr Ile Arg Pro Tyr Asn Arg Ser Leu Asp Asp Ser
545                 550                 555                 560

Tyr Ser Asn Lys Ile Leu Thr Phe Lys Lys Leu Asn Asp Leu Lys Gln
                565                 570                 575

Gly Lys Thr Pro Phe Glu Ala Phe Gly Glu Asp Glu Lys Leu Trp Ala
            580                 585                 590

Glu Ile Asn Glu Arg Ile Lys Glu Tyr Asn Gly Lys Lys Arg Phe Lys
        595                 600                 605

Ile Phe Asp Lys Phe Phe Lys Asp Lys Lys Pro Phe Asp Phe Thr Glu
    610                 615                 620

Gln Thr Leu Gln Asp Thr Arg Trp Leu Thr Lys Leu Val Ala Ser Tyr
625                 630                 635                 640
```

```
Leu Asn Glu Tyr Leu Leu Phe Leu Pro Ile Asn Glu Asp Glu Asn Thr
               645                 650                 655

Ala Leu Gly Tyr Gly Glu Lys Gly Ser Lys Gln His Val Val Leu Ser
            660                 665                 670

Ser Gly Met Ile Thr Gln Met Leu Arg Asn Phe Trp Tyr Leu Gly Phe
        675                 680                 685

Lys Asn His Lys Asp Tyr Lys Asn Asn Ala Met Asp Ala Ile Ile Val
    690                 695                 700

Ala Phe Thr Thr Asn Ser Ile Ile Phe Ala Phe Asn Asn Phe Lys Lys
705                 710                 715                 720

Glu Leu Asp Leu Ala Lys Ala Glu Phe Tyr Ala Asn Lys Ile Ser Glu
               725                 730                 735

Ser Asp Tyr Leu Leu Lys Arg Lys Phe Leu Pro Pro Phe Ser Gly Phe
            740                 745                 750

Lys Glu Gln Ala Leu Glu Lys Val Lys Asn Ile Phe Val Ser His Ser
        755                 760                 765

Leu Lys Ile Lys Asn Lys Gly Thr Leu His Glu Leu Thr Pro Leu Lys
    770                 775                 780

Ile Lys Glu Leu Lys Asn Thr Tyr Gly Asp Leu Asp Leu Ala Val Lys
785                 790                 795                 800

Leu Gly Lys Ile Arg Lys Tyr Asn Asp Lys Tyr Tyr Ala Asn Ala Lys
               805                 810                 815

Gly Ser Leu Val Arg Thr Asp Leu Phe Ala Asp Lys Glu Asn Lys Phe
            820                 825                 830

His Ala Val Ser Ile Tyr Lys Ala Asp Phe Ser Thr Lys Lys Leu Pro
```

```
        835                 840                 845

Asn Lys Thr Pro Ala Thr Thr Ser Asn Gly Glu Thr Lys Glu Gly Ile
    850                 855                 860

Glu Met Asn Glu Asn Tyr Asn Phe Cys Met Ser Leu Tyr Lys Asn Thr
865                 870                 875                 880

Pro Ile Ser Val Lys Ile Lys Gly Met Lys Glu Pro Ile Ile Cys Tyr
                885                 890                 895

Tyr His Gly Phe Asn Thr Ser Gly Ser Lys Ile Thr Tyr Lys Lys His
            900                 905                 910

Asp Asn Asn Tyr His Asn Leu Ser Glu Asp Glu Met Val Val Phe Arg
        915                 920                 925

Lys Asn Asp Lys Glu Ser Ile Val Val Gly Lys Ile Leu Glu Ile Lys
    930                 935                 940

Lys Tyr Ser Ile Ser Pro Ser Gly Glu Leu Ser Leu Ile Glu Asn Glu
945                 950                 955                 960

Glu Arg Lys Trp Phe
                965
```

<210> 337
<211> 933
<212> PRT
<213> Campylobacter coli

<400> 337

```
Met Lys Ile Ile Gly Phe Asn Leu Gly Ile Ala Asn Ile Gly Trp Ala
1               5                   10                  15

Leu Arg Glu Asn Asp Glu Ile Ile Asp Cys Gly Val Arg Val Phe Asp
            20                  25                  30
```

```
Ile Pro Glu Asn Pro Lys Asn Gly Asn Ser Leu Ala Leu Glu Arg Arg
        35                  40                  45

Glu Asn Lys Ala Arg Met Lys Ile Val Lys Arg Lys Lys Ala Arg Met
    50                  55                  60

Leu Ala Thr Lys Thr Phe Leu Lys Lys Glu Leu Asn Val Asp Leu Ser
65                  70                  75                  80

Lys Leu Phe Leu Ile Gly Ser Thr Gln Ser Ile Tyr Glu Leu Arg Thr
                85                  90                  95

Lys Ala Leu Ser Ser Leu Ile Ser Lys Glu Glu Leu Ser Val Ile Ile
            100                 105                 110

Leu His Ile Ala Lys His Arg Gly Tyr Asp Asp Ser Ala Leu Lys Asn
        115                 120                 125

Glu Asn Gly Thr Ile Ile Glu Ala Leu Asn Lys Asn Lys Glu Thr Met
    130                 135                 140

Leu Lys Phe Lys Ser Val Gly Glu Tyr Phe Tyr Lys Asn Phe Val Gln
145                 150                 155                 160

Asn Lys Glu Val Lys Lys Ile Arg Asn Thr Thr Glu Asp Tyr Ser Asn
                165                 170                 175

Ser Val Pro Arg Ser Leu Leu Lys Gln Glu Leu Asp Leu Ile Leu Asp
            180                 185                 190

Arg Gln Lys Glu Leu Gly Leu Ile Lys Asn Ala Asp Phe Lys Ala Lys
        195                 200                 205

Leu Phe Glu Ile Ile Phe Phe Lys Arg Pro Leu Lys Asp Phe Ser Asn
    210                 215                 220

Lys Ile Gly Asn Cys Ile Phe Phe Glu Asn Glu Lys Arg Ala Ala Lys
225                 230                 235                 240
```

```
Asn Thr Ile Ser Ala Cys Glu Phe Val Ala Leu Gly Lys Val Val Asn
                245                 250                 255

Leu Leu Lys Ser Ile Glu Lys Asp Ile Gly Ile Val Tyr Glu Lys Asp
            260                 265                 270

Ser Ile Asn Glu Ile Met Ser Ile Ile Leu Asp Lys Thr Ser Ile Ser
        275                 280                 285

Tyr Lys Lys Ile Arg Asp Ile Leu Asn Leu Pro Gln Asp Ile Asn Phe
    290                 295                 300

Lys Gly Leu Asp Tyr Ser Lys Asn Asn Val Glu Asn Ser Lys Leu Val
305                 310                 315                 320

Asp Leu Lys Lys Leu Asn Glu Phe Lys Lys Ala Leu Gly Asp Gly Phe
                325                 330                 335

Thr Asn Leu Asp Lys Asp Ile Leu Asp Ser Ile Ala Thr Asp Ile Thr
            340                 345                 350

Leu Thr Lys Asp Thr Ala Thr Leu Lys Glu Lys Leu Lys Asn Tyr Asn
        355                 360                 365

Val Leu Asn Ala Glu Gln Ile Glu Lys Leu Ser Glu Leu Val Phe Asn
    370                 375                 380

Asp His Ile Asn Leu Ser Leu Lys Ala Leu Lys Gln Ile Ile Pro Leu
385                 390                 395                 400

Met Tyr Glu Gly Lys Arg Tyr Asp Glu Ala Cys Glu Leu Cys Asn Phe
                405                 410                 415

Thr Ile Ala Lys Asn Gln Glu Lys Asn Glu Tyr Leu Pro Leu Phe Glu
            420                 425                 430
```

```
Lys Thr Arg Phe Ala Lys Asp Ile Ser Ser Pro Val Val Ile Arg Ala
        435                 440                 445

Ile Cys Glu Phe Arg Lys Leu Leu Asn Asp Ile Ile Arg Arg Tyr Gly
    450                 455                 460

Ser Val His Lys Ile His Leu Glu Leu Thr Arg Asp Phe Gly Ile Ser
465                 470                 475                 480

Phe Asn Asp Arg Lys Lys Ile Ile Lys Glu Ile Glu Gln Asn Glu Gln
                485                 490                 495

Ser Arg Ile Lys Ala Leu Glu Thr Ile Lys Glu Leu Lys Leu Glu Glu
            500                 505                 510

Thr Ser Lys Asn Ile Gln Ile Val Arg Leu Phe Glu Asp Gln Lys Gly
        515                 520                 525

Ile Cys Pro Tyr Ser Gly Leu Lys Met Asp Leu Lys Cys Leu Asp Glu
    530                 535                 540

Leu Val Ile Asp Tyr Ile Arg Pro Tyr Asn Arg Ser Leu Asp Asp Ser
545                 550                 555                 560

Tyr Ser Asn Lys Val Leu Thr Phe Lys Lys Leu Asn Asp Leu Lys Gln
                565                 570                 575

Gly Lys Thr Pro Phe Glu Ala Phe Gly Glu Asp Glu Lys Leu Trp Ala
            580                 585                 590

Glu Ile Asn Glu Arg Ile Lys Glu Tyr Asn Gly Lys Lys Arg Phe Lys
        595                 600                 605

Ile Phe Asp Lys Phe Phe Lys Asp Lys Lys Pro Phe Asp Phe Thr Glu
    610                 615                 620

Gln Thr Leu Gln Asp Thr Arg Trp Leu Thr Lys Leu Val Ala Ser Tyr
625                 630                 635                 640
```

```
Leu Asn Glu His Leu Ser Phe Leu Pro Ile Ser Glu Asp Glu Asn Thr
               645                 650                 655

Ala Leu Gly Tyr Gly Glu Lys Gly Ser Lys Gln His Val Ile Leu Ser
            660                 665                 670

Ser Gly Met Ile Thr Gln Met Leu Arg Asn Phe Trp Tyr Leu Gly Phe
        675                 680                 685

Lys Asn His Lys Asp Tyr Lys Asn Asn Ala Met Asp Ala Ile Ile Val
    690                 695                 700

Ala Phe Thr Thr Asn Ser Ile Ile Phe Thr Phe Asn Asn Phe Lys Lys
705                 710                 715                 720

Glu Leu Asp Leu Ala Lys Ala Glu Phe Tyr Ala Asn Lys Ile Ser Glu
               725                 730                 735

Ser Asp Tyr Leu Leu Lys Arg Lys Phe Leu Pro Pro Phe Ser Gly Phe
            740                 745                 750

Lys Glu Gln Ala Leu Glu Lys Val Lys Asn Ile Phe Val Ser His Ser
        755                 760                 765

Leu Lys Ile Lys Asn Lys Gly Thr Leu His Glu Leu Thr Pro Leu Lys
    770                 775                 780

Ile Lys Glu Leu Lys Asn Thr Tyr Gly Asp Leu Asp Leu Ala Val Lys
785                 790                 795                 800

Leu Gly Lys Ile Arg Lys Tyr Asn Asp Lys Tyr Tyr Ala Asn Ala Asn
               805                 810                 815

Gly Ser Leu Val Arg Ser Asp Leu Phe Ile Asp Lys Lys Asn Lys Phe
            820                 825                 830
```

```
His Ala Val Pro Ile Tyr Lys Ala Asp Phe Ser Thr Lys Lys Leu Pro
        835                 840                 845

Asn Lys Thr Pro Ala Thr Thr Ser Asn Gly Glu Thr Lys Glu Gly Ile
    850                 855                 860

Glu Met Asn Glu Asn Tyr Asn Phe Cys Met Ser Leu Tyr Lys Asn Thr
865                 870                 875                 880

Pro Ile Ser Val Lys Ile Lys Gly Met Lys Glu Ser Ile Ile Cys Tyr
                885                 890                 895

Tyr His Gly Phe Asn Thr Ser Gly Ser Lys Ile Thr Tyr Lys Lys His
            900                 905                 910

Asp Asn Asn Tyr His Asn Leu Ser Glu Asp Glu Met Val Val Phe Arg
        915                 920                 925

Lys Asn Asp Lys Glu
    930
```

<210> 338
<211> 666
<212> PRT
<213> Campylobacter jejuni

<400> 338

```
Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys Glu
1               5                   10                  15

Phe Ile Lys Ala Leu Asp Glu His Ser Leu Ser Gln Asp Asp Leu Asn
            20                  25                  30

Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu Lys
        35                  40                  45

Lys Ala Leu Ala Lys Tyr Asp Leu Lys Glu Asn Gln Ile Asp Ser Leu
    50                  55                  60
```

```
Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala Leu
65                  70                  75                  80

Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu Ala
                85                  90                  95

Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys Asp
            100                 105                 110

Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr Asn
        115                 120                 125

Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Ile Leu Asn Ala
    130                 135                 140

Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu Ala
145                 150                 155                 160

Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys Glu
                165                 170                 175

Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys Glu
            180                 185                 190

Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg Leu
        195                 200                 205

Phe Lys Glu Gln Lys Glu Phe Cys Val Tyr Ser Gly Glu Lys Ile Lys
    210                 215                 220

Leu Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile Tyr
225                 230                 235                 240

Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu Val
                245                 250                 255

Phe Ala Lys Gln Asn Gln Glu Lys Leu Asn Lys Thr Pro Phe Glu Ala
```

```
            260                 265                 270

Phe Gly Asn Asp Ser Thr Lys Trp Gln Lys Ile Glu Val Leu Thr Lys
        275                 280                 285

Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr Lys
    290                 295                 300

Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr Arg
305                 310                 315                 320

Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp Phe
                325                 330                 335

Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln Lys
            340                 345                 350

Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser Ala
        355                 360                 365

Leu Arg His Thr Trp Gly Phe Ser Thr Lys Asp Arg Asn Asn His Leu
    370                 375                 380

His His Ala Ile Asp Ala Ala Ile Ile Ala Tyr Ala Asn Asn Ser Ile
385                 390                 395                 400

Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser Ala
                405                 410                 415

Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys Arg
            420                 425                 430

Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp Lys
        435                 440                 445

Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser Gly
    450                 455                 460
```

```
Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln Ser
465                 470                 475                 480

Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys Ile
                485                 490                 495

Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg Val
            500                 505                 510

Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro Ile
        515                 520                 525

Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val Ala
    530                 535                 540

Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu Asp
545                 550                 555                 560

Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile Gln
                565                 570                 575

Thr Lys Asp Met Gln Glu Pro Glu Leu Val Tyr Phe Asn Ala Phe Thr
            580                 585                 590

Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe Glu
        595                 600                 605

Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu Lys
    610                 615                 620

Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe Glu
625                 630                 635                 640

Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe Arg
                645                 650                 655

Gln Arg Glu Asp Phe Lys Asn Glu Leu Arg
```

660 665

<210> 339
<211> 190
<212> PRT
<213> Campylobacter jejuni

<400> 339

Met Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp Ala Phe Ser Glu
1 5 10 15

Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe Thr Lys Val Glu
20 25 30

Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg Arg Leu Ala Arg
35 40 45

Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg Leu Asn His Leu
50 55 60

Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr Glu Asp Tyr Gln
65 70 75 80

Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly Ser Leu Ile Ser
85 90 95

Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu Leu Ser Lys Gln
100 105 110

Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg Arg Gly Tyr Asp
115 120 125

Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala Ile Leu Lys Ala
130 135 140

Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln Ser Val Gly Glu
145 150 155 160

Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu Asn Ser Lys Glu
165 170 175

Phe Thr Asn Val Arg Asn Lys Lys Lys Val Met Asn Ala Ala
180 185 190

<210> 340
<211> 985
<212> PRT
<213> Campylobacter jejuni

<400> 340

Met Ala Lys Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1 5 10 15

Ala Phe Val Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
20 25 30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
35 40 45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
50 55 60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65 70 75 80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
85 90 95

Thr Leu Ile Ser Pro Tyr Glu Leu Arg Phe Lys Ala Leu Asn Glu Leu
100 105 110

Leu Ser Lys Gln Asp Leu Ala Arg Val Ile Leu His Ile Ala Lys Arg
115 120 125

Arg Gly Tyr Asp Asn Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
130 135 140

```
Ile Leu Lys Ala Val Lys Glu Asn Glu Glu Lys Leu Ala Asn Tyr Lys
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Gln Lys Gln Arg Glu Phe Gly Phe Asn Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Val Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Glu Phe Val Ala Leu Thr Arg Ile Val
            260                 265                 270

Asn Leu Leu Asn Asn Leu Asn Lys Asn Asn Ser Tyr Ile Lys Asp Asp
        275                 280                 285

Leu Asn Ala Leu Leu Ser Glu Val Leu Lys Asn Gly Thr Leu Thr Tyr
    290                 295                 300

Lys Gln Thr Lys Lys Ile Leu Gly Leu Ser Asp Asp Tyr Glu Phe Lys
305                 310                 315                 320

Gly Gln Lys Gly Asn Tyr Phe Ile Glu Phe Lys Lys Tyr Lys Glu Phe
                325                 330                 335

Ile Lys Ala Leu Cys Glu His Asn Leu Asn Gln Asp Asp Leu Asn Glu
```

```
            340                 345                 350

Ile Ala Lys Asp Ile Thr Leu Val Lys Asp Glu Thr Lys Leu Lys Lys
        355                 360                 365

Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Glu Asn Leu Ser
    370                 375                 380

Lys Ile Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala Leu Lys
385                 390                 395                 400

Leu Ile Val Pro Leu Met Arg Glu Gly Lys Lys Tyr Asp Glu Val Cys
                405                 410                 415

Asn Glu Leu Asn Leu Lys Thr Ala Ile Asn Glu Asp Lys Lys Glu Phe
            420                 425                 430

Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Asn Asn Pro
        435                 440                 445

Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn Ser Leu
    450                 455                 460

Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu Ala Arg
465                 470                 475                 480

Glu Val Gly Lys Asn His Arg Glu Arg Ser Lys Ile Glu Lys Glu Gln
                485                 490                 495

Asn Glu Asn Phe Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys Glu Lys
            500                 505                 510

Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg Leu Phe
        515                 520                 525

Lys Glu Gln Lys Glu Phe Cys Val Tyr Ser Gly Glu Lys Ile Lys Ile
    530                 535                 540
```

```
Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile Tyr Pro
545                 550                 555                 560

Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu Val Phe
                565                 570                 575

Thr Lys Gln Asn Gln Glu Lys Leu Asn Lys Thr Pro Phe Glu Ala Phe
            580                 585                 590

Gly Lys Asp Asp Val Lys Trp Gln Lys Ile Glu Thr Leu Ala Lys Asn
        595                 600                 605

Leu Pro Ala Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr Lys Asp
    610                 615                 620

Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr Arg Tyr
625                 630                 635                 640

Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Glu Phe Leu
                645                 650                 655

Pro Leu Ser Asp Asp Glu Asn Ile Lys Leu Asn Asp Thr Gln Lys Gly
            660                 665                 670

Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser Val Leu
        675                 680                 685

Arg His Thr Trp Gly Phe Ser Thr Lys Asp Arg Asn Asn His Leu His
    690                 695                 700

His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Ala Ser Val Val
705                 710                 715                 720

Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Asn Tyr Thr Ala Glu
                725                 730                 735

Leu Tyr Ala Lys Lys Ile Asn Glu Leu Asp Phe Lys Asn Lys Arg Lys
```

```
            740                 745                 750

Phe Phe Glu Pro Phe Ser Asn Phe Arg Gln Lys Val Leu Glu Lys Ile
        755                 760                 765

Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser Gly Ala
    770                 775                 780

Leu His Glu Glu Thr Phe Tyr Lys Glu Glu Glu Phe Tyr Lys Glu Tyr
785                 790                 795                 800

Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys Ile Arg
                805                 810                 815

Lys Val Asn Gly Lys Ile Val Ser Asn Ala Asn Met Phe Arg Val Asp
            820                 825                 830

Ile Phe Lys Tyr Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro Ile Tyr
        835                 840                 845

Thr Met Asp Phe Ala Leu Gly Ile Leu Pro Asn Lys Ala Val Val Gly
    850                 855                 860

Gly Lys Asp Lys Gln Gly Ile Ile Lys Asp Trp Leu Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Leu
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Leu Val Tyr Phe Lys Ser Phe
            900                 905                 910

Lys Ser Ser Thr Ala Gly Leu Val Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Asn Leu Asn Glu Asn Gln Lys Lys Leu Phe Lys Ser Ala Asn Glu
    930                 935                 940
```

```
Lys Lys Val Val Ala Glu Gly Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960


Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Ile Thr Lys Ala Glu Ile
                965                 970                 975


Lys Glu Arg Glu Asn Phe Lys Lys Lys
            980                 985
```

<210> 341
<211> 987
<212> PRT
<213> Campylobacter jejuni

<400> 341

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15


Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30


Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45


Cys Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60


Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80


Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95


Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110


Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125
```

```
Arg Gly Tyr Asp Asp Ile Lys Asn Asn Gly Asp Glu Glu Lys Gly Glu
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Val Ser Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Gln Lys Gln Arg Lys Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Thr Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asn Asp Tyr Glu
305                 310                 315                 320
```

```
Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Gln Lys Tyr Lys
                325                 330                 335

Glu Phe Val Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525
```

```
Leu Phe Lys Glu Gln Lys Glu Phe Cys Val Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Lys Thr Pro Phe Glu
            580                 585                 590

Thr Phe Gly Asn Asp Arg Val Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Thr Leu Arg His Thr Trp Gly Phe Ser Thr Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Ala Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720
```

```
Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Thr
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Leu Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Ser Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Val Gln Gly Lys Asp Lys Lys Ser Gly Leu Ile Lys Asp Trp Ile Leu
865                 870                 875                 880

Met Asp Glu Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu
                885                 890                 895

Ile Leu Ile Gln Thr Lys Asp Met Gln Glu Pro Glu Leu Val Tyr Tyr
            900                 905                 910

Glu Arg Leu Asp Ser Ser Asn Ala Ser Leu Thr Val Ser Lys His Asp
        915                 920                 925
```

```
Asn Lys Phe Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn
    930                 935                 940

Ala Asn Glu Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu
945                 950                 955                 960

Lys Val Phe Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys
                965                 970                 975

Ala Glu Phe Arg Gln Arg Glu Asp Phe Lys Lys
            980                 985
```

<210> 342
<211> 987
<212> PRT
<213> Campylobacter jejuni

<400> 342

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Gly Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
```

```
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Asn Gly Asp Glu Glu Lys Ser Glu
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Val Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Gln Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Thr Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300
```

```
Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asn Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Tyr Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
```

```
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700
```

```
Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Val Gln Gly Lys Asp Lys Lys Ser Gly Leu Ile Lys Asp Trp Ile Leu
865                 870                 875                 880

Met Asp Glu Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu
                885                 890                 895

Ile Leu Ile Gln Thr Lys Asp Met Gln Glu Pro Glu Leu Val Tyr Phe
```

```
            900                 905                 910

Asn Ala Phe Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp
        915                 920                 925

Asn Lys Phe Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn
    930                 935                 940

Ala Asn Glu Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu
945                 950                 955                 960

Lys Val Phe Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys
                965                 970                 975

Ala Glu Phe Arg Gln Arg Glu Asp Phe Lys Lys
            980                 985
```

<210> 343
<211> 961
<212> PRT
<213> Campylobacter jejuni

<400> 343

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80
```

```
Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Asn Gly Asp Glu Glu Lys Gly Lys
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Val Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Thr Gln Ser Phe Leu Lys Tyr Glu Leu Lys Leu Ile Phe
        195                 200                 205

Gln Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Ser Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285
```

```
Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Gly Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480
```

```
Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Leu Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Lys Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Asn Val Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Glu Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Lys Gly Ser Lys
            660                 665                 670

Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser Ala Leu Arg His
        675                 680                 685
```

```
Thr Trp Gly Phe Ser Thr Lys Asp Arg Asn Asn His Leu His His Ala
    690                 695                 700

Ile Asp Ala Ala Ile Ile Ala Tyr Ala Asn Asn Ser Ile Val Lys Asp
705                 710                 715                 720

Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser Ala Glu Leu Tyr
                725                 730                 735

Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys Arg Lys Phe Phe
            740                 745                 750

Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp Lys Ile Asp Glu
        755                 760                 765

Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser Gly Ala Leu His
    770                 775                 780

Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln Ser Tyr Gly Gly
785                 790                 795                 800

Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys Ile Arg Lys Val
                805                 810                 815

Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg Val Asp Ile Phe
            820                 825                 830

Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro Ile Tyr Thr Met
        835                 840                 845

Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val Ala Arg Ser Lys
    850                 855                 860

Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu Asn Tyr Glu Phe
865                 870                 875                 880
```

```
Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile Gln Thr Lys Asp
                885                 890                 895

Met Gln Glu Pro Glu Leu Val Tyr Phe Asn Ala Phe Thr Ser Ser Thr
            900                 905                 910

Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe Glu Thr Leu Ser
        915                 920                 925

Lys Asn Leu Lys Val Phe Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu
    930                 935                 940

Val Thr Lys Ala Glu Phe Arg Gln Arg Glu Asp Phe Lys Asn Glu Leu
945                 950                 955                 960

Arg
```

<210> 344
<211> 984
<212> PRT
<213> Campylobacter jejuni

<400> 344

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80
```

```
Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Asn Gly Asp Glu Glu Lys Gly Lys
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Val Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Thr Gln Ser Phe Leu Lys Tyr Glu Leu Lys Leu Ile Phe
        195                 200                 205

Gln Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Ile Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
```

```
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Ile Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480
```

```
Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
               485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Ile Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
               565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
               645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
```

```
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880
```

```
Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895


Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910


Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925


Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940


Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960


Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975


Arg Gln Arg Glu Asp Phe Lys Lys
            980
```

<210> 345
<211> 987
<212> PRT
<213> Campylobacter jejuni

<400> 345

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15


Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30


Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45


Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60
```

```
Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Asn Gly Asp Glu Glu Lys Gly Lys
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Val Ser Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Gln Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Leu Leu Met Lys Lys Glu Arg Gln
                245                 250                 255
```

```
Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Thr Leu Leu Asn Glu Ala Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asn Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Gln Lys Tyr Lys
                325                 330                 335

Glu Phe Val Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460
```

```
Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480


Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495


Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510


Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525


Leu Phe Lys Glu Gln Lys Glu Phe Cys Val Tyr Ser Gly Glu Lys Ile
    530                 535                 540


Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560


Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575


Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Lys Thr Pro Phe Glu
            580                 585                 590


Thr Phe Gly Asn Asp Arg Val Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605


Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620


Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640


Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655
```

```
Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Thr Leu Arg His Thr Trp Gly Phe Ser Thr Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Ala Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Thr
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Leu Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Met Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860
```

```
Val Gln Gly Lys Asp Lys Lys Ser Gly Leu Ile Lys Asp Trp Ile Leu
865                 870                 875                 880


Met Asp Glu Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu
                885                 890                 895


Ile Leu Ile Gln Thr Lys Asp Met Gln Glu Pro Glu Leu Val Tyr Tyr
            900                 905                 910


Glu Arg Leu Asp Ser Ser Asn Ala Ser Leu Thr Val Ser Lys His Asp
        915                 920                 925


Asn Lys Phe Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn
    930                 935                 940


Ala Asn Glu Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu
945                 950                 955                 960


Lys Val Phe Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys
                965                 970                 975


Ala Glu Phe Arg Gln Arg Glu Asp Phe Lys Lys
            980                 985


<210>  346
<211>  987
<212>  PRT
<213>  Campylobacter jejuni

<400>  346

Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15


Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30


Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
```

```
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Asn Gly Asp Glu Glu Lys Ser Glu
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Val Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Gln Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240
```

```
His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
               245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Thr Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
               325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asn Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
               405                 410                 415

Ala Tyr Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
```

```
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640
```

```
Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Pro Val Pro
```

```
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Val Gln Gly Lys Asp Lys Lys Ser Gly Leu Ile Lys Asp Trp Ile Leu
865                 870                 875                 880

Met Asp Glu Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu
                885                 890                 895

Ile Leu Ile Gln Thr Lys Asp Met Gln Glu Pro Glu Leu Val Tyr Phe
            900                 905                 910

Asn Ala Phe Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp
        915                 920                 925

Asn Lys Phe Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn
    930                 935                 940

Ala Asn Glu Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu
945                 950                 955                 960

Lys Val Phe Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys
                965                 970                 975

Ala Glu Phe Arg Gln Arg Glu Asp Phe Lys Lys
            980                 985


<210>  347
<211>  987
<212>  PRT
<213>  Campylobacter jejuni

<400>  347

Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15
```

```
Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Asn Gly Asp Glu Glu Lys Ser Glu
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Val Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Gln Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220
```

```
Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Thr Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asn Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415
```

```
Ala Tyr Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620
```

```
Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe His Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815
```

```
Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Val Gln Gly Lys Asp Lys Lys Ser Gly Leu Ile Lys Asp Trp Ile Leu
865                 870                 875                 880

Met Asp Glu Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu
                885                 890                 895

Ile Leu Ile Gln Thr Lys Asp Met Gln Glu Pro Glu Leu Val Tyr Phe
            900                 905                 910

Asn Ala Phe Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp
        915                 920                 925

Asn Lys Phe Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn
    930                 935                 940

Ala Asn Glu Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu
945                 950                 955                 960

Lys Val Phe Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys
                965                 970                 975

Ala Glu Phe Arg Gln Arg Glu Asp Phe Lys Lys
            980                 985
```

<210> 348
<211> 987
<212> PRT
<213> Campylobacter jejuni

<400> 348

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                  10                  15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Asn Gly Asp Glu Glu Lys Ser Glu
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Val Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
```

```
        195                 200                 205

Gln Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Thr Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asn Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400
```

```
Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
               405                 410                 415

Ala Tyr Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
               485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
               565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
```

```
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800
```

```
Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Val Gln Gly Lys Asp Lys Lys Ser Gly Leu Ile Lys Asp Trp Ile Leu
865                 870                 875                 880

Met Asp Glu Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu
                885                 890                 895

Ile Leu Ile Gln Thr Lys Asp Met Gln Glu Pro Glu Leu Val Tyr Phe
            900                 905                 910

Asn Ala Phe Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp
        915                 920                 925

Asn Lys Phe Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn
    930                 935                 940

Ala Asn Glu Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu
945                 950                 955                 960

Lys Val Phe Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys
                965                 970                 975

Ala Glu Phe Arg Gln Arg Glu Asp Phe Lys Lys
            980                 985
```

<210> 349

<211> 861
<212> PRT
<213> Campylobacter jejuni

<400> 349

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15


Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30


Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45


Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60


Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80


Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95


Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110


Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125


Arg Gly Tyr Asp Asp Ile Lys Asn Asn Gly Asp Glu Glu Lys Ser Glu
    130                 135                 140


Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Val Asn Tyr Gln
145                 150                 155                 160


Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175
```

```
Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Thr Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Gln Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Ile Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380
```

```
Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400


Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415


Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430


Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445


Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Ile Leu Asn
    450                 455                 460


Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480


Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495


Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Ile Glu Cys
            500                 505                 510


Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525


Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540


Lys Leu Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560


Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575
```

```
Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Lys Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Thr Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Glu Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Ala Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Val Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780
```

```
Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800


Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815


Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830


Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Leu Cys Cys Ala
        835                 840                 845


Asn Leu Tyr Tyr Gly Phe Cys Phe Lys Ser Ile Thr Lys
    850                 855                 860


<210>  350
<211>  462
<212>  PRT
<213>  Campylobacter jejuni

<400>  350

Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15


Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30


Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45


Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60


Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80


Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
```

```
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Asn Gly Asp Glu Glu Lys Ser Glu
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Val Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Thr Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Gln Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Ile Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285
```

```
Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Ser
    450                 455                 460
```

<210> 351
<211> 984
<212> PRT
<213> Campylobacter jejuni

<400> 351

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Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15


Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30


Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45


Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60


Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80


Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95


Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110


Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125


Arg Gly Tyr Asp Asp Ile Lys Asn Asn Gly Asp Glu Glu Lys Ser Glu
    130                 135                 140


Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Val Asn Tyr Gln
145                 150                 155                 160


Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175


Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190
```

```
Arg Cys Ile Thr Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Gln Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Asp Glu His Ser Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400
```

```
Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
               405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Ile Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
               485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Ile Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
               565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Lys Thr Pro Phe Glu
            580                 585                 590
```

```
Ala Phe Gly Asn Asp Gly Val Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Glu Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Thr Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Ala Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800
```

```
Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
               805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
               885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Leu Val Tyr Phe Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Val Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
               965                 970                 975

Arg Gln Arg Glu Asp Phe Lys Lys
            980
```

<210> 352
<211> 984
<212> PRT
<213> Campylobacter jejuni

<400> 352

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15


Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30


Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45


Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60


Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80


Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95


Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110


Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125


Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
    130                 135                 140


Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145                 150                 155                 160


Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175
```

```
Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Asp His Ser Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
```

```
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn Tyr Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575
```

```
Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
```

```
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975
```

Arg Gln Arg Glu Asp Phe Lys Lys
980

<210> 353
<211> 984
<212> PRT
<213> Campylobacter jejuni

<400> 353

Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1 5 10 15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
20 25 30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
35 40 45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
50 55 60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65 70 75 80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
85 90 95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
100 105 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
115 120 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
130 135 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145 150 155 160

```
Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Thr Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350
```

```
Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn Tyr Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560
```

```
Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Lys Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Thr Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Glu Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Leu Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750
```

```
Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960
```

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
965 970 975

Arg Gln Arg Glu Asp Phe Lys Lys
980

<210> 354
<211> 984
<212> PRT
<213> Campylobacter jejuni

<400> 354

Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1 5 10 15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
20 25 30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
35 40 45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
50 55 60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65 70 75 80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
85 90 95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
100 105 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
115 120 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala

```
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335
```

```
Glu Phe Ile Lys Ala Leu Gly Asp His Ser Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn Tyr Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
```

```
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asn Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Thr Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735
```

```
Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
```

```
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975

Arg Gln Arg Glu Asp Phe Lys Lys
            980
```

<210> 355
<211> 984
<212> PRT
<213> Campylobacter jejuni

<400> 355

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110
```

```
Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Thr Phe Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320
```

```
Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
               325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Asp His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
               405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
               485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510
```

```
Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Lys Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Thr Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720
```

```
Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910
```

```
Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975

Arg Gln Arg Glu Asp Phe Lys Lys
            980
```

<210> 356
<211> 987
<212> PRT
<213> Campylobacter jejuni

<400> 356

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95
```

```
Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Thr Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
```

```
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ser Leu Gly Asp His Ser Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495
```

```
Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asn Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
```

```
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895
```

```
Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975

Arg Gln Arg Glu Asp Phe Lys Asn Glu Leu Arg
            980                 985
```

<210> 357
<211> 987
<212> PRT
<213> Campylobacter jejuni

<400> 357

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80
```

```
Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270
```

```
Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Asp His Ser Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Val Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480
```

```
Ala Arg Glu Val Gly Lys Asn Tyr Ser Gln Arg Ala Lys Ile Glu Lys
               485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
               565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
               645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670
```

```
Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880
```

```
Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895


Gln Thr Lys Asp Met Gln Glu Pro Glu Leu Val Tyr Phe Asn Ala Phe
            900                 905                 910


Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925


Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940


Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960


Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975


Arg Gln Arg Glu Asp Phe Lys Asn Glu Leu Arg
            980                 985


<210>  358
<211>  983
<212>  PRT
<213>  Campylobacter jejuni

<400>  358

Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15


Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30


Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45


Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
```

```
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255
```

```
Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Val Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
```

```
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asn Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655
```

```
Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Phe Tyr Gln Ser
785                 790                 795                 800

Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys Ile
                805                 810                 815

Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg Val
            820                 825                 830

Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro Ile
        835                 840                 845

Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val Ala
```

```
    850                 855                 860

Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu Asn
865                 870                 875                 880

Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile Gln
                885                 890                 895

Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe Thr
            900                 905                 910

Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe Glu
        915                 920                 925

Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu Lys
    930                 935                 940

Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe Glu
945                 950                 955                 960

Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe Arg
                965                 970                 975

Gln Arg Glu Asp Phe Lys Lys
            980


<210>  359
<211>  987
<212>  PRT
<213>  Campylobacter jejuni

<400>  359

Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30
```

```
Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Val Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240
```

```
His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
               245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
               325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Asp His Ser Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
               405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430
```

```
Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn Tyr Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640
```

```
Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830
```

```
Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Glu Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Leu Val Tyr Phe Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975

Arg Gln Arg Glu Asp Phe Lys Asn Glu Leu Arg
            980                 985
```

<210> 360
<211> 987
<212> PRT
<213> Campylobacter jejuni

<400> 360

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15
```

```
Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asn Ile Lys Asn Ser Asp Asn Glu Glu Lys Ser Glu
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Val Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Ile Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Gln Lys Gln Arg Glu Phe Gly Leu Ser Phe Ser Lys Lys Phe Glu Glu
```

```
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Thr Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Asp His Ser Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415
```

```
Ala Cys Asn Glu Leu Asn Leu Lys Val Val Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Asn Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Leu Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Lys Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Thr Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
```

```
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Ile Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Thr Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815
```

```
Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Val Gln Gly Lys Asp Lys Lys Ser Gly Leu Ile Lys Asp Trp Ile Leu
865                 870                 875                 880

Met Asp Glu Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu
                885                 890                 895

Ile Leu Ile Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr
            900                 905                 910

Asn Ala Phe Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp
        915                 920                 925

Asn Lys Phe Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn
    930                 935                 940

Ala Asn Glu Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu
945                 950                 955                 960

Lys Val Phe Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys
                965                 970                 975

Ala Glu Phe Arg Gln Arg Glu Asp Phe Lys Lys
            980                 985
```

<210> 361
<211> 984
<212> PRT
<213> Campylobacter jejuni

<400> 361

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                  10                  15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Val Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190
```

```
Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Thr Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Asp His Ser Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400
```

```
Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Phe Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Lys Thr Pro Phe Glu
            580                 585                 590
```

```
Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Thr Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800
```

```
Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
               805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975

Arg Gln Arg Glu Asp Phe Lys Lys
            980
```

<210> 362
<211> 984
<212> PRT
<213> Campylobacter jejuni

<400> 362

Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1 5 10 15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
20 25 30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
35 40 45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
50 55 60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65 70 75 80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
85 90 95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
100 105 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Val Lys Arg
115 120 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Thr
130 135 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145 150 155 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
165 170 175

```
Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Thr Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
```

```
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn Tyr Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575
```

```
Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
```

```
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975
```

Arg Gln Arg Glu Asp Phe Lys Lys
980

<210> 363
<211> 987
<212> PRT
<213> Campylobacter jejuni

<400> 363

Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1 5 10 15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
20 25 30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
35 40 45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
50 55 60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65 70 75 80

Glu Asp Tyr Gln Ser Phe Asn Glu Ser Leu Ala Lys Ala Tyr Lys Gly
85 90 95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
100 105 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
115 120 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
130 135 140

Ile Leu Lys Val Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145 150 155 160

```
Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Gln Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Asp His Ser Leu Ser Gln Asp Asp Leu
            340                 345                 350
```

```
Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn Tyr Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560
```

```
Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750
```

```
Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Leu Val Tyr Phe Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960
```

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
965 970 975

Arg Gln Arg Glu Asp Phe Lys Asn Glu Leu Arg
980 985

<210> 364
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<212> PRT
<213> Campylobacter jejuni

<400> 364

Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1 5 10 15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
20 25 30

Thr Lys Ala Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
35 40 45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
50 55 60

Leu Asn Arg Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65 70 75 80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
85 90 95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
100 105 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
115 120 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala

```
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335
```

```
Glu Phe Ile Lys Ala Leu Gly Asp His Ser Leu Asn Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn Tyr Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Val Tyr Ser Gly Glu Lys Ile
```

```
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val Tyr Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Thr Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735
```

```
Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
```

```
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975

Arg Gln Arg Glu Asp Phe Lys Lys
            980
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<210> 365
<211> 984
<212> PRT
<213> Campylobacter jejuni

<400> 365

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Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30

Thr Lys Val Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110
```

```
Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Leu Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320
```

```
Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
               325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
               405                 410                 415

Ala Tyr Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
               485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510
```

```
Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720
```

```
Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Leu Val Tyr Phe Asn Ala Phe
            900                 905                 910
```

```
Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975

Arg Gln Arg Glu Asp Phe Lys Lys
            980
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<210> 366
<211> 984
<212> PRT
<213> Campylobacter jejuni

<400> 366

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Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30

Thr Lys Val Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95
```

```
Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
```

```
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495
```

```
Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Lys Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asn Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Thr Lys Asp Arg Asn Asn His
```

```
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895
```

```
Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975

Arg Gln Arg Glu Asp Phe Lys Lys
            980
```

<210> 367
<211> 984
<212> PRT
<213> Campylobacter jejuni

<400> 367

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30

Thr Lys Val Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80
```

```
Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270
```

```
Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480
```

```
Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Lys Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670
```

```
Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Thr Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880
```

```
Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895


Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910


Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925


Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940


Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960


Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975


Arg Gln Arg Glu Asp Phe Lys Lys
            980
```

<210> 368
<211> 984
<212> PRT
<213> Campylobacter jejuni

<400> 368

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15


Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30


Thr Lys Val Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45


Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
```

```
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255
```

```
Lys Asn Ser Pro Leu Ala Phe Met Phe Val Thr Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
```

```
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Lys Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655
```

```
Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Thr Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
```

```
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975

Arg Gln Arg Glu Asp Phe Lys Lys
            980


<210>  369
<211>  984
<212>  PRT
<213>  Campylobacter jejuni

<400>  369

Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30
```

```
Thr Lys Val Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240
```

```
His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430
```

```
Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Lys Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640
```

```
Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Thr Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830
```

```
Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975

Ile Gln Arg Glu Asp Phe Lys Lys
            980
```

<210> 370
<211> 987
<212> PRT
<213> Campylobacter jejuni

<400> 370

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15
```

```
Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30

Thr Lys Val Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
```

```
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Val Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415
```

```
Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Gln Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
```

```
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asn Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Ala Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815
```

```
Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Gly Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975

Arg Gln Arg Glu Asp Phe Lys Asn Glu Leu Arg
            980                 985
```

<210> 371
<211> 984
<212> PRT
<213> Campylobacter jejuni

<400> 371

```
Met Ala Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                  10                  15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30

Thr Lys Val Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Val Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190
```

```
Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270

Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400
```

```
Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
               405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
               485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
               565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Lys Thr Pro Phe Glu
            580                 585                 590
```

```
Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670

Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Thr Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800
```

```
Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
               805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
865                 870                 875                 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
                885                 890                 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
            900                 905                 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
        915                 920                 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
    930                 935                 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945                 950                 955                 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
                965                 970                 975

Arg Gln Arg Glu Asp Phe Lys Lys
            980
```

<210> 372
<211> 721
<212> PRT
<213> Campylobacter jejuni

<400> 372

Met Phe Val Ala Leu Thr Arg Ile Ile Asn Leu Leu Asn Asn Leu Lys
1 5 10 15

Asn Thr Glu Gly Ile Leu Tyr Thr Lys Asp Asp Leu Asn Thr Leu Leu
20 25 30

Asn Glu Val Leu Lys Asn Gly Thr Leu Thr Tyr Lys Gln Thr Lys Lys
35 40 45

Leu Leu Gly Leu Ser Asp Asp Tyr Glu Phe Lys Gly Glu Lys Gly Thr
50 55 60

Tyr Phe Ile Glu Phe Lys Lys Tyr Lys Glu Phe Ile Lys Ala Leu Gly
65 70 75 80

Asp His Ser Leu Ser Gln Asp Asp Leu Asn Glu Ile Ala Lys Asp Ile
85 90 95

Thr Leu Ile Lys Asp Glu Ile Lys Leu Lys Lys Ala Leu Ala Lys Tyr
100 105 110

Asp Leu Asn Gln Asn Gln Ile Asp Ser Leu Ser Lys Leu Glu Phe Lys
115 120 125

Asp His Leu Asn Ile Ser Phe Lys Ala Leu Lys Leu Ile Thr Pro Leu
130 135 140

Met Leu Glu Gly Lys Lys Tyr Asp Glu Ala Cys Asn Glu Leu Asn Leu
145 150 155 160

Lys Val Ala Ile Asn Glu Asp Lys Lys Asp Phe Leu Pro Ala Phe Asn
165 170 175

```
Glu Thr Tyr Tyr Lys Asp Glu Val Thr Asn Pro Val Val Leu Arg Ala
            180                 185                 190

Ile Lys Glu Tyr Arg Lys Val Leu Asn Ala Leu Leu Lys Lys Tyr Gly
        195                 200                 205

Lys Val His Lys Ile Asn Ile Glu Leu Ala Arg Glu Val Gly Lys Asn
    210                 215                 220

Tyr Ser Gln Arg Ala Lys Ile Glu Lys Glu Gln Asn Glu Asn Tyr Lys
225                 230                 235                 240

Ala Lys Lys Asp Ala Glu Leu Glu Cys Glu Lys Leu Gly Leu Lys Ile
                245                 250                 255

Asn Ser Lys Asn Ile Leu Lys Leu Arg Leu Phe Lys Glu Gln Lys Glu
            260                 265                 270

Phe Cys Ala Tyr Ser Gly Glu Lys Ile Lys Ile Ser Asp Leu Gln Asp
        275                 280                 285

Glu Lys Met Leu Glu Ile Asp His Ile Tyr Pro Tyr Ser Arg Ser Phe
    290                 295                 300

Asp Asp Ser Tyr Met Asn Lys Val Leu Val Phe Thr Lys Gln Asn Gln
305                 310                 315                 320

Glu Lys Leu Asn Gln Thr Pro Phe Glu Ala Phe Gly Asn Asp Ser Ala
                325                 330                 335

Lys Trp Gln Lys Ile Glu Val Leu Ala Lys Asn Leu Pro Thr Lys Lys
            340                 345                 350

Gln Lys Arg Ile Leu Asp Lys Asn Tyr Lys Asp Lys Glu Gln Lys Asp
        355                 360                 365

Phe Lys Asp Arg Asn Leu Asn Asp Thr Arg Tyr Ile Ala Arg Leu Val
```

```
    370                 375                 380

Leu Asn Tyr Thr Lys Asp Tyr Leu Asp Phe Leu Pro Leu Ser Asp Asp
385                 390                 395                 400

Glu Asn Thr Lys Leu Asn Asn Thr Gln Lys Gly Ser Lys Val Tyr Val
                405                 410                 415

Glu Ala Lys Ser Gly Met Leu Thr Ser Ala Leu Arg His Thr Trp Gly
            420                 425                 430

Phe Ser Thr Lys Asp Arg Asn Asn His Leu His His Ala Ile Asp Ala
        435                 440                 445

Val Ile Ile Ala Tyr Ala Asn Asn Ser Ile Val Lys Ala Phe Ser Asp
    450                 455                 460

Phe Lys Lys Glu Gln Glu Ser Asn Ser Ala Glu Leu Tyr Ala Lys Lys
465                 470                 475                 480

Ile Ser Glu Leu Asp Tyr Lys Asn Lys Arg Lys Phe Phe Glu Pro Phe
                485                 490                 495

Ser Gly Phe Arg Gln Lys Val Leu Asp Lys Ile Asp Glu Ile Phe Val
            500                 505                 510

Ser Lys Pro Glu Arg Lys Lys Pro Ser Gly Ala Leu His Glu Glu Thr
        515                 520                 525

Phe Arg Lys Glu Glu Glu Phe Tyr Gln Ser Tyr Gly Gly Lys Glu Gly
    530                 535                 540

Val Leu Lys Ala Leu Glu Leu Gly Lys Ile Arg Lys Val Asn Gly Lys
545                 550                 555                 560

Ile Val Lys Asn Gly Asp Met Phe Arg Val Asp Ile Phe Lys His Lys
                565                 570                 575
```

```
Lys Thr Asn Lys Phe Tyr Ala Val Pro Ile Tyr Thr Met Asp Phe Ala
            580                 585                 590

Leu Lys Val Leu Pro Asn Lys Ala Val Ala Arg Ser Lys Lys Gly Glu
        595                 600                 605

Ile Lys Asp Trp Ile Leu Met Asp Glu Asn Tyr Glu Phe Cys Phe Ser
    610                 615                 620

Leu Tyr Lys Asp Ser Leu Ile Leu Ile Gln Thr Lys Asp Met Gln Glu
625                 630                 635                 640

Pro Glu Phe Val Tyr Tyr Asn Ala Phe Thr Ser Ser Thr Val Ser Leu
                645                 650                 655

Ile Val Ser Lys His Asp Asn Lys Phe Glu Thr Leu Ser Lys Asn Gln
            660                 665                 670

Lys Ile Leu Phe Lys Asn Ala Asn Glu Lys Glu Val Ile Ala Lys Ser
        675                 680                 685

Ile Gly Ile Gln Asn Leu Lys Val Phe Glu Lys Tyr Ile Val Ser Ala
    690                 695                 700

Leu Gly Glu Val Thr Lys Ala Glu Phe Arg Gln Arg Glu Asp Phe Lys
705                 710                 715                 720

Lys
```

<210> 373
<211> 512
<212> PRT
<213> Campylobacter jejuni

<400> 373

```
Met His Lys Ile Asn Ile Glu Leu Ala Arg Glu Val Gly Lys Asn His
1               5                   10                  15
```

```
Ser Gln Arg Ala Lys Ile Glu Lys Glu Gln Asn Glu Asn Tyr Lys Ala
            20                  25                  30

Lys Lys Asp Ala Glu Ile Glu Cys Glu Lys Leu Gly Leu Lys Ile Asn
        35                  40                  45

Ser Lys Asn Ile Leu Lys Leu Arg Leu Phe Lys Glu Gln Lys Glu Phe
    50                  55                  60

Cys Ala Tyr Ser Gly Glu Lys Ile Lys Leu Ser Asp Leu Gln Asp Glu
65                  70                  75                  80

Lys Met Leu Glu Ile Asp His Ile Tyr Pro Tyr Ser Arg Ser Phe Asp
                85                  90                  95

Asp Ser Tyr Met Asn Lys Val Leu Val Phe Thr Lys Gln Asn Gln Glu
            100                 105                 110

Lys Leu Asn Lys Thr Pro Phe Glu Ala Phe Gly Asn Asp Ser Thr Lys
        115                 120                 125

Trp Gln Lys Ile Glu Val Leu Ala Lys Asn Leu Pro Glu Lys Lys Gln
    130                 135                 140

Lys Arg Ile Leu Asp Lys Asn Tyr Lys Asp Lys Glu Gln Lys Asp Phe
145                 150                 155                 160

Lys Asp Arg Asn Leu Asn Asp Thr Arg Tyr Ile Ala Arg Leu Val Leu
                165                 170                 175

Asn Tyr Thr Lys Asp Tyr Leu Asp Phe Leu Pro Leu Ser Asp Asp Glu
            180                 185                 190

Asn Thr Lys Leu Asn Asp Thr Gln Lys Gly Ser Lys Val His Val Glu
        195                 200                 205
```

```
Ala Lys Ser Gly Met Leu Thr Ser Ala Leu Arg His Thr Trp Gly Phe
    210                 215                 220

Ser Ala Lys Asp Arg Asn Asn His Leu His His Ala Ile Asp Ala Ala
225                 230                 235                 240

Ile Ile Ala Tyr Ala Asn Asn Ser Ile Val Lys Ala Phe Ser Asp Phe
                245                 250                 255

Lys Lys Glu Gln Glu Ser Asn Ser Val Glu Leu Tyr Ala Lys Lys Ile
            260                 265                 270

Ser Glu Leu Asp Tyr Lys Asn Lys Arg Lys Phe Phe Glu Pro Phe Ser
        275                 280                 285

Gly Phe Arg Gln Lys Val Leu Asp Lys Ile Asp Glu Ile Phe Val Ser
    290                 295                 300

Lys Pro Glu Arg Lys Lys Pro Ser Gly Ala Leu His Glu Glu Thr Phe
305                 310                 315                 320

Arg Lys Glu Glu Glu Phe Tyr Gln Ser Tyr Gly Gly Lys Glu Gly Val
                325                 330                 335

Leu Lys Ala Leu Glu Leu Gly Lys Ile Arg Lys Val Asn Gly Lys Ile
            340                 345                 350

Val Lys Asn Gly Asp Met Phe Arg Val Asp Ile Phe Lys His Lys Lys
        355                 360                 365

Thr Asn Lys Phe Tyr Ala Val Pro Ile Tyr Thr Met Asp Phe Ala Leu
    370                 375                 380

Lys Val Leu Pro Asn Lys Ala Val Ala Arg Ser Lys Lys Gly Glu Ile
385                 390                 395                 400

Lys Asp Trp Ile Leu Met Asp Glu Asn Tyr Glu Phe Cys Phe Ser Leu
                405                 410                 415
```

```
Tyr Lys Asp Ser Leu Ile Leu Ile Gln Thr Lys Asp Met Gln Glu Pro
            420                 425                 430

Glu Leu Val Tyr Phe Asn Ala Phe Thr Ser Ser Thr Val Ser Leu Ile
        435                 440                 445

Val Ser Lys His Asp Asn Lys Phe Glu Thr Leu Ser Lys Asn Gln Lys
    450                 455                 460

Ile Leu Phe Lys Asn Ala Asn Glu Lys Glu Val Ile Ala Lys Ser Ile
465                 470                 475                 480

Gly Ile Gln Asn Leu Lys Val Phe Glu Lys Tyr Ile Val Ser Ala Leu
                485                 490                 495

Gly Glu Val Thr Lys Ala Glu Phe Arg Gln Arg Glu Asp Phe Lys Lys
            500                 505                 510
```

<210> 374
<211> 965
<212> PRT
<213> Campylobacter jejuni

<400> 374

```
Met Lys Ile Ile Gly Phe Asn Leu Gly Ile Ala Asn Ile Gly Trp Ala
1               5                   10                  15

Leu Arg Glu Asn Asp Glu Ile Ile Asp Cys Gly Val Arg Val Phe Asp
            20                  25                  30

Ile Pro Glu Asn Pro Lys Asn Gly Asn Ser Leu Ala Leu Glu Arg Arg
        35                  40                  45

Glu Asn Lys Ala Arg Met Lys Ile Val Lys Arg Lys Lys Ala Arg Met
    50                  55                  60

Leu Ala Thr Lys Thr Phe Leu Lys Lys Glu Leu Asn Val Asp Leu Ser
```

```
65                  70                  75                  80

Lys Leu Phe Leu Ile Gly Ser Thr Gln Ser Ile Tyr Glu Leu Arg Ala
                85                  90                  95

Lys Ala Leu Ser Ser Leu Ile Ser Lys Glu Glu Leu Ser Ala Ile Ile
            100                 105                 110

Leu His Ile Ala Lys His Arg Gly Tyr Asp Asp Ser Ala Leu Lys Asn
        115                 120                 125

Glu Asn Gly Thr Ile Ile Glu Ala Leu Asn Lys Asn Lys Glu Thr Met
    130                 135                 140

Leu Lys Phe Lys Ser Val Gly Glu Tyr Phe Tyr Lys Asn Phe Val Gln
145                 150                 155                 160

Asn Lys Glu Val Lys Lys Ile Arg Asn Thr Thr Glu Asp Tyr Ser Asn
                165                 170                 175

Ser Val Pro Arg Ser Leu Leu Lys Gln Glu Leu Asp Leu Ile Leu Asp
            180                 185                 190

Lys Gln Lys Glu Leu Gly Leu Ile Lys Asn Ala Asp Phe Lys Glu Lys
        195                 200                 205

Leu Phe Glu Ile Ile Phe Phe Lys Arg Pro Leu Lys Asp Phe Ser Asn
    210                 215                 220

Lys Ile Gly Asn Cys Ile Phe Phe Glu Asn Glu Lys Arg Ala Ala Lys
225                 230                 235                 240

Asn Thr Ile Ser Ala Cys Glu Phe Val Ala Leu Gly Lys Val Val Asn
                245                 250                 255

Leu Leu Lys Ser Ile Glu Lys Asp Ile Gly Ile Val Tyr Glu Lys Asp
            260                 265                 270
```

```
Ser Ile Asn Glu Ile Met Ser Ile Ile Leu Asp Lys Thr Ser Ile Ser
        275                 280                 285

Tyr Lys Lys Ile Arg Asp Ile Leu Asn Leu Pro Gln Glu Ile Asn Phe
    290                 295                 300

Lys Gly Leu Asp Tyr Ser Lys Asn Asn Val Glu Asn Ser Lys Leu Val
305                 310                 315                 320

Asp Leu Lys Lys Leu Asn Glu Phe Lys Lys Ala Leu Gly Asp Gly Phe
                325                 330                 335

Ala Asn Leu Asp Lys Asp Ile Leu Asp Ser Ile Ala Thr Asp Ile Thr
            340                 345                 350

Leu Thr Lys Asp Thr Ala Thr Leu Lys Glu Lys Leu Lys Asn Tyr Asn
        355                 360                 365

Val Leu Asn Ala Glu Gln Ile Glu Lys Leu Ser Glu Leu Val Phe Asn
    370                 375                 380

Asp His Ile Asn Leu Ser Leu Lys Ala Leu Lys Gln Ile Ile Pro Leu
385                 390                 395                 400

Met Tyr Glu Gly Lys Arg Tyr Asp Glu Ala Cys Glu Leu Cys Asn Phe
                405                 410                 415

Thr Ile Ala Lys Asn Gln Glu Lys Ser Glu Tyr Leu Pro Leu Phe Glu
            420                 425                 430

Lys Thr Arg Phe Ala Lys Asp Ile Ser Ser Pro Val Val Ile Arg Ala
        435                 440                 445

Ile Cys Glu Phe Arg Lys Leu Leu Asn Asp Ile Ile Arg Arg Tyr Gly
    450                 455                 460

Ser Val His Lys Ile His Leu Glu Leu Thr Arg Asp Phe Gly Ile Ser
```

```
465                 470                 475                 480

Phe Ser Asp Arg Lys Lys Ile Ile Lys Glu Ile Glu Gln Asn Glu Gln
                485                 490                 495

Ser Arg Ile Lys Ala Leu Glu Thr Ile Lys Glu Leu Lys Leu Glu Glu
            500                 505                 510

Thr Ser Lys Asn Ile Gln Ile Val Arg Leu Phe Glu Asp Gln Lys Gly
        515                 520                 525

Ile Cys Pro Tyr Ser Gly Leu Lys Met Asp Leu Asn Arg Leu Asp Glu
    530                 535                 540

Leu Val Ile Asp Tyr Ile Arg Pro Tyr Asn Arg Ser Leu Asp Asp Ser
545                 550                 555                 560

Tyr Ser Asn Lys Val Leu Thr Phe Lys Lys Leu Ser Asp Leu Lys Gln
                565                 570                 575

Gly Lys Thr Pro Phe Glu Ala Phe Gly Glu Asp Glu Lys Leu Trp Ala
            580                 585                 590

Glu Ile Asn Glu Arg Ile Lys Glu Tyr Asn Gly Lys Lys Arg Phe Lys
        595                 600                 605

Ile Phe Asp Lys Phe Phe Lys Asp Lys Lys Pro Phe Asp Phe Thr Glu
    610                 615                 620

Gln Thr Leu Gln Asp Thr Arg Trp Leu Thr Lys Leu Val Ala Ser Tyr
625                 630                 635                 640

Leu Asn Glu Tyr Leu Ser Phe Leu Pro Ile Ser Glu Asp Glu Asn Thr
                645                 650                 655

Ala Leu Gly Tyr Gly Glu Lys Gly Ser Lys Gln His Val Ile Leu Ser
            660                 665                 670
```

```
Ser Gly Met Ile Thr Gln Met Leu Arg Asn Phe Trp Tyr Leu Gly Phe
        675                 680                 685

Lys Asn His Lys Asp Tyr Lys Asn Asn Ala Met Asp Ala Ile Ile Val
    690                 695                 700

Ala Phe Thr Thr Asn Ser Ile Ile Phe Ala Phe Asn Asn Phe Lys Lys
705                 710                 715                 720

Glu Leu Asp Leu Ala Lys Ala Glu Phe Tyr Ala Asn Lys Ile Ser Glu
                725                 730                 735

Ser Asp Tyr Leu Leu Lys Arg Lys Phe Leu Pro Pro Phe Ser Gly Phe
            740                 745                 750

Lys Glu Gln Ala Leu Glu Lys Val Lys Asn Ile Phe Val Ser His Ser
        755                 760                 765

Leu Lys Ile Lys Asn Lys Gly Thr Leu His Asp Leu Thr Pro Leu Lys
    770                 775                 780

Ile Lys Glu Leu Lys Asn Thr Tyr Gly Asp Leu Asp Leu Ala Val Lys
785                 790                 795                 800

Leu Gly Lys Ile Arg Lys Tyr Asn Asp Lys Tyr Tyr Ala Asn Ala Asn
                805                 810                 815

Gly Ser Leu Val Arg Ala Asp Leu Phe Val Asp Lys Lys Asn Lys Phe
            820                 825                 830

His Ala Val Ser Ile Tyr Lys Ala Asp Phe Ser Thr Lys Lys Leu Pro
        835                 840                 845

Asn Lys Thr Pro Ala Thr Thr Ser Asn Gly Glu Thr Lys Glu Gly Ile
    850                 855                 860

Glu Met Asn Glu Asn Tyr Asn Phe Cys Met Ser Leu Tyr Lys Asn Thr
```

```
865                 870                 875                 880

Pro Ile Ser Val Lys Ile Lys Gly Met Lys Glu Pro Ile Ile Cys Tyr
                885                 890                 895

Tyr His Gly Phe Asn Thr Ser Gly Ser Lys Ile Thr Tyr Lys Lys His
            900                 905                 910

Asp Asn Asn Tyr His Asn Leu Ser Glu Asp Glu Met Val Val Phe Arg
        915                 920                 925

Lys Asn Asp Lys Glu Ser Ile Ala Val Gly Lys Ile Leu Glu Ile Lys
    930                 935                 940

Lys Tyr Ser Ile Ser Pro Ser Gly Glu Leu Ser Leu Ile Glu Asn Glu
945                 950                 955                 960

Glu Arg Lys Trp Phe
                965
```

<210> 375
<211> 759
<212> PRT
<213> Campylobacter jejuni

<400> 375

```
Met Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser His
1               5                   10                  15

Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro Lys
            20                  25                  30

Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile Asn
        35                  40                  45

Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys Asp
    50                  55                  60
```

```
Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu Thr
65                  70                  75                  80

Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu Phe
                85                  90                  95

Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys Glu
            100                 105                 110

Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu Asn
        115                 120                 125

Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu Lys
    130                 135                 140

Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser Leu
145                 150                 155                 160

Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala Leu
                165                 170                 175

Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu Ala
            180                 185                 190

Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys Asp
        195                 200                 205

Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr Asn
    210                 215                 220

Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn Ala
225                 230                 235                 240

Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu Ala
                245                 250                 255

Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys Glu
            260                 265                 270
```

```
Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys Glu
        275                 280                 285

Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg Leu
    290                 295                 300

Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile Lys
305                 310                 315                 320

Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile Tyr
                325                 330                 335

Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu Val
            340                 345                 350

Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Lys Thr Pro Phe Glu Ala
        355                 360                 365

Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala Lys
    370                 375                 380

Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr Lys
385                 390                 395                 400

Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr Arg
                405                 410                 415

Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp Phe
            420                 425                 430

Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln Lys
        435                 440                 445

Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser Ala
    450                 455                 460
```

```
Leu Arg His Thr Trp Gly Phe Ser Thr Lys Asp Arg Asn Asn His Leu
465                 470                 475                 480


His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser Ile
                485                 490                 495


Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser Ala
            500                 505                 510


Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys Arg
        515                 520                 525


Lys Phe Phe Glu Ser Phe Ser Gly Phe Arg Gln Lys Val Leu Asp Lys
    530                 535                 540


Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser Gly
545                 550                 555                 560


Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln Ser
                565                 570                 575


Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys Ile
            580                 585                 590


Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg Val
        595                 600                 605


Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro Ile
    610                 615                 620


Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val Ala
625                 630                 635                 640


Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu Asn
                645                 650                 655


Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile Gln
            660                 665                 670
```

```
Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe Thr
        675                 680                 685

Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe Glu
    690                 695                 700

Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu Lys
705                 710                 715                 720

Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe Glu
                725                 730                 735

Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe Arg
            740                 745                 750

Gln Arg Glu Asp Phe Lys Lys
        755
```

<210> 376
<211> 984
<212> PRT
<213> Campylobacter jejuni

<400> 376

```
Met Val Arg Ile Leu Ala Phe Asp Ile Gly Ile Ser Ser Ile Gly Trp
1               5                   10                  15

Ala Phe Ser Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe
            20                  25                  30

Thr Lys Val Glu Asn Pro Lys Thr Gly Glu Ser Leu Ala Leu Pro Arg
        35                  40                  45

Arg Leu Ala Arg Ser Ala Arg Lys Arg Leu Ala Arg Arg Lys Ala Arg
    50                  55                  60

Leu Asn His Leu Lys His Leu Ile Ala Asn Glu Phe Lys Leu Asn Tyr
```

```
65                  70                  75                  80

Glu Asp Tyr Gln Ser Phe Asp Glu Ser Leu Ala Lys Ala Tyr Lys Gly
                85                  90                  95

Ser Leu Ile Ser Pro Tyr Glu Leu Arg Phe Arg Ala Leu Asn Glu Leu
            100                 105                 110

Leu Ser Lys Gln Asp Phe Ala Arg Val Ile Leu His Ile Ala Lys Arg
        115                 120                 125

Arg Gly Tyr Asp Asp Ile Lys Asn Ser Asp Asp Lys Glu Lys Gly Ala
    130                 135                 140

Ile Leu Lys Ala Ile Lys Gln Asn Glu Glu Lys Leu Ala Asn Tyr Gln
145                 150                 155                 160

Ser Val Gly Glu Tyr Leu Tyr Lys Glu Tyr Phe Gln Lys Phe Lys Glu
                165                 170                 175

Asn Ser Lys Glu Phe Thr Asn Val Arg Asn Lys Lys Glu Ser Tyr Glu
            180                 185                 190

Arg Cys Ile Ala Gln Ser Phe Leu Lys Asp Glu Leu Lys Leu Ile Phe
        195                 200                 205

Lys Lys Gln Arg Glu Phe Gly Phe Ser Phe Ser Lys Lys Phe Glu Glu
    210                 215                 220

Glu Val Leu Ser Val Ala Phe Tyr Lys Arg Ala Leu Lys Asp Phe Ser
225                 230                 235                 240

His Leu Val Gly Asn Cys Ser Phe Phe Thr Asp Glu Lys Arg Ala Pro
                245                 250                 255

Lys Asn Ser Pro Leu Ala Phe Met Phe Val Ala Leu Thr Arg Ile Ile
            260                 265                 270
```

```
Asn Leu Leu Asn Asn Leu Lys Asn Thr Glu Gly Ile Leu Tyr Thr Lys
        275                 280                 285

Asp Asp Leu Asn Ala Leu Leu Asn Glu Val Leu Lys Asn Gly Thr Leu
    290                 295                 300

Thr Tyr Lys Gln Thr Lys Lys Leu Leu Gly Leu Ser Asp Asp Tyr Glu
305                 310                 315                 320

Phe Lys Gly Glu Lys Gly Thr Tyr Phe Ile Glu Phe Lys Lys Tyr Lys
                325                 330                 335

Glu Phe Ile Lys Ala Leu Gly Glu His Asn Leu Ser Gln Asp Asp Leu
            340                 345                 350

Asn Glu Ile Ala Lys Asp Ile Thr Leu Ile Lys Asp Glu Ile Lys Leu
        355                 360                 365

Lys Lys Ala Leu Ala Lys Tyr Asp Leu Asn Gln Asn Gln Ile Asp Ser
    370                 375                 380

Leu Ser Lys Leu Glu Phe Lys Asp His Leu Asn Ile Ser Phe Lys Ala
385                 390                 395                 400

Leu Lys Leu Ile Thr Pro Leu Met Leu Glu Gly Lys Lys Tyr Asp Glu
                405                 410                 415

Ala Cys Asn Glu Leu Asn Leu Lys Val Ala Ile Asn Glu Asp Lys Lys
            420                 425                 430

Asp Phe Leu Pro Ala Phe Asn Glu Thr Tyr Tyr Lys Asp Glu Val Thr
        435                 440                 445

Asn Pro Val Val Leu Arg Ala Ile Lys Glu Tyr Arg Lys Val Leu Asn
    450                 455                 460

Ala Leu Leu Lys Lys Tyr Gly Lys Val His Lys Ile Asn Ile Glu Leu
```

```
465                 470                 475                 480

Ala Arg Glu Val Gly Lys Asn His Ser Gln Arg Ala Lys Ile Glu Lys
                485                 490                 495

Glu Gln Asn Glu Asn Tyr Lys Ala Lys Lys Asp Ala Glu Leu Glu Cys
            500                 505                 510

Glu Lys Leu Gly Leu Lys Ile Asn Ser Lys Asn Ile Leu Lys Leu Arg
        515                 520                 525

Leu Phe Lys Glu Gln Lys Glu Phe Cys Ala Tyr Ser Gly Glu Lys Ile
    530                 535                 540

Lys Ile Ser Asp Leu Gln Asp Glu Lys Met Leu Glu Ile Asp His Ile
545                 550                 555                 560

Tyr Pro Tyr Ser Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Val Leu
                565                 570                 575

Val Phe Thr Lys Gln Asn Gln Glu Lys Leu Asn Lys Thr Pro Phe Glu
            580                 585                 590

Ala Phe Gly Asn Asp Ser Ala Lys Trp Gln Lys Ile Glu Val Leu Ala
        595                 600                 605

Lys Asn Leu Pro Thr Lys Lys Gln Lys Arg Ile Leu Asp Lys Asn Tyr
    610                 615                 620

Lys Asp Lys Glu Gln Lys Asp Phe Lys Asp Arg Asn Leu Asn Asp Thr
625                 630                 635                 640

Arg Tyr Ile Ala Arg Leu Val Leu Asn Tyr Thr Lys Asp Tyr Leu Asp
                645                 650                 655

Phe Leu Pro Leu Ser Asp Asp Glu Asn Thr Lys Leu Asn Asp Thr Gln
            660                 665                 670
```

```
Lys Gly Ser Lys Val His Val Glu Ala Lys Ser Gly Met Leu Thr Ser
        675                 680                 685

Ala Leu Arg His Thr Trp Gly Phe Ser Thr Lys Asp Arg Asn Asn His
    690                 695                 700

Leu His His Ala Ile Asp Ala Val Ile Ile Ala Tyr Ala Asn Asn Ser
705                 710                 715                 720

Ile Val Lys Ala Phe Ser Asp Phe Lys Lys Glu Gln Glu Ser Asn Ser
                725                 730                 735

Ala Glu Leu Tyr Ala Lys Lys Ile Ser Glu Leu Asp Tyr Lys Asn Lys
            740                 745                 750

Arg Lys Phe Phe Glu Pro Phe Ser Gly Phe Arg Gln Lys Val Leu Asp
        755                 760                 765

Lys Ile Asp Glu Ile Phe Val Ser Lys Pro Glu Arg Lys Lys Pro Ser
    770                 775                 780

Gly Ala Leu His Glu Glu Thr Phe Arg Lys Glu Glu Glu Phe Tyr Gln
785                 790                 795                 800

Ser Tyr Gly Gly Lys Glu Gly Val Leu Lys Ala Leu Glu Leu Gly Lys
                805                 810                 815

Ile Arg Lys Val Asn Gly Lys Ile Val Lys Asn Gly Asp Met Phe Arg
            820                 825                 830

Val Asp Ile Phe Lys His Lys Lys Thr Asn Lys Phe Tyr Ala Val Pro
        835                 840                 845

Ile Tyr Thr Met Asp Phe Ala Leu Lys Val Leu Pro Asn Lys Ala Val
    850                 855                 860

Ala Arg Ser Lys Lys Gly Glu Ile Lys Asp Trp Ile Leu Met Asp Glu
```

865 870 875 880

Asn Tyr Glu Phe Cys Phe Ser Leu Tyr Lys Asp Ser Leu Ile Leu Ile
885 890 895

Gln Thr Lys Asp Met Gln Glu Pro Glu Phe Val Tyr Tyr Asn Ala Phe
900 905 910

Thr Ser Ser Thr Val Ser Leu Ile Val Ser Lys His Asp Asn Lys Phe
915 920 925

Glu Thr Leu Ser Lys Asn Gln Lys Ile Leu Phe Lys Asn Ala Asn Glu
930 935 940

Lys Glu Val Ile Ala Lys Ser Ile Gly Ile Gln Asn Leu Lys Val Phe
945 950 955 960

Glu Lys Tyr Ile Val Ser Ala Leu Gly Glu Val Thr Lys Ala Glu Phe
965 970 975

Arg Gln Arg Glu Asp Phe Lys Lys
980

<210> 377
<211> 1003
<212> PRT
<213> Campylobacter lari]

<400> 377

Met Arg Ile Leu Gly Phe Asp Ile Gly Ile Asn Ser Ile Gly Trp Ala
1 5 10 15

Phe Val Glu Asn Asp Glu Leu Lys Asp Cys Gly Val Arg Ile Phe Thr
20 25 30

Lys Ala Glu Asn Pro Lys Asn Lys Glu Ser Leu Ala Leu Pro Arg Arg
35 40 45

```
Asn Ala Arg Ser Ser Arg Arg Arg Leu Lys Arg Arg Lys Ala Arg Leu
    50                  55                  60

Ile Ala Ile Lys Arg Ile Leu Ala Lys Glu Leu Lys Leu Asn Tyr Lys
65                  70                  75                  80

Asp Tyr Val Ala Ala Asp Gly Glu Leu Pro Lys Ala Tyr Glu Gly Ser
                85                  90                  95

Leu Ala Ser Val Tyr Glu Leu Arg Tyr Lys Ala Leu Thr Gln Asn Leu
            100                 105                 110

Glu Thr Lys Asp Leu Ala Arg Val Ile Leu His Ile Ala Lys His Arg
        115                 120                 125

Gly Tyr Met Asn Lys Asn Glu Lys Lys Ser Asn Asp Ala Lys Lys Gly
    130                 135                 140

Lys Ile Leu Ser Ala Leu Lys Asn Asn Ala Leu Lys Leu Glu Asn Tyr
145                 150                 155                 160

Gln Ser Val Gly Glu Tyr Phe Tyr Lys Glu Phe Phe Gln Lys Tyr Lys
                165                 170                 175

Lys Asn Thr Lys Asn Phe Ile Lys Ile Arg Asn Thr Lys Asp Asn Tyr
            180                 185                 190

Asn Asn Cys Val Leu Ser Ser Asp Leu Glu Lys Glu Leu Lys Leu Ile
        195                 200                 205

Leu Glu Lys Gln Lys Glu Phe Gly Tyr Asn Tyr Ser Glu Asp Phe Ile
    210                 215                 220

Asn Glu Ile Leu Lys Val Ala Phe Phe Gln Arg Pro Leu Lys Asp Phe
225                 230                 235                 240

Ser His Leu Val Gly Ala Cys Thr Phe Phe Glu Glu Glu Lys Arg Ala
                245                 250                 255
```

```
Cys Lys Asn Ser Tyr Ser Ala Trp Glu Phe Val Ala Leu Thr Lys Ile
            260                 265                 270

Ile Asn Glu Ile Lys Ser Leu Glu Lys Ile Ser Gly Glu Ile Val Pro
        275                 280                 285

Thr Gln Thr Ile Asn Glu Val Leu Asn Leu Ile Leu Asp Lys Gly Ser
    290                 295                 300

Ile Thr Tyr Lys Lys Phe Arg Ser Cys Ile Asn Leu His Glu Ser Ile
305                 310                 315                 320

Ser Phe Lys Ser Leu Lys Tyr Asp Lys Glu Asn Ala Glu Asn Ala Lys
                325                 330                 335

Leu Ile Asp Phe Arg Lys Leu Val Glu Phe Lys Lys Ala Leu Gly Val
            340                 345                 350

His Ser Leu Ser Arg Gln Glu Leu Asp Gln Ile Ser Thr His Ile Thr
        355                 360                 365

Leu Ile Lys Asp Asn Val Lys Leu Lys Thr Val Leu Glu Lys Tyr Asn
    370                 375                 380

Leu Ser Asn Glu Gln Ile Asn Asn Leu Leu Glu Ile Glu Phe Asn Asp
385                 390                 395                 400

Tyr Ile Asn Leu Ser Phe Lys Ala Leu Gly Met Ile Leu Pro Leu Met
                405                 410                 415

Arg Glu Gly Lys Arg Tyr Asp Glu Ala Cys Glu Ile Ala Asn Leu Lys
            420                 425                 430

Pro Lys Thr Val Asp Glu Lys Lys Asp Phe Leu Pro Ala Phe Cys Asp
        435                 440                 445
```

```
Ser Ile Phe Ala His Glu Leu Ser Asn Pro Val Val Asn Arg Ala Ile
    450                 455                 460

Ser Glu Tyr Arg Lys Val Leu Asn Ala Leu Leu Lys Lys Tyr Gly Lys
465                 470                 475                 480

Val His Lys Ile His Leu Glu Leu Ala Arg Asp Val Gly Leu Ser Lys
                485                 490                 495

Lys Ala Arg Glu Lys Ile Glu Lys Glu Gln Lys Glu Asn Gln Ala Val
            500                 505                 510

Asn Ala Trp Ala Leu Lys Glu Cys Glu Asn Ile Gly Leu Lys Ala Ser
        515                 520                 525

Ala Lys Asn Ile Leu Lys Leu Lys Leu Trp Lys Glu Gln Lys Glu Ile
    530                 535                 540

Cys Ile Tyr Ser Gly Asn Lys Ile Ser Ile Glu His Leu Lys Asp Glu
545                 550                 555                 560

Lys Ala Leu Glu Val Asp His Ile Tyr Pro Tyr Ser Arg Ser Phe Asp
                565                 570                 575

Asp Ser Phe Ile Asn Lys Val Leu Val Phe Thr Lys Glu Asn Gln Glu
            580                 585                 590

Lys Leu Asn Lys Thr Pro Phe Glu Ala Phe Gly Lys Asn Ile Glu Lys
        595                 600                 605

Trp Ser Lys Ile Gln Thr Leu Ala Gln Asn Leu Pro Tyr Lys Lys Lys
    610                 615                 620

Asn Lys Ile Leu Asp Glu Asn Phe Lys Asp Lys Gln Gln Glu Asp Phe
625                 630                 635                 640

Ile Ser Arg Asn Leu Asn Asp Thr Arg Tyr Ile Ala Thr Leu Ile Ala
                645                 650                 655
```

```
Lys Tyr Thr Lys Glu Tyr Leu Asn Phe Leu Leu Leu Ser Glu Asn Glu
            660                 665                 670

Asn Ala Asn Leu Lys Ser Gly Glu Lys Gly Ser Lys Ile His Val Gln
        675                 680                 685

Thr Ile Ser Gly Met Leu Thr Ser Val Leu Arg His Thr Trp Gly Phe
    690                 695                 700

Asp Lys Lys Asp Arg Asn Asn His Leu His His Ala Leu Asp Ala Ile
705                 710                 715                 720

Ile Val Ala Tyr Ser Thr Asn Ser Ile Ile Lys Ala Phe Ser Asp Phe
                725                 730                 735

Arg Lys Asn Gln Glu Leu Leu Lys Ala Arg Phe Tyr Ala Lys Glu Leu
            740                 745                 750

Thr Ser Asp Asn Tyr Lys His Gln Val Lys Phe Phe Glu Pro Phe Lys
        755                 760                 765

Ser Phe Arg Glu Lys Ile Leu Ser Lys Ile Asp Glu Ile Phe Val Ser
    770                 775                 780

Lys Pro Pro Arg Lys Arg Ala Arg Arg Ala Leu His Lys Asp Thr Phe
785                 790                 795                 800

His Ser Glu Asn Lys Ile Ile Asp Lys Cys Ser Tyr Asn Ser Lys Glu
                805                 810                 815

Gly Leu Gln Ile Ala Leu Ser Cys Gly Arg Val Arg Lys Ile Gly Thr
            820                 825                 830

Lys Tyr Val Glu Asn Asp Thr Ile Val Arg Val Asp Ile Phe Lys Lys
        835                 840                 845
```

```
Gln Asn Lys Phe Tyr Ala Ile Pro Ile Tyr Ala Met Asp Phe Ala Leu
    850                 855                 860

Gly Ile Leu Pro Asn Lys Ile Val Ile Thr Gly Lys Asp Lys Asn Asn
865                 870                 875                 880

Asn Pro Lys Gln Trp Gln Thr Ile Asp Glu Ser Tyr Glu Phe Cys Phe
                885                 890                 895

Ser Leu Tyr Lys Asn Asp Leu Ile Leu Leu Gln Lys Lys Asn Met Gln
            900                 905                 910

Glu Pro Glu Phe Ala Tyr Tyr Asn Asp Phe Ser Ile Ser Thr Ser Ser
        915                 920                 925

Ile Cys Val Glu Lys His Asp Asn Lys Phe Glu Asn Leu Thr Ser Asn
    930                 935                 940

Gln Lys Leu Leu Phe Ser Asn Ala Lys Glu Gly Ser Val Lys Val Glu
945                 950                 955                 960

Ser Leu Gly Ile Gln Asn Leu Lys Val Phe Glu Lys Tyr Ile Ile Thr
                965                 970                 975

Pro Leu Gly Asp Lys Ile Lys Ala Asp Phe Gln Pro Arg Glu Asn Ile
            980                 985                 990

Ser Leu Lys Thr Ser Lys Lys Tyr  Gly Leu Arg
        995                 1000
```

<210> 378
<211> 372
<212> PRT
<213> candidate division

<400> 378

```
Asp Asn Glu Ser Ala Ile Asn Gln Ile Ala Tyr Ile Leu Thr Thr Gln
1               5                   10                  15
```

```
Lys Ala Asp Glu Gly Ile Arg Ala Glu Leu Asp Ser Leu Pro Leu Ser
            20                  25                  30

Asp Lys Ala Lys Lys Ala Ile Val Lys Ile Lys Pro Thr Asn Phe Lys
        35                  40                  45

Ala Phe Gly His Leu Ser Ile Lys Ala Leu Gln Lys Ile Thr Pro His
    50                  55                  60

Ile Leu Glu Gly Met Thr Tyr Asp Lys Ala Cys Glu Ala Ala Gly Tyr
65                  70                  75                  80

Asp Phe Lys Lys Gln Ser Ala Ser Leu Glu Gln Ile Thr Asn Pro Val
                85                  90                  95

Val Lys Arg Ala Ile Thr Gln Thr Leu Lys Val Val Arg Ala Ile Glu
            100                 105                 110

Arg Lys Tyr Gly Lys Pro Tyr Phe Ile Lys Val Glu Thr Ala Arg Asp
        115                 120                 125

Leu Ala Lys Asn Phe Lys Asp Arg Asn Ala Ile Lys Lys Glu Asn Glu
    130                 135                 140

Glu Asn Gln Gly Tyr Asn Glu Asp Ile Lys Ser Ile Ile Thr Asn Gly
145                 150                 155                 160

Tyr Glu Ala Ser Pro Lys Thr Lys Gly Gly Lys Gln Leu Leu Asn His
                165                 170                 175

Leu Lys Glu Phe Asn Val Arg Leu Asn Lys Asn Ala Asp Phe Asn Gly
            180                 185                 190

Gln Gln Ile Ile Lys Val Lys Leu Tyr Arg Glu Gln Gln Gly Lys Cys
        195                 200                 205

Leu Tyr Ser Gly Asn Pro Ile Asp Phe Glu Thr Met Leu Arg Asp Asp
```

```
    210                 215                 220

Asn Ala Tyr Gln Val Asp His Ile Val Pro Phe Ser Arg Ser Asn Asn
225                 230                 235                 240

Asp Gly Ile Thr Asn Lys Val Leu Val Phe Thr Glu Glu Asn Gln Lys
                245                 250                 255

Lys Ala Asp Arg Thr Pro Phe Glu Tyr Phe Gly Thr Asp Glu Arg Arg
            260                 265                 270

Trp Glu Lys Phe Val Ala Leu Val Glu Thr Thr Tyr Lys Thr Arg Asp
        275                 280                 285

Val Lys Thr Ser Asp Lys Ala Thr Asn Ala Ile Asn Tyr Glu Tyr Asn
    290                 295                 300

Gly Tyr Ala Met Lys Lys Lys Gln Asn Leu Leu Leu Gln Asp Tyr Lys
305                 310                 315                 320

Asn Asp Ser Trp Asn Val Arg Ala Leu Asn Asp Thr Arg Tyr Ile Thr
                325                 330                 335

Arg Phe Ile Gln Asn Tyr Leu Arg Gln Asn Val Asp Phe Ala Glu Gly
            340                 345                 350

Glu Glu Lys Gln Arg Ile Ile Ala Pro Asn Gly Thr Thr Thr Ala Tyr
        355                 360                 365

Leu Arg Lys Arg
    370
```

<210> 379
<211> 1117
<212> PRT
<213> Capnocytophaga ochracea

<400> 379

```
Met Lys His Ile Leu Gly Leu Asp Leu Gly Ser Asn Ser Ile Gly Trp
1               5                  10                  15

Ala Phe Val Gln Gln Asp Phe Glu Asn Lys Gln Gly Lys Ile Ile Ala
            20                  25                  30

Thr Gly Ser Arg Ile Ile Pro Met Asp Gln Gly Ile Leu Gly Asp Phe
        35                  40                  45

Glu Arg Gly Asn Thr Val Ser Gln Thr Ala Glu Arg Thr Thr Tyr Arg
    50                  55                  60

Ser Met Arg Arg Leu Arg Glu Arg His Leu Leu Arg Arg Glu Arg Leu
65                  70                  75                  80

His Arg Val Leu His Leu Leu Gly Phe Leu Pro Pro His Tyr Asp Ala
                85                  90                  95

Gln Ile Asp Phe Thr Lys Arg Tyr Gly Lys Phe Ile Asp Asn Ala Glu
            100                 105                 110

Pro Lys Ile Ala Tyr Asn Asn Gly Asn Phe Ile Phe Met Asn Ser Phe
        115                 120                 125

Asn Glu Met Val Glu Asp Phe Lys Lys His Gln Pro Gln Leu Phe Tyr
    130                 135                 140

Lys Lys Ser Asn Gly Glu Glu Ser Arg Ile Pro Tyr Asp Trp Thr Ile
145                 150                 155                 160

Tyr Tyr Leu Arg Lys Lys Ala Leu Ser Gln Lys Ile Thr Gln Gln Glu
                165                 170                 175

Leu Ala Trp Leu Ile Leu His Phe Asn Gln Lys Arg Gly Tyr Tyr Gln
            180                 185                 190

Leu Arg Gly Glu Glu Glu Thr Glu Asn Pro Asn Lys Glu Val Ala Phe
        195                 200                 205
```

```
His Ser Leu Lys Val Val Asp Val Glu Ala Glu Ala Pro Asn Lys Lys
    210                 215                 220

Gly Glu Ile Trp Tyr Thr Ile Arg Leu Glu Asn Gly Trp Ile Tyr Arg
225                 230                 235                 240

Arg Thr Ser Lys Asn Pro Leu Asp Asp Trp Lys Gly Lys Thr Arg Asp
                245                 250                 255

Phe Ile Val Thr Thr Asp Leu Asn Asp Asp Gly Thr Ile Lys Leu Asp
            260                 265                 270

Lys Glu Gly Lys Glu Lys Arg Ser Phe Arg Ala Pro Asp Glu Asn Asp
        275                 280                 285

Trp Asn Leu Leu Lys Lys Lys Thr Glu His Asp Ile Asp Phe Ser Gly
    290                 295                 300

Lys Pro Val Gly Thr Tyr Ile Tyr Asp His Leu Leu Gln Asn Pro Asn
305                 310                 315                 320

Gln Lys Ile Lys Gly Lys Leu Val Arg Thr Ile Glu Arg Lys Tyr Tyr
                325                 330                 335

Lys Asp Glu Leu Lys Ala Ile Leu Ala Lys Gln Ile Ala Leu Gln Pro
            340                 345                 350

Glu Leu Phe Thr Glu Thr Leu Leu Ala Asp Cys Ile Arg Glu Leu Tyr
        355                 360                 365

Arg Lys Asn Glu Thr Gln Gln Gln Asn Leu Leu Ser Lys Asp Phe Leu
    370                 375                 380

His Leu Phe Val Glu Asp Ile Ile Phe Tyr Gln Arg Pro Leu Cys Ser
385                 390                 395                 400
```

```
Lys Lys Ser Thr Ile Ala Asn Cys Thr Leu Glu Lys Arg Ser Tyr Ile
                405                 410                 415

Asp Lys Glu Thr Asn Glu Arg Lys Asp Ala Pro Ile Lys Val Cys Ala
            420                 425                 430

Lys Ser Asn Pro Tyr Tyr Gln Glu Phe Arg Val Leu Gln Trp Leu Gln
        435                 440                 445

Asn Leu Arg Ile Tyr Glu Ile Glu Thr Asp Arg Glu Val Thr Ala Glu
    450                 455                 460

Phe Ile Glu Thr Pro Gln Asp Tyr Glu Ala Leu Phe Asn Phe Leu Met
465                 470                 475                 480

Ser Gln Lys Glu Ile Asp Asn Glu Gly Leu Leu Lys Tyr Phe Leu Phe
                485                 490                 495

Ala Lys Asn Pro Gln Ile Lys Asp Lys Ala Ala Lys Ser Glu Leu Lys
            500                 505                 510

Lys Trp Leu Thr Thr Tyr Arg Trp Asn Tyr Val Tyr Asp Ala Ala Asp
        515                 520                 525

Asn Ser Ser Lys Lys Tyr Pro Met Asn Glu Thr Gly Tyr Glu Leu Gln
    530                 535                 540

Arg Tyr Leu Gln Lys Val Glu Gly Leu Pro Ala Asn Phe Leu Thr Phe
545                 550                 555                 560

Asp Ile Thr Tyr Gln Leu Trp His Leu Leu Tyr Ser Val Lys Asp Lys
                565                 570                 575

Val Glu Phe Glu Lys Ala Leu Lys Lys Phe Ala Lys Lys Lys Gln Leu
            580                 585                 590

Asp Lys Thr Ser Phe Val Asp Ser Phe Lys Asn Phe Lys Pro Tyr Pro
        595                 600                 605
```

```
Asn Glu Tyr Gly Ser Phe Ser Glu Lys Ala Ile Lys Lys Leu Leu Pro
    610                 615                 620

Leu Met Arg Phe Gly Asn His Trp Asp Phe Asn Arg Ile Asp Val Ser
625                 630                 635                 640

Thr Gln Lys Arg Ile Asp Asp Leu Ile Asn Gly Val Ala Asn Glu Asp
                645                 650                 655

Ile Arg Thr Ile Ile Arg Glu Lys Ala Glu Lys Tyr Gln Leu Asn Ser
            660                 665                 670

Glu Thr Cys Phe Gln Asp Leu Pro Leu Trp Leu Ala Gln Tyr Val Val
        675                 680                 685

Tyr Asn Arg His Ala Glu Ala Thr Asp Ile Glu Lys Trp Thr Ser Val
    690                 695                 700

Ser Asp Leu Glu Ala Tyr Leu Glu Asp Phe Lys Gln His Ser Leu Arg
705                 710                 715                 720

Asn Pro Ile Val Glu Gln Val Val Thr Glu Thr Leu Arg Val Val Arg
                725                 730                 735

Asp Ile Trp Gln Gln Tyr Ser Gly Gly Gln Ala Asn Phe Phe Asp Glu
            740                 745                 750

Ile His Ile Glu Leu Gly Arg Glu Leu Lys Lys Thr Ala Glu Glu Arg
        755                 760                 765

Lys Gln Leu Ser Asp Lys Asn Gln Glu Asn Glu Asn Thr Asn Leu Arg
    770                 775                 780

Ile Lys Lys Leu Leu Ala Glu Leu Lys Glu Asp Ala Ser Ile Gln Asn
785                 790                 795                 800
```

```
Val Arg Pro Tyr Ser Leu Val Gln Gln Glu Leu Leu Lys Ile Tyr Glu
                805                 810                 815

Glu Gly Val Phe Ser Ser Thr Asp Glu Ile Glu Glu Asp Ile Gln Lys
            820                 825                 830

Ile Arg Lys Lys Val Glu Pro Thr Pro Pro Glu Ile Gln Arg Tyr Lys
        835                 840                 845

Leu Trp Leu Glu Gln Lys Tyr Lys Ser Pro Tyr Thr Gly Glu Val Ile
    850                 855                 860

Ser Leu Thr Lys Leu Phe Thr Glu Glu Tyr Glu Ile Glu His Ile Ile
865                 870                 875                 880

Pro Gln Ser Arg Tyr Tyr Asp Asp Ser Leu Ser Asn Lys Val Ile Cys
                885                 890                 895

Glu Ser Ala Val Asn Lys Leu Lys Thr Asn Gln Leu Gly Leu Glu Phe
            900                 905                 910

Ile Gln Asn His His Gly Glu Lys Val Arg Ile Thr Ala Asn Lys Glu
        915                 920                 925

Val Thr Ile Phe Thr Glu Glu Gln Tyr Lys Glu Phe Val Lys Lys His
    930                 935                 940

Tyr Ala Asn Asn Ser Ala Lys Gln Gln Lys Leu Leu Leu Asn Glu Ile
945                 950                 955                 960

Pro Glu Lys Met Val Ala Arg Gln Leu Asn Asp Thr Arg Tyr Ile Ser
                965                 970                 975

Lys Cys Ile Ser Glu Ile Leu Ser Lys Ile Val Arg Ser Asp Glu Lys
            980                 985                 990

Asp Glu Gly Val Asn Ser Lys Asn  Ile Ile Pro Cys Thr  Gly Lys Ile
        995                 1000                1005
```

```
Thr Thr  Ala Leu Lys Gln Asp  Trp Gly Leu Asn Asp  Val Trp Asn
    1010                1015                1020


Glu Leu  Ile Leu Pro Arg Phe  Glu Arg Met Asn Gln  Leu Thr Gln
    1025                1030                1035


Thr Gln  Leu Phe Thr Ser Tyr  Asn Asp Arg Leu Gln  Lys Asn Leu
    1040                1045                1050


Pro Thr  Val Pro Ile Glu Tyr  Ser Gln Gly Phe Gln  Lys Lys Arg
    1055                1060                1065


Ile Asp  His Arg His His Ala  Met Asp Ala Leu Val  Ile Ala Cys
    1070                1075                1080


Ala Thr  Arg Glu His Ile Asn  Tyr Met Asn Asn Gln  His Ala Leu
    1085                1090                1095


Asp Lys  Ser Lys Asp Lys Lys  Glu Lys Gln Gln Ser  Arg Ile Asp
    1100                1105                1110


Leu His  Pro Leu
    1115


<210>  380
<211>  303
<212>  PRT
<213>  Capnocytophaga ochracea

<400>  380

Met Ser Phe Lys Gln Asn Leu Arg Val Ile Asn Lys Ala Thr Asn Tyr
1               5                  10                  15


Tyr Glu Lys Trp Glu Glu Lys Asn Gly Val Leu Val Lys Lys Lys Val
            20                  25                  30


Lys Gln Glu Gly Thr Asn Trp Ala Ile Arg Lys Pro Leu His Lys Glu
```

```
        35                  40                  45

Thr Val Ser Gly Lys Ile Val Leu Asp Arg Lys Ile Gly Lys Asp Lys
    50                  55                  60

Ile Leu Thr Ala Thr Arg Lys Ala Val Asp Ile Thr Phe Thr Glu Lys
65                  70                  75                  80

Ile Ile Ser Ser Ile Thr Asp Thr Gly Ile Gln Lys Ile Leu Leu Asn
                85                  90                  95

Tyr Leu Lys Tyr Lys Gly Ser Pro Glu Val Ala Phe Ser Ala Glu Gly
            100                 105                 110

Leu Glu Glu Leu Asn Lys Asn Ile Ala Gln Tyr Asn Asp Gly Lys Lys
        115                 120                 125

His Gln Pro Ile Tyr Lys Val Arg Ile Phe Glu Glu Gly Ser Lys Phe
    130                 135                 140

Pro Leu Gly Glu Thr Gly Ala Lys Ala Thr Lys Tyr Val Glu Ala Ala
145                 150                 155                 160

Lys Gly Thr Asn Leu Phe Phe Gly Val Tyr Gln Gly Lys Glu Lys Arg
                165                 170                 175

Thr Tyr Ala Thr Ile Pro Leu Asn Glu Val Ile Glu Arg Gln Lys Gln
            180                 185                 190

Gly Leu Pro Ser Val Pro Glu Arg Asn Glu Lys Gly Glu Pro Leu Leu
        195                 200                 205

Phe Ser Leu Ser Pro Asn Asp Leu Val Tyr Val Pro Met Glu Gly Glu
    210                 215                 220

Ile Ala Glu Thr Ile Asp Phe Asn Asn Leu Ser Lys Glu Gln Lys Glu
225                 230                 235                 240
```

```
Arg Ile Tyr Lys Thr Val Ser Phe Thr Gly Asn Gln Cys Phe Phe Val
                245                 250                 255


Gln Glu Ala Val Ala Ser Pro Ile Val Asn Lys Met Glu Tyr Ser Pro
            260                 265                 270


Leu Asn Lys Met Glu Arg Asp Ile Leu Gly Ile Met Ile Lys Glu Val
        275                 280                 285


Cys Val Lys Leu Lys Val Asp Arg Leu Gly Asn Ile Ile Lys Ala
    290                 295                 300
```

<210> 381
<211> 1471
<212> PRT
<213> Capnocytophaga sp.

<400> 381

```
Met Cys Lys Tyr Phe Tyr Ile Lys Asn Phe Ile Thr Phe Val Leu Ser
1               5                   10                  15


Lys Ser Ile Ile Pro Met Lys His Ile Leu Gly Leu Asp Leu Gly Ser
            20                  25                  30


Asn Ser Ile Gly Trp Ala Phe Val Gln Gln Asp Phe Glu Asn Lys Gln
        35                  40                  45


Gly Lys Ile Ile Ala Thr Gly Ser Arg Ile Ile Pro Met Asp Gln Gly
    50                  55                  60


Ile Leu Gly Asp Phe Glu Arg Gly Asn Thr Val Ser Gln Thr Ala Glu
65                  70                  75                  80


Arg Thr Thr Tyr Arg Ser Thr Arg Arg Leu Arg Glu Arg His Leu Leu
                85                  90                  95


Arg Arg Glu Arg Leu His Arg Val Leu His Ile Leu Gly Phe Leu Pro
            100                 105                 110
```

```
Pro His Tyr Asp Ala Gln Ile Asp Phe Thr Lys Arg Tyr Gly Lys Phe
        115                 120                 125

Ile Asp Asn Ala Glu Pro Lys Ile Ala Tyr Asn Asn Gly Asn Phe Ile
    130                 135                 140

Phe Met Asn Ser Phe Asn Glu Met Ile Glu Asp Phe Lys Lys His Gln
145                 150                 155                 160

Pro Gln Leu Phe Tyr Lys Lys Ser Asn Gly Glu Glu Ser Lys Ile Pro
                165                 170                 175

Tyr Asp Trp Thr Ile Tyr Tyr Leu Arg Lys Lys Ala Leu Ser Gln Lys
            180                 185                 190

Ile Thr Gln Gln Glu Leu Ala Trp Leu Ile Leu His Phe Asn Gln Lys
        195                 200                 205

Arg Gly Tyr Tyr Gln Leu Arg Gly Glu Glu Glu Thr Glu Asn Pro Asn
    210                 215                 220

Lys Glu Val Ala Phe His Ser Leu Lys Val Val Asp Val Glu Ala Glu
225                 230                 235                 240

Ala Pro Asn Lys Lys Gly Glu Ile Trp Tyr Thr Ile Arg Leu Glu Asn
                245                 250                 255

Gly Trp Ile Tyr Arg Arg Thr Ser Lys Ile Pro Leu Asp Asp Trp Lys
            260                 265                 270

Gly Lys Thr Arg Asp Phe Ile Val Thr Thr Asp Leu Asn Asp Asp Gly
        275                 280                 285

Thr Ile Lys Val Asp Lys Glu Gly Lys Glu Lys Arg Ser Phe Arg Ala
    290                 295                 300
```

```
Pro Asp Glu Asn Asp Trp Asn Leu Leu Lys Lys Lys Thr Glu His Asp
305                 310                 315                 320

Ile Asp Phe Ser Gly Lys Thr Val Gly Ala Tyr Ile Tyr Asp His Leu
                325                 330                 335

Leu Gln Asn Pro Asn Gln Lys Ile Lys Gly Lys Leu Val Arg Thr Ile
            340                 345                 350

Glu Arg Lys Tyr Tyr Lys Asp Glu Leu Lys Ala Ile Leu Ala Lys Gln
        355                 360                 365

Ile Ala Leu Gln Pro Glu Leu Phe Thr Glu Thr Leu Leu Ala Asp Cys
    370                 375                 380

Ile Arg Glu Leu Tyr Arg Lys Asn Glu Thr Gln Gln Gln Asn Leu Leu
385                 390                 395                 400

Ser Lys Asp Phe Leu His Leu Phe Val Glu Asp Ile Ile Phe Tyr Gln
                405                 410                 415

Arg Pro Leu Arg Ser Lys Lys Ser Thr Ile Ala Asn Cys Thr Leu Glu
            420                 425                 430

Lys Arg Ser Tyr Ile Asp Lys Glu Thr Asn Glu Arg Lys Asp Ala Pro
        435                 440                 445

Ile Lys Val Cys Ala Lys Ser Asn Pro Tyr Tyr Gln Glu Phe Arg Val
    450                 455                 460

Leu Gln Trp Leu Gln Asn Leu Arg Ile Tyr Glu Ile Glu Thr Asp Arg
465                 470                 475                 480

Glu Val Thr Ala Glu Phe Ile Glu Thr Pro Gln Asp Cys Glu Ala Leu
                485                 490                 495

Phe Asn Phe Leu Met Ser Gln Lys Glu Ile Asp Asn Lys Gly Leu Leu
            500                 505                 510
```

```
Lys Tyr Phe Leu Phe Ala Lys Asn Pro Gln Ile Lys Asp Lys Ala Ala
        515                 520                 525

Lys Ser Glu Leu Lys Lys Trp Leu Thr Thr Tyr Arg Trp Asn Tyr Val
    530                 535                 540

Tyr Asp Ala Ala Asp Asn Ser Ser Lys Lys Tyr Pro Met Asn Glu Thr
545                 550                 555                 560

Gly Tyr Glu Leu Gln Arg Tyr Leu Gln Lys Val Glu Gly Leu Pro Ala
                565                 570                 575

Asn Phe Leu Thr Phe Asp Ile Thr Tyr Gln Leu Trp His Leu Leu Tyr
            580                 585                 590

Ser Val Lys Asp Lys Val Glu Phe Glu Lys Ala Leu Lys Lys Phe Ala
        595                 600                 605

Lys Lys Lys Gln Leu Asp Lys Thr Ser Phe Val Asp Ser Phe Lys Asn
    610                 615                 620

Phe Lys Pro Tyr Pro Asn Glu Tyr Gly Ser Phe Ser Glu Lys Ala Ile
625                 630                 635                 640

Lys Lys Leu Leu Pro Leu Met Arg Phe Gly Asn His Trp Asp Phe Asn
                645                 650                 655

Arg Ile Asp Val Ser Thr Gln Lys Arg Ile Asp Asp Leu Ile Asn Gly
            660                 665                 670

Val Ala Asn Glu Asp Ile Arg Thr Ile Ile Arg Glu Lys Ala Glu Lys
        675                 680                 685

Tyr Gln Leu Asn Ser Glu Thr Cys Phe Gln Asp Leu Pro Leu Trp Leu
    690                 695                 700
```

```
Ala Gln Tyr Val Val Tyr Asn Arg His Ala Glu Ala Thr Asp Ile Glu
705                 710                 715                 720


Lys Trp Thr Ser Val Ser Asp Leu Glu Ala Tyr Leu Glu Asp Phe Lys
                725                 730                 735


Gln His Ser Leu Arg Asn Pro Ile Val Glu Gln Val Val Thr Glu Thr
            740                 745                 750


Leu Arg Val Val Arg Asp Ile Trp Gln Gln Tyr Gly Gly Gly Gln Ala
        755                 760                 765


Asn Phe Phe Asp Glu Ile His Ile Glu Leu Gly Arg Glu Leu Lys Lys
    770                 775                 780


Thr Ala Glu Glu Arg Lys Gln Leu Ser Asp Lys Asn Gln Glu Asn Glu
785                 790                 795                 800


Ser Thr Asn Leu Arg Ile Lys Lys Leu Leu Ala Glu Leu Lys Glu Asp
                805                 810                 815


Ala Ser Ile Gln Asn Val Arg Pro Tyr Ser Leu Val Gln Gln Glu Leu
            820                 825                 830


Leu Lys Ile Tyr Glu Glu Gly Val Phe Ser Ala Thr Asp Glu Val Glu
        835                 840                 845


Glu Asp Ile Gln Lys Ile Arg Lys Lys Ala Glu Pro Ser Lys Ala Asp
    850                 855                 860


Leu Gln Arg Tyr Lys Leu Trp Leu Glu Gln Lys Tyr Lys Ser Pro Tyr
865                 870                 875                 880


Thr Gly Glu Val Ile Ser Leu Thr Lys Leu Phe Thr Glu Glu Tyr Glu
                885                 890                 895


Ile Glu His Ile Ile Pro Gln Ser Arg Tyr Tyr Asp Asp Ser Leu Ser
            900                 905                 910
```

```
Asn Lys Val Ile Cys Glu Ser Ala Val Asn Lys Leu Lys Thr Asn Gln
        915                 920                 925

Leu Gly Leu Glu Phe Ile Gln Asn His His Gly Glu Lys Val Arg Ile
    930                 935                 940

Thr Ala Asn Lys Glu Val Thr Ile Phe Thr Glu Glu Gln Tyr Lys Glu
945                 950                 955                 960

Phe Val Lys Lys His Tyr Ala Asn Asn Ser Ala Lys Gln Gln Lys Leu
                965                 970                 975

Leu Leu Asn Glu Ile Pro Glu Lys Met Val Ala Arg Gln Leu Asn Asp
            980                 985                 990

Thr Arg Tyr Ile Ser Lys Tyr Ile  Ser Glu Ile Leu Ser  Lys Ile Val
        995                 1000                1005

Arg Ser  Asp Glu Lys Asp Glu  Gly Val Asn Ser Lys  Asn Ile Ile
    1010                1015                1020

Pro Cys  Thr Gly Lys Ile Thr  Thr Ala Leu Lys Gln  Asp Trp Gly
    1025                1030                1035

Leu Asn  Asp Val Trp Asn Lys  Leu Ile Leu Pro Arg  Phe Glu Arg
    1040                1045                1050

Met Asn  Gln Leu Thr Gln Thr  Gln Leu Phe Thr Ser  Tyr Asn Asp
    1055                1060                1065

Arg Leu  Gln Lys Asn Leu Pro  Thr Val Pro Ile Glu  Tyr Ser Gln
    1070                1075                1080

Gly Phe  Gln Lys Lys Arg Ile  Asp His Arg His His  Ala Met Asp
    1085                1090                1095
```

```
Ala Leu  Val Ile Ala Cys Ala  Thr Arg Glu His Ile  Asn Tyr Met
    1100                1105                1110

Asn Asn  Gln His Ala Leu Asp  Lys Ser Lys Asp Lys  Lys Glu Lys
    1115                1120                1125

Gln Gln  Ser Arg Ile Asp Leu  Arg Thr Ile Leu Cys  Glu Lys Lys
    1130                1135                1140

Asn Asn  Asn Trp Gln Phe Lys  Lys Pro Trp Ser Thr  Phe Thr Gln
    1145                1150                1155

Glu Ala  Lys Glu Ala Leu Glu  His Ile Val Val Ser  Phe Lys Gln
    1160                1165                1170

Asn Leu  Arg Val Ile Asn Lys  Ala Thr Asn Tyr Tyr  Glu Lys Trp
    1175                1180                1185

Glu Glu  Lys Asn Gly Val Leu  Val Lys Lys Lys Val  Lys Gln Glu
    1190                1195                1200

Gly Thr  Asn Trp Ala Ile Arg  Lys Pro Leu His Lys  Glu Thr Val
    1205                1210                1215

Ser Gly  Lys Ile Val Leu Asp  Arg Lys Ile Gly Lys  Asp Lys Ile
    1220                1225                1230

Leu Thr  Ala Thr Arg Lys Ala  Val Asp Ile Thr Phe  Thr Glu Lys
    1235                1240                1245

Ile Ile  Ser Ser Ile Thr Asp  Thr Gly Ile Gln Lys  Ile Leu Leu
    1250                1255                1260

Asn Tyr  Leu Lys Tyr Lys Gly  Ser Pro Glu Val Ala  Phe Ser Thr
    1265                1270                1275

Glu Gly  Leu Glu Glu Leu Asn  Lys Asn Ile Ala Gln  Tyr Asn Asn
    1280                1285                1290
```

```
Gly Lys  Lys His Gln Pro Ile  Tyr Lys Val Arg Ile  Phe Glu Glu
    1295                1300                1305

Gly Ser  Lys Phe Pro Leu Gly  Glu Thr Gly Ala Lys  Ala Thr Lys
    1310                1315                1320

Tyr Val  Glu Ala Ala Lys Gly  Thr Asn Leu Phe Phe  Gly Val Tyr
    1325                1330                1335

Gln Gly  Lys Gly Lys Arg Thr  Tyr Ala Thr Ile Pro  Leu Asn Glu
    1340                1345                1350

Val Ile  Glu Arg Gln Lys Gln  Gly Leu Pro Ser Val  Pro Glu Arg
    1355                1360                1365

Asn Glu  Lys Gly Glu Pro Leu  Leu Phe Ser Leu Ser  Pro Asn Asp
    1370                1375                1380

Leu Val  Tyr Val Pro Met Glu  Gly Glu Ile Ala Glu  Thr Ile Asp
    1385                1390                1395

Phe Asn  Asn Leu Ser Lys Glu  Gln Lys Glu Arg Ile  Tyr Lys Thr
    1400                1405                1410

Val Ser  Phe Thr Gly Asn Gln  Cys Phe Phe Val Gln  Glu Ala Val
    1415                1420                1425

Ala Thr  Pro Ile Val Asn Lys  Met Glu Tyr Ser Pro  Leu Asn Lys
    1430                1435                1440

Met Glu  Arg Asp Ile Leu Gly  Thr Met Ile Lys Glu  Val Cys Ile
    1445                1450                1455

Lys Leu  Lys Val Asp Arg Leu  Gly Asn Ile Thr Lys  Ala
    1460                1465                1470
```

<210> 382
<211> 1450
<212> PRT
<213> Capnocytophaga sp.

<400> 382

```
Met Lys His Ile Leu Gly Leu Asp Leu Gly Ser Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Phe Val Gln Gln Asp Phe Glu Asn Lys Gln Gly Lys Ile Ile Ala
            20                  25                  30


Thr Gly Ser Arg Ile Ile Pro Met Asp Gln Gly Ile Leu Gly Asp Phe
        35                  40                  45


Glu Arg Gly Asn Thr Val Ser Gln Thr Ala Glu Arg Thr Thr Tyr Arg
    50                  55                  60


Asn Thr Arg Arg Leu Arg Glu Arg His Leu Leu Arg Arg Glu Arg Leu
65                  70                  75                  80


His Arg Val Leu His Ile Leu Gly Phe Leu Pro Pro His Tyr Asp Ser
                85                  90                  95


Gln Ile Asp Phe Thr Lys Arg Tyr Gly Lys Phe Ile Asp Asn Ala Glu
            100                 105                 110


Pro Lys Ile Ala Tyr Asn Asn Gly Asn Phe Ile Phe Met Asn Ser Phe
        115                 120                 125


Asn Glu Met Ile Glu Asp Phe Lys Lys Tyr Gln Pro Gln Leu Phe Tyr
    130                 135                 140


Lys Lys Ser Asn Gly Glu Glu Ser Lys Ile Pro Tyr Asp Trp Thr Ile
145                 150                 155                 160


Tyr Tyr Leu Arg Lys Lys Ala Leu Ser Gln Lys Ile Thr Gln Gln Glu
                165                 170                 175
```

```
Leu Ala Trp Leu Ile Leu His Phe Asn Gln Lys Arg Gly Tyr Tyr Gln
            180                 185                 190

Leu Arg Gly Glu Glu Glu Thr Glu Asn Pro Asn Lys Glu Val Ala Phe
        195                 200                 205

His Ser Leu Glu Val Val Asp Val Glu Ala Glu Ala Pro Asn Lys Lys
    210                 215                 220

Gly Glu Ile Trp Tyr Thr Ile Arg Leu Glu Asn Gly Trp Ile Tyr Arg
225                 230                 235                 240

Arg Thr Ser Lys Ile Pro Leu Asp Asp Trp Lys Gly Lys Thr Arg Asp
                245                 250                 255

Phe Ile Val Thr Thr Asp Leu Asn Asp Asp Gly Thr Ile Lys Leu Asp
            260                 265                 270

Lys Glu Gly Lys Glu Lys Arg Ser Phe Arg Ala Pro Asp Glu Asn Asp
        275                 280                 285

Trp Asn Leu Leu Lys Lys Lys Thr Glu His Asp Ile Asp Phe Ser Gly
    290                 295                 300

Lys Thr Val Gly Ala Tyr Ile Tyr Asp His Leu Leu Gln Asn Pro Asn
305                 310                 315                 320

Gln Lys Ile Lys Gly Lys Leu Val Arg Thr Ile Glu Arg Lys Tyr Tyr
                325                 330                 335

Lys Asp Glu Leu Lys Ala Ile Leu Ala Lys Gln Ile Ala Leu Gln Pro
            340                 345                 350

Glu Leu Phe Thr Glu Thr Leu Leu Ala Asp Cys Ile Arg Glu Leu Tyr
        355                 360                 365

Arg Lys Asn Glu Thr Gln Gln Gln Asn Leu Leu Ser Lys Asp Phe Leu
```

```
    370                 375                 380

His Leu Phe Val Glu Asp Ile Ile Phe Tyr Gln Arg Pro Leu Arg Ser
385                 390                 395                 400

Lys Lys Ser Thr Ile Ala Asn Cys Thr Leu Glu Lys Arg Ser Tyr Ile
                405                 410                 415

Asp Lys Glu Thr Asn Glu Arg Lys Asp Thr Pro Ile Lys Val Cys Ala
            420                 425                 430

Lys Ser Asn Pro Tyr Tyr Gln Glu Phe Arg Val Leu Gln Trp Leu Gln
        435                 440                 445

Asn Leu Arg Ile Tyr Glu Ile Glu Thr Asp Arg Glu Val Thr Ala Glu
    450                 455                 460

Phe Ile Glu Thr Ala Gln Asp Asn Glu Ala Leu Phe Asn Phe Leu Met
465                 470                 475                 480

Ser Gln Lys Glu Ile Asp Asn Glu Ser Leu Leu Lys Tyr Phe Leu Phe
                485                 490                 495

Ala Lys Asn Pro Gln Ile Lys Asp Lys Val Ala Lys Ser Glu Leu Lys
            500                 505                 510

Lys Trp Leu Thr Thr Tyr Arg Trp Asn Tyr Val Tyr Asp Ala Ala Asp
        515                 520                 525

Asn Ser Ser Lys Lys Tyr Pro Met Asn Glu Thr Gly Tyr Glu Leu Gln
    530                 535                 540

Gln Tyr Leu Gln Lys Val Glu Gly Leu Pro Ala Asn Phe Leu Thr Phe
545                 550                 555                 560

Asp Ile Thr Tyr Arg Leu Trp His Leu Leu Tyr Ser Val Lys Asp Lys
                565                 570                 575
```

```
Val Glu Phe Glu Lys Ala Leu Lys Lys Phe Ala Gln Glu Tyr Gln Leu
            580                 585                 590

Asp Glu Ala Ser Phe Val Asp Ser Phe Lys Asn Phe Lys Pro Tyr Pro
        595                 600                 605

Asn Glu Tyr Gly Ser Phe Ser Glu Lys Ala Ile Lys Lys Leu Leu Pro
    610                 615                 620

Leu Met Arg Phe Gly Asn His Trp Asp Phe Asn Arg Ile Asp Val Ser
625                 630                 635                 640

Thr Gln Lys Arg Ile Asp Asp Leu Ile Asn Gly Val Ala Asn Asp Glu
                645                 650                 655

Ile Arg Thr Ile Ile Arg Glu Lys Ala Glu Lys Tyr Gln Leu Asn Ser
            660                 665                 670

Glu Thr Cys Phe Gln Gly Leu Pro Leu Trp Leu Ala Gln Tyr Val Val
        675                 680                 685

Tyr Asn Arg His Ala Glu Ala Ala Asp Ile Glu Lys Trp Thr Ser Val
    690                 695                 700

Asn Asp Leu Glu Ala Tyr Leu Glu Asp Phe Lys Gln His Ser Leu Arg
705                 710                 715                 720

Asn Pro Ile Val Glu Gln Val Ile Thr Glu Thr Leu Arg Val Val Arg
                725                 730                 735

Asp Ile Trp Gln Arg Tyr Gly Gly Gly Gln Ala Asn Phe Phe Asp Glu
            740                 745                 750

Ile His Ile Glu Leu Gly Arg Glu Leu Lys Lys Thr Ala Glu Glu Arg
        755                 760                 765

Lys Gln Leu Ser Asn Arg Asn Gln Glu Asn Glu Asn Thr Asn Leu Arg
```

```
    770                 775                 780

Ile Lys Lys Leu Leu Ala Glu Leu Lys Glu Asp Ala Ser Ile Gln Asn
785                 790                 795                 800

Val Arg Pro Tyr Ser Pro Val Gln Gln Glu Leu Leu Lys Ile Tyr Glu
                805                 810                 815

Glu Gly Val Phe Ser Ala Thr Asp Glu Val Glu Glu Asp Ile Gln Lys
            820                 825                 830

Ile Arg Lys Lys Ala Glu Pro Thr Thr Pro Glu Ile Gln Arg Tyr Lys
        835                 840                 845

Leu Trp Leu Glu Gln Lys Tyr Lys Ser Pro Tyr Thr Gly Glu Val Ile
    850                 855                 860

Ser Leu Thr Lys Leu Phe Thr Glu Glu Tyr Glu Ile Glu His Ile Ile
865                 870                 875                 880

Pro Gln Ser Arg Tyr Tyr Asp Asp Ser Leu Ser Asn Lys Val Ile Cys
                885                 890                 895

Glu Ser Ala Val Asn Lys Leu Lys Thr Asn Gln Leu Gly Leu Glu Phe
            900                 905                 910

Ile Gln Asn His His Gly Glu Lys Val Arg Ile Thr Ala Asn Lys Glu
        915                 920                 925

Val Thr Ile Phe Thr Glu Glu Gln Tyr Lys Glu Phe Val Lys Lys His
    930                 935                 940

Tyr Ala Asn Asn Ser Ala Lys Gln Gln Lys Leu Leu Leu Asn Glu Ile
945                 950                 955                 960

Pro Glu Lys Met Val Ala Arg Gln Leu Asn Asp Thr Arg Tyr Ile Ser
                965                 970                 975
```

```
Lys Tyr Ile Ser Glu Ile Leu Ser Lys Ile Val Arg Ser Asp Glu Lys
            980                 985                 990

Asp Glu Gly Val Asn Ser Lys Asn  Ile Ile Pro Cys Thr  Gly Lys Ile
        995                 1000                1005

Thr Thr  Ala Leu Lys Gln Asp  Trp Gly Leu Asn Asp  Val Trp Asn
    1010                1015                1020

Glu Leu  Ile Leu Pro Arg Phe  Glu Arg Met Asn Gln  Leu Thr Gln
    1025                1030                1035

Thr Gln  Leu Phe Thr Ser Tyr  Asn Asp Arg Phe Gln  Lys Asn Leu
    1040                1045                1050

Pro Thr  Val Pro Ile Glu Tyr  Ser Gln Gly Phe Gln  Lys Lys Arg
    1055                1060                1065

Ile Asp  His Arg His His Ala  Met Asp Ala Leu Val  Ile Ala Cys
    1070                1075                1080

Ala Thr  Arg Glu His Ile Asn  Tyr Met Asn Asn Gln  His Ala Leu
    1085                1090                1095

Asp Lys  Ser Lys Asp Lys Lys  Glu Lys Gln Gln Ser  Arg Ile Asp
    1100                1105                1110

Leu Arg  Thr Ile Leu Cys Glu  Lys Lys Asn Asn Asn  Trp Gln Phe
    1115                1120                1125

Lys Lys  Pro Trp Ser Thr Phe  Thr Gln Glu Ala Gln  Glu Ala Leu
    1130                1135                1140

Glu His  Ile Val Val Ser Phe  Lys Gln Asn Leu Arg  Val Ile Asn
    1145                1150                1155

Lys Ala  Thr Asn Tyr Tyr Glu  Lys Trp Glu Glu Lys  Asn Gly Val
```

```
    1160                1165                1170

Leu Val  Lys Lys Lys Val Lys  Gln Glu Gly Thr Asn  Trp Ala Ile
    1175                1180                1185

Arg Lys  Pro Leu His Lys Glu  Thr Val Ser Gly Lys  Ile Val Leu
    1190                1195                1200

Asp Arg  Lys Ile Gly Lys Asp  Lys Ile Leu Thr Ala  Thr Arg Lys
    1205                1210                1215

Ser Val  Asp Ile Thr Phe Thr  Glu Lys Ile Ile Ser  Ser Ile Thr
    1220                1225                1230

Asp Thr  Gly Ile Gln Lys Ile  Leu Leu Asn Tyr Leu  Lys Tyr Lys
    1235                1240                1245

Gly Ser  Pro Glu Val Ala Phe  Ser Ala Glu Gly Leu  Glu Glu Leu
    1250                1255                1260

Asn Lys  Asn Ile Ala Gln Tyr  Asn Asp Gly Lys Lys  His Gln Pro
    1265                1270                1275

Ile Tyr  Lys Val Arg Ile Phe  Glu Glu Gly Ser Lys  Phe Pro Leu
    1280                1285                1290

Gly Glu  Thr Gly Ala Lys Ala  Thr Lys Tyr Val Glu  Ala Ala Lys
    1295                1300                1305

Gly Thr  Asn Leu Phe Phe Gly  Val Tyr Gln Gly Lys  Gly Lys Arg
    1310                1315                1320

Thr Tyr  Ala Thr Ile Pro Leu  Asn Glu Val Ile Glu  Arg Gln Lys
    1325                1330                1335

Gln Gly  Leu Pro Ser Val Pro  Glu Arg Asn Glu Lys  Gly Glu Pro
    1340                1345                1350
```

```
Leu Leu  Phe Ser Leu Ser Pro  Asn Asp Leu Val Tyr  Val Pro Met
    1355                1360                1365


Glu Gly  Glu Ile Ala Glu Thr  Ile Asp Phe Asn Asn  Leu Ser Lys
    1370                1375                1380


Glu Gln  Lys Glu Arg Ile Tyr  Lys Thr Val Ser Phe  Thr Gly Asn
    1385                1390                1395


Gln Cys  Phe Phe Val Gln Glu  Ala Val Ala Thr Pro  Ile Val Asn
    1400                1405                1410


Lys Ile  Glu Tyr Ser Pro Leu  Asn Lys Met Glu Arg  Asp Ile Leu
    1415                1420                1425


Gly Thr  Met Ile Lys Glu Val  Cys Ile Lys Leu Lys  Val Asp Arg
    1430                1435                1440


Leu Gly  Asn Ile Thr Lys Ala
    1445                1450
```

<210> 383
<211> 1435
<212> PRT
<213> Capnocytophaga sp.

<400> 383

```
Met Lys Asn Ile Leu Gly Leu Asp Leu Gly Thr Thr Ser Ile Gly Phe
1               5                   10                  15


Ala His Ile Val Glu Asp Glu Asn Lys Glu Lys Ser Glu Ile Lys Glu
            20                  25                  30


Leu Gly Val Arg Ile Val Ser Leu Ala Thr Asp Glu Gln Ser Asp Phe
        35                  40                  45


Glu Lys Gly Lys Ser Ile Ser Thr Asn Ala Asn Arg Thr Leu Lys His
    50                  55                  60
```

```
Gly Ala Arg Leu Asn Leu Asp Arg Tyr Gln Gln Arg Arg Lys Phe Leu
65                  70                  75                  80

Ile Asp Leu Leu Gln Lys Ala Asn Leu Ile Thr Ser Ala Ser Ile Leu
                85                  90                  95

Ala Glu Asn Gly Lys Asn Thr Thr His Ser Thr Trp Gln Leu Arg Ala
            100                 105                 110

Lys Ala Val Thr Glu Arg Ile Glu Lys Glu Glu Phe Ala Arg Val Leu
        115                 120                 125

Leu Ala Ile Asn Lys Lys Arg Gly Tyr Lys Asn Ser Arg Lys Thr Lys
    130                 135                 140

Thr Glu Asp Glu Gly Gln Ala Ile Asp Gly Met Ala Ile Ala Lys Cys
145                 150                 155                 160

Leu Tyr Asp Glu Asn Leu Thr Pro Gly Gln Leu Ser Leu Gln Leu Leu
                165                 170                 175

Gln Gln Asn Lys Lys Leu Leu Pro Asp Phe Tyr Arg Ser Asp Leu Gln
            180                 185                 190

Lys Glu Phe Asp Leu Val Trp Asn Leu Gln Lys Gln Phe Tyr Pro Asp
        195                 200                 205

Ile Leu Thr Asp Ser Phe Tyr Lys Glu Leu Gln Gly Lys Gly Lys Asp
    210                 215                 220

Ala Thr Ser Lys Ala Phe Ser Lys Arg Tyr His Phe Asp Thr Ala Glu
225                 230                 235                 240

Asn Lys Gly Ser Lys Glu Ser Val Arg Leu Gln Ala Tyr Gln Trp Arg
                245                 250                 255
```

```
Ala Glu Ala Ile Ser Lys Gln Leu Ser Lys Glu Glu Val Ala Tyr Val
            260                 265                 270

Leu Thr Glu Ile Asn Asn Asn Leu Asn Asn Ser Ser Gly Tyr Leu Gly
        275                 280                 285

Ala Ile Ser Asp Arg Ser Lys Glu Leu Tyr Phe Asn Arg Gln Thr Val
    290                 295                 300

Gly Gln Tyr Leu Tyr Ala Gln Leu Gln Glu Asn Arg His Asn Ser Leu
305                 310                 315                 320

Lys Asn Lys Val Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe Glu Arg
                325                 330                 335

Ile Trp Glu Thr Gln Ala Ser Phe His Lys Glu Leu Thr Asp Glu Leu
            340                 345                 350

Lys Lys Gln Ile Arg Asp Val Val Ile Phe Tyr Gln Arg Lys Leu Lys
        355                 360                 365

Ser Gln Lys Gly Leu Val Ser Phe Cys Glu Phe Glu Ser Lys Glu Ile
    370                 375                 380

Glu Ile Glu Lys Asp Gly Lys Ala Ile Thr Lys Ser Ile Gly Ala Arg
385                 390                 395                 400

Val Val Pro Lys Ser Ser Pro Leu Phe Gln Glu Phe Lys Ile Trp Gln
                405                 410                 415

Ile Leu Asn Asn Val Thr Cys Lys Arg Lys Gly Ile Arg Lys Lys Lys
            420                 425                 430

Ser Ser Ala Lys Ser Thr Glu Leu Asp Leu Phe Asn Glu Pro Ser Gln
        435                 440                 445

Ser Ile Phe Ser Leu Asp Met Glu Cys Lys Gln Leu Leu Phe Asp Glu
    450                 455                 460
```

```
Leu Asn Leu Lys Gly Asp Leu Lys Ser Asp Lys Val Leu Lys Leu Leu
465                 470                 475                 480

Gly Tyr Ser Pro Gln Glu Trp Glu Ile Asn Tyr Asn Gln Leu Glu Gly
                485                 490                 495

Asn Arg Thr Gln Lys Ser Leu Tyr Glu Ala Tyr Leu Lys Ile Ile Glu
            500                 505                 510

Ile Glu Gly Tyr Glu Val Lys Asp Ile Leu Gln Ile Lys Ser Thr Lys
        515                 520                 525

Asp Asp Trp Ser Leu Asp Glu Ser Pro Leu Ser Ala Ser Glu Ile Arg
    530                 535                 540

Glu Arg Val Lys Val Ile Phe Gln Thr Leu Gly Ile Cys Thr Lys Ile
545                 550                 555                 560

Leu Tyr Phe Asp Pro Leu Leu Pro Val Lys Glu Phe Glu Gln Gln Tyr
                565                 570                 575

Ser Tyr Gln Leu Trp His Leu Leu Tyr Ser Tyr Glu Ser Asp Asp Ser
            580                 585                 590

Thr Ser Gly Asn Glu Thr Leu Tyr Arg Ile Leu Glu Lys Lys Tyr Ala
        595                 600                 605

Phe Lys Arg Glu His Ala Thr Ile Leu Ala Asn Val Ala Leu Gln Asp
    610                 615                 620

Asp Tyr Gly Ser Leu Ser Thr Lys Ala Ile Arg Lys Ile Tyr Pro Tyr
625                 630                 635                 640

Ile Lys Glu Asn Gln Tyr Ser Thr Ala Cys Glu Leu Ala Gly Tyr Lys
                645                 650                 655
```

```
His Ser Lys Leu Ser Leu Thr Thr Glu Glu Leu Glu Ala Arg Glu Leu
            660                 665                 670

Lys Asn Ile Ile Pro Leu Leu Lys Lys Asn Ala Leu Arg Asn Pro Val
        675                 680                 685

Val Glu Lys Ile Leu Asn Gln Met Ile Asn Val Val Asn Ala Leu Ile
    690                 695                 700

Glu Lys Asn Ser Glu Arg Asp Ala Glu Gly Lys Ile Thr Lys Tyr Phe
705                 710                 715                 720

His Phe Asp Glu Ile Arg Ile Glu Leu Ala Arg Glu Leu Lys Lys Asn
                725                 730                 735

Ala Gln Glu Arg Tyr Glu Met Thr Gln Asn Ile Asn Lys Ala Lys Leu
            740                 745                 750

Glu His Gln Lys Ile Ser Glu Lys Leu Gln Lys Gln Phe Gly Ile Lys
        755                 760                 765

Asn Pro Thr Lys Ser Asp Ile Ile Arg Tyr Arg Leu Tyr Gln Glu Leu
    770                 775                 780

Glu His Asn Gly Tyr Lys Glu Leu Tyr Thr Asn Thr Tyr Ile Ala Pro
785                 790                 795                 800

Asp Val Leu Phe Ser Lys Asn Ile Asp Ile Glu His Ile Val Pro Lys
                805                 810                 815

Ala Arg Val Phe Asp Asp Ser Phe Ser Asn Lys Thr Leu Ala Phe Lys
            820                 825                 830

Glu Phe Asn Ile Lys Lys Gly Glu Ser Thr Ala Phe Asp Tyr Ile Thr
        835                 840                 845

Ser Leu Asn Cys Glu Gly Glu Leu Asn Gln Tyr Leu Thr Arg Val Glu
    850                 855                 860
```

```
Asn Ala Tyr Lys Thr Lys Ser Ile Ser Leu Thr Lys Tyr Lys Asn Leu
865                 870                 875                 880

Leu Lys Lys Ala Ser Glu Ile Gly Asp Gly Phe Ile Asn Arg Asp Leu
                885                 890                 895

Arg Asp Thr Gln Tyr Ile Ala Lys Lys Ala Lys Glu Ile Leu Phe Gln
            900                 905                 910

Val Thr Lys Asn Val Leu Ser Thr Ser Gly Ser Ile Thr Asp Arg Leu
        915                 920                 925

Arg Glu Asp Trp Gly Leu Val Asp Val Met Lys Glu Leu Asn Met Pro
    930                 935                 940

Lys Tyr Gln Ser Leu Gly Leu Thr Glu Val Glu Glu Arg Lys Asp Gly
945                 950                 955                 960

Asn Lys Val Thr Val Ile Lys Asp Trp Thr Lys Arg Asn Asp His Arg
                965                 970                 975

His His Ala Met Asp Ala Leu Thr Val Ala Phe Thr Lys Pro Ser Tyr
            980                 985                 990

Ile Gln Tyr Leu Asn His Leu Asn  Ala Arg Lys Asp Glu  Asn Asn Lys
        995                 1000                1005

Asn Tyr  Ser Val Ile Leu Ala  Ile Glu Lys Lys Glu  Thr Ile Lys
    1010                1015                1020

Val Pro  Ile Asn Asn Gly Lys  Asn Lys Arg Val Phe  Ile Glu Pro
    1025                1030                1035

Ile Leu  Asn Phe Arg Gln Val  Ala Lys Lys His Leu  Glu Glu Ile
    1040                1045                1050
```

```
Phe Ile  Ser His Lys Ala Lys  Asn Lys Val Val Thr  Lys Asn Ile
    1055                1060                1065

Asn Lys  Pro Ala Gly Thr Asp  Lys Gln Gln Ile Thr  Leu Thr Pro
    1070                1075                1080

Arg Gly  Gln Leu His Lys Glu  Thr Ile Tyr Gly Lys  Tyr Gln Tyr
    1085                1090                1095

Tyr Val  Asn Lys Glu Glu Lys  Val Gly Val Lys Phe  Asp Glu Arg
    1100                1105                1110

Thr Ile  Thr Lys Val Ser Asn  Pro Leu Tyr Arg Glu  Ala Leu Leu
    1115                1120                1125

Lys Arg  Leu Gln Ala Asn Asp  Asn Asp Pro Lys Lys  Ala Phe Ala
    1130                1135                1140

Gly Lys  Asn Ala Leu Ser Lys  Asn Pro Ile Tyr Leu  Asp Glu Ala
    1145                1150                1155

Lys Thr  Lys Thr Leu Pro Glu  Lys Val Asn Leu Thr  Tyr Leu Glu
    1160                1165                1170

Glu Asp  Phe Ser Ile Arg Lys  Asp Ile Ser Pro Asp  Asn Phe Lys
    1175                1180                1185

Asp Leu  Lys Ser Ile Glu Lys  Val Ile Asp Gln Gly  Val Lys Arg
    1190                1195                1200

Ile Leu  Ile Lys Arg Leu Gln  Ala Tyr Asp Asn Asp  Pro Lys Lys
    1205                1210                1215

Ala Phe  Val Asp Leu Glu Lys  Asn Pro Ile Trp Leu  Asn Lys Glu
    1220                1225                1230

Lys Gly  Ile Ala Ile Lys Arg  Val Thr Ile Ser Gly  Val Ser Asn
    1235                1240                1245
```

```
Ala Gln  Pro Leu His Ile Gly  Lys Asp His Leu Gly  Lys Thr Thr
    1250                1255                1260

Leu Asn  Lys Glu Gly Lys Glu  Val Pro Val Asp Tyr  Val Ser Thr
    1265                1270                1275

Gly Asn  Asn His His Val Ala  Ile Tyr Arg Asp Lys  Glu Gly Asn
    1280                1285                1290

Leu Gln  Glu Gln Ile Val Ser  Phe Phe Glu Ala Val  Val Arg Ala
    1295                1300                1305

Gln Gln  Gly Leu Pro Ile Ile  Asp Lys Asn Tyr Lys  Gln Ala Glu
    1310                1315                1320

Gly Trp  Gln Phe Met Phe Thr  Met Lys Gln Asn Glu  Met Phe Val
    1325                1330                1335

Phe Pro  Asn Glu Ala Thr Gly  Phe Asn Pro Ala Glu  Ile Asp Leu
    1340                1345                1350

Leu Asp  Pro Lys Asn Lys Lys  Leu Ile Ser Pro Asn  Leu Phe Arg
    1355                1360                1365

Val Gln  Thr Ile Ser Ile Val  Lys Tyr Gly Asn Ser  Val Val Arg
    1370                1375                1380

Asp Phe  Lys Phe Arg His His  Leu Glu Thr Thr Leu  Gln Asp Asp
    1385                1390                1395

Lys Ile  Leu Gln Gly Ile Thr  Phe Gln Gln Ile Lys  Ser Leu Glu
    1400                1405                1410

Pro Leu  Arg Asn Ile Val Lys  Val Arg Ile Asn His  Leu Gly Asp
    1415                1420                1425
```

Ile Val Asn Ile Gly Glu Tyr
    1430   1435

<210> 384
<211> 1432
<212> PRT
<213> Capnocytophaga sp.

<400> 384

Met Lys Asn Ile Leu Gly Leu Asp Leu Gly Thr Thr Ser Ile Gly Phe
1   5   10   15

Ala His Ile Val Glu Asp Glu Asn Lys Glu Lys Ser Glu Ile Lys Glu
            20   25   30

Leu Gly Val Arg Ile Val Ser Leu Thr Thr Asp Glu Gln Ser Asp Phe
        35   40   45

Glu Lys Gly Lys Ser Ile Thr Thr Asn Ala Asn Arg Thr Leu Lys His
    50   55   60

Gly Ala Arg Leu Asn Leu Asp Arg Tyr Gln Gln Arg Arg Lys Tyr Leu
65   70   75   80

Ile Asp Leu Leu His Lys Ala Asn Leu Ile Thr Pro Ser Ser Ile Leu
                85   90   95

Ala Glu Asn Gly Lys Asn Thr Thr His Ser Thr Trp Gln Leu Arg Ala
            100   105   110

Lys Ala Val Thr Glu Arg Ile Glu Lys Glu Glu Phe Ala Arg Ile Leu
        115   120   125

Leu Ala Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Ala Lys
    130   135   140

Thr Glu Asp Glu Gly Gln Ala Ile Asp Gly Met Ala Ile Ala Lys Arg
145   150   155   160

```
Leu Tyr Asp Glu Asn Leu Thr Pro Gly Gln Leu Ser Leu Gln Leu Leu
                165                 170                 175

Gln Gln Asn Lys Lys Leu Leu Pro Asp Phe Tyr Arg Ser Asp Leu Gln
            180                 185                 190

Lys Glu Phe Asp Leu Val Trp Asn Phe Gln Lys Gln Phe Tyr Pro Asp
        195                 200                 205

Ile Leu Thr Asp Ile Phe Tyr Lys Glu Leu Gln Gly Lys Gly Lys Asp
    210                 215                 220

Ala Thr Ser Lys Ala Phe Ser Lys Arg Tyr His Phe Asp Thr Ala Glu
225                 230                 235                 240

Asn Lys Gly Ser Lys Glu Ser Val Arg Leu Gln Ala Tyr Gln Trp Arg
                245                 250                 255

Ala Glu Ala Val Ser Lys Gln Leu Ser Lys Glu Glu Val Ala Tyr Val
            260                 265                 270

Leu Thr Glu Ile Asn Asn Asn Leu Asn Asn Ala Ser Gly Tyr Leu Gly
        275                 280                 285

Ala Ile Ser Asp Arg Ser Lys Glu Leu Tyr Phe Asn Arg Gln Thr Val
    290                 295                 300

Gly Gln Tyr Leu Tyr Ala Gln Leu Gln Glu Asn Arg His Asn Ser Leu
305                 310                 315                 320

Lys Asn Lys Val Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe Glu Arg
                325                 330                 335

Ile Trp Glu Thr Gln Ala Leu Phe His Lys Glu Leu Thr Asp Glu Leu
            340                 345                 350

Lys Lys Gln Ile Arg Asp Val Val Ile Phe Tyr Gln Arg Lys Pro Lys
```

```
        355                 360                 365

Ser Gln Lys Gly Leu Ile Ser Phe Cys Glu Phe Glu Ser Lys Glu Ile
    370                 375                 380

Glu Ile Glu Lys Asp Gly Lys Thr Ile Thr Lys Asn Ile Gly Ala Arg
385                 390                 395                 400

Val Val Pro Lys Ser Ser Pro Leu Phe Gln Glu Phe Lys Ile Trp Gln
                405                 410                 415

Ile Leu Asn Asn Val Ile Cys Lys Arg Lys Gly Ile Arg Lys Lys Lys
            420                 425                 430

Ile Ser Ala Lys Thr Thr Gln Leu Asp Leu Leu Asn Glu Ser Ser Gln
        435                 440                 445

Thr Ile Phe Ser Leu Asp Met Glu Cys Lys Gln Leu Leu Phe Asp Glu
    450                 455                 460

Leu Asn Leu Lys Gly Asp Leu Lys Ser Asp Lys Val Leu Lys Leu Leu
465                 470                 475                 480

Gly Tyr Ser Pro Gln Glu Trp Glu Ile Asn Tyr Asn Gln Leu Glu Gly
                485                 490                 495

Asn Arg Thr Gln Lys Ala Leu Tyr Glu Ala Tyr Leu Lys Ile Val Glu
            500                 505                 510

Met Glu Ala His Asp Val Lys Asp Ile Leu Gln Ile Lys Ser Thr Lys
        515                 520                 525

Asp Asp Trp Ser Leu Asp Glu Ser Pro Leu Ser Ala Ser Glu Ile Arg
    530                 535                 540

Glu Ser Val Lys Ala Ile Phe Gln Ala Leu Gly Ile Cys Thr Lys Ile
545                 550                 555                 560
```

```
Leu Tyr Phe Asp Pro Leu Leu Pro Val Lys Asp Phe Glu Glu Gln Asp
               565                 570                 575

Ser Tyr Gln Leu Trp His Leu Leu Tyr Ser Tyr Glu Ser Asp Asp Ser
            580                 585                 590

Thr Ser Gly Asn Glu Thr Leu Tyr Arg Ile Leu Glu Lys Lys Tyr Ala
        595                 600                 605

Phe Lys Arg Glu His Ala Arg Ile Leu Ala Asn Val Ala Leu Gln Asp
    610                 615                 620

Asp Tyr Gly Ser Leu Ser Thr Lys Ala Ile Arg Lys Ile Tyr Pro Asn
625                 630                 635                 640

Ile Lys Glu Asn Gln Tyr Ser Thr Ala Cys Glu Met Ala Gly Tyr Lys
               645                 650                 655

His Ser Lys Leu Ser Leu Thr Thr Glu Glu Leu Glu Ala Arg Glu Leu
            660                 665                 670

Lys Asn Ile Ile Pro Leu Leu Lys Lys Asn Ala Leu Arg Asn Pro Val
        675                 680                 685

Val Glu Lys Ile Leu Asn Gln Met Ile Asn Val Val Asn Ala Leu Ile
    690                 695                 700

Glu Lys Asn Ser Glu Arg Asp Ala Glu Gly Lys Ile Thr Lys Tyr Phe
705                 710                 715                 720

His Phe Asp Glu Ile Arg Ile Glu Leu Ala Arg Glu Leu Lys Lys Asn
               725                 730                 735

Ala Gln Lys Arg Tyr Glu Met Thr Gln Asn Ile Asn Lys Ala Lys Ser
            740                 745                 750

Glu His Gln Lys Ile Ser Glu Ile Leu Gln Lys Glu Phe Gly Ile Lys
```

```
        755                 760                 765

Asn Pro Thr Lys Ser Asp Ile Ile Arg Tyr Arg Leu Tyr Lys Glu Leu
    770                 775                 780

Glu His Asn Gly Tyr Lys Glu Leu Tyr Thr Asn Thr Tyr Ile Ala Pro
785                 790                 795                 800

Asp Val Leu Phe Ser Lys Asn Ile Asp Ile Glu His Ile Val Pro Lys
                805                 810                 815

Ala Arg Val Phe Asp Asp Ser Phe Ser Asn Lys Thr Leu Ala Phe Lys
            820                 825                 830

Asp Phe Asn Ile Lys Lys Gly Glu Ser Thr Ala Phe Asp Tyr Ile Thr
        835                 840                 845

Ser Leu Lys Asn Glu Glu Lys Leu Asn Gln Tyr Leu Ala Arg Val Glu
    850                 855                 860

Asn Ala Tyr Lys Thr Lys Asn Ile Ser Pro Ala Lys Tyr Lys Asn Leu
865                 870                 875                 880

Leu Lys Lys Ala Ser Glu Ile Gly Asp Gly Phe Ile Asn Arg Asp Leu
                885                 890                 895

Arg Asp Thr Gln Tyr Ile Ala Lys Lys Ala Lys Glu Ile Leu Phe Gln
            900                 905                 910

Val Thr Lys Asn Val Leu Ser Thr Ser Gly Ser Ile Thr Asp Arg Leu
        915                 920                 925

Arg Glu Asp Trp Ser Leu Val Asp Val Met Lys Glu Leu Asn Met Pro
    930                 935                 940

Lys Tyr Gln Ser Leu Gly Leu Thr Glu Val Glu Glu Arg Lys Asp Gly
945                 950                 955                 960
```

```
Asn Lys Val Thr Val Ile Lys Asp Trp Thr Lys Arg Asn Asp His Arg
               965                 970                 975

His His Ala Met Asp Ala Leu Thr Val Ala Phe Thr Lys Pro Ser Tyr
            980                 985                 990

Ile Gln Tyr Leu Asn His Leu Asn  Ala Arg Lys Asp Glu  Asn Asn Lys
        995                 1000                1005

Asn Tyr  Ser Val Ile Leu Ala  Ile Glu Lys Lys Glu  Thr Ile Lys
    1010                1015                1020

Val Pro  Thr Asn Asn Gly Lys  Asn Lys Arg Val Phe  Ile Glu Pro
    1025                1030                1035

Ile Pro  Asn Phe Arg Gln Val  Ala Lys Lys His Leu  Glu Glu Ile
    1040                1045                1050

Phe Ile  Ser His Lys Ala Lys  Asn Lys Val Val Thr  Lys Asn Thr
    1055                1060                1065

Asn Lys  Pro Ala Gly Thr Asn  Lys Gln Gln Ile Thr  Leu Thr Pro
    1070                1075                1080

Arg Gly  Gln Leu His Lys Glu  Thr Ile Tyr Gly Lys  Tyr Gln Tyr
    1085                1090                1095

Tyr Val  Asn Lys Glu Glu Lys  Val Gly Val Lys Phe  Asp Lys Glu
    1100                1105                1110

Thr Ile  Ala Lys Val Ser Asn  Pro Leu Tyr Arg Glu  Ala Leu Leu
    1115                1120                1125

Lys Arg  Leu Gln Ala Asn Asp  Asn Asp Pro Lys Lys  Ala Phe Thr
    1130                1135                1140

Gly Lys  Asn Ala Leu Ser Lys  Asn Pro Ile Tyr Leu  Asp Glu Ala
```

```
    1145                1150                1155

Lys Thr  Lys Thr Leu Pro Glu  Lys Val Asn Leu Thr  Tyr Leu Glu
    1160                1165                1170

Glu Asp  Phe Ser Val Arg Lys  Lys Ile Val Pro Lys  Asn Pro Thr
    1175                1180                1185

Ser Lys  Glu Phe Val Pro Asn  Leu Lys Ser Ile Glu  Lys Val Val
    1190                1195                1200

Asp Glu  Gly Val Arg Asn Ile  Leu Ile Glu Arg Leu  Arg Val Tyr
    1205                1210                1215

Asn Asn  Asp Pro Glu Lys Ala  Phe Val Asp Leu Glu  Lys Asn Pro
    1220                1225                1230

Ile Trp  Leu Asn Lys Glu Lys  Gly Ile Ala Ile Lys  Arg Val Thr
    1235                1240                1245

Ile Ser  Gly Val Asn Asn Ala  Gln Pro Leu His Ile  Gly Lys Asp
    1250                1255                1260

His Leu  Gly Lys Thr Thr Leu  Asn Lys Glu Gly Lys  Glu Ile Pro
    1265                1270                1275

Val Asp  Tyr Val Ser Thr Gly  Asn Asn His His Val  Ala Ile Tyr
    1280                1285                1290

Arg Asp  Lys Glu Gly Asn Leu  Gln Glu Gln Ile Val  Ser Phe Phe
    1295                1300                1305

Glu Ala  Val Val Arg Thr Gln  Gln Gly Leu Pro Ile  Ile Asp Lys
    1310                1315                1320

Thr Tyr  Lys Gln Glu Glu Gly  Trp Gln Phe Leu Phe  Thr Met Lys
    1325                1330                1335
```

```
Gln Asn  Glu Met Phe Val Phe  Pro Asn Glu Ala Thr  Gly Phe Asn
    1340                1345                1350


Pro Ala  Glu Ile Asp Leu Leu  Asp Pro Lys Asn Lys  Lys Gln Ile
    1355                1360                1365


Ser Pro  Asn Leu Phe Arg Val  Gln Lys Ile Ala Thr  Lys Asp Tyr
    1370                1375                1380


Phe Phe  Arg His His Leu Glu  Thr Asn Val Glu Thr  Asp Asn Val
    1385                1390                1395


Leu Lys  Asn Thr Thr Trp Lys  Arg Glu Gly Leu Ser  Gly Leu Lys
    1400                1405                1410


Asp Ile  Val Lys Val Arg Ile  Asn His Leu Gly Asp  Ile Val Ser
    1415                1420                1425


Ile Gly  Glu Tyr
    1430
```

<210> 385
<211> 1426
<212> PRT
<213> Capnocytophaga sp.

<400> 385

```
Met Lys Asn Ile Leu Gly Leu Asp Leu Gly Thr Thr Ser Ile Gly Phe
1               5                  10                  15


Thr His Ile Val Glu Asp Glu Asn Lys Glu Lys Ser Glu Ile Lys Glu
            20                  25                  30


Leu Gly Val Arg Ile Val Ser Leu Thr Thr Asp Glu Gln Ser Asp Phe
        35                  40                  45


Glu Lys Gly Lys Ser Ile Ser Thr Asn Ala Asn Arg Thr Leu Lys His
    50                  55                  60
```

```
Gly Ala Arg Leu Asn Leu Asp Arg Tyr Gln Gln Arg Arg Lys Phe Leu
65                  70                  75                  80

Ile Asp Leu Leu Gln Lys Ala Asn Leu Ile Thr Ser Ser Ser Ile Leu
                85                  90                  95

Ala Glu Asn Gly Lys Asn Thr Thr His Ser Thr Trp Gln Leu Arg Ala
            100                 105                 110

Lys Ala Val Thr Glu Arg Ile Glu Lys Glu Glu Phe Ala Arg Val Leu
        115                 120                 125

Leu Ala Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Ala Lys
    130                 135                 140

Thr Glu Asp Glu Gly Gln Ala Ile Asp Gly Met Ala Ile Ala Lys Arg
145                 150                 155                 160

Leu Tyr Asp Glu Asn Leu Thr Pro Gly Gln Leu Ser Leu Gln Leu Leu
                165                 170                 175

Gln Gln Asn Lys Lys Leu Leu Pro Asp Phe Tyr Arg Ser Asp Leu Gln
            180                 185                 190

Lys Glu Phe Asp Leu Val Trp Asn Phe Gln Lys Gln Phe Tyr Pro Asp
        195                 200                 205

Ile Leu Thr Asp Ser Phe Tyr Lys Glu Leu Gln Gly Lys Gly Lys Asp
    210                 215                 220

Ala Thr Ser Lys Ala Phe Ser Lys Arg Tyr His Phe Asp Thr Ala Glu
225                 230                 235                 240

Asn Lys Gly Ser Arg Glu Ser Val Arg Leu Gln Ala Tyr Gln Trp Arg
                245                 250                 255
```

```
Ala Glu Ala Ile Ser Lys Gln Leu Ser Lys Glu Glu Val Ala Tyr Val
            260                 265                 270

Leu Thr Glu Ile Asn Asn Asn Leu Asn Asn Ala Ser Gly Tyr Leu Gly
        275                 280                 285

Ala Ile Ser Asp Arg Ser Lys Glu Leu Tyr Phe Asn Arg Gln Thr Val
    290                 295                 300

Gly Gln Tyr Leu Tyr Ala Gln Leu Gln Glu Asn Lys His Asn Ser Leu
305                 310                 315                 320

Lys Asn Lys Val Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe Glu Arg
                325                 330                 335

Ile Trp Glu Thr Gln Ala Ser Phe His Lys Glu Leu Thr Glu Glu Leu
            340                 345                 350

Lys Lys Gln Ile Arg Asp Val Val Ile Phe Tyr Gln Arg Lys Leu Lys
        355                 360                 365

Ser Gln Lys Gly Leu Ile Ser Phe Cys Glu Phe Glu Ser Lys Glu Ile
    370                 375                 380

Glu Ile Glu Lys Asp Gly Lys Thr Ile Thr Lys Ser Ile Gly Ala Arg
385                 390                 395                 400

Val Val Pro Lys Ser Ser Pro Leu Phe Gln Glu Phe Lys Ile Trp Gln
                405                 410                 415

Ile Leu Asn Asn Val Thr Cys Lys Arg Lys Gly Ile Arg Lys Lys Lys
            420                 425                 430

Ser Ser Ala Lys Ser Thr Glu Leu Asp Leu Phe Asn Glu Pro Ser Gln
        435                 440                 445

Thr Ile Phe Ser Leu Asp Met Glu Cys Lys Gln Leu Leu Phe Glu Glu
    450                 455                 460
```

```
Leu Asn Leu Lys Gly Asp Leu Lys Ser Asp Lys Val Leu Lys Leu Leu
465                 470                 475                 480

Gly Tyr Ser Pro Gln Glu Trp Glu Ile Asn Tyr Asn Gln Leu Glu Gly
                485                 490                 495

Asn Arg Thr Gln Lys Ala Leu Tyr Glu Ala Tyr Leu Lys Ile Val Glu
            500                 505                 510

Met Glu Ala His Asp Val Lys Asp Ile Leu Gln Ile Lys Ser Thr Lys
        515                 520                 525

Asp Asp Trp Ala Leu Glu Glu Ser Pro Leu Ser Ala Ser Glu Ile Arg
    530                 535                 540

Glu Arg Val Lys Ala Ile Phe Gln Thr Leu Gly Ile Cys Thr Lys Ile
545                 550                 555                 560

Leu Tyr Phe Asp Pro Leu Leu Pro Val Lys Glu Phe Glu Glu Gln Asp
                565                 570                 575

Ser Tyr Gln Leu Trp His Leu Leu Tyr Ser Tyr Glu Ser Asp Asp Ser
            580                 585                 590

Thr Ser Gly Asn Glu Thr Leu Tyr Arg Ile Leu Glu Lys Lys Tyr Ala
        595                 600                 605

Phe Lys Arg Glu His Ala Thr Ile Leu Ala Asn Val Thr Leu Gln Asp
    610                 615                 620

Asp Tyr Gly Ser Leu Ser Thr Lys Ala Ile Arg Lys Ile Tyr Pro Tyr
625                 630                 635                 640

Ile Lys Glu Asn Gln Tyr Ser Thr Ala Cys Glu Lys Ala Gly Tyr Lys
                645                 650                 655
```

```
His Ser Lys Leu Ser Leu Thr Thr Glu Glu Leu Glu Ala Arg Glu Leu
            660                 665                 670

Lys Asn Ile Ile Pro Leu Leu Lys Lys Asn Ala Leu Arg Asn Pro Val
        675                 680                 685

Val Glu Lys Ile Leu Asn Gln Met Ile Asn Val Val Asn Ala Leu Ile
    690                 695                 700

Glu Lys Asn Ser Glu Arg Asp Ala Glu Gly Lys Ile Thr Lys Tyr Phe
705                 710                 715                 720

His Phe Asp Glu Ile Arg Ile Glu Leu Ala Arg Glu Leu Lys Lys Asn
                725                 730                 735

Ala Gln Glu Arg Tyr Glu Met Thr Gln Asn Ile Asn Lys Ala Lys Leu
            740                 745                 750

Glu His Gln Lys Ile Ser Gly Ile Leu Gln Lys Glu Phe Gly Ile Lys
        755                 760                 765

Asn Pro Thr Lys Ser Asp Ile Thr Arg Tyr Arg Leu Tyr Gln Glu Leu
    770                 775                 780

Ala His Asn Gly Tyr Asn Asp Leu Tyr Thr Asn Thr Tyr Ile Pro Lys
785                 790                 795                 800

Glu Leu Leu Phe Ser Lys Asn Ile Asp Ile Glu His Ile Val Ser Lys
                805                 810                 815

Ala Arg Val Phe Asp Asp Ser Phe Ser Asn Lys Thr Leu Ala Phe Arg
            820                 825                 830

Glu Phe Asn Ile Lys Lys Gly Glu Ser Thr Ala Phe Asp Tyr Ile Thr
        835                 840                 845

Ser Leu Asn Asn Glu Glu Glu Leu Asn Gln Tyr Leu Asn Arg Val Glu
    850                 855                 860
```

```
Asn Ala Tyr Lys Thr Lys Asn Ile Ser Pro Ala Lys Tyr Lys Asn Leu
865                 870                 875                 880


Leu Lys Lys Ala Ser Glu Ile Gly Asp Gly Phe Ile Asn Arg Asp Leu
                885                 890                 895


Arg Asp Thr Gln Tyr Ile Ala Lys Lys Ala Lys Glu Ile Leu Phe Gln
            900                 905                 910


Val Thr Lys Asn Val Leu Ser Thr Ser Gly Ser Ile Thr Asp Arg Leu
        915                 920                 925


Arg Glu Asp Trp Gly Leu Val Asp Val Met Lys Glu Leu Asn Met Pro
    930                 935                 940


Lys Tyr Gln Ser Leu Gly Leu Thr Glu Val Glu Glu Arg Lys Glu Gly
945                 950                 955                 960


Asn Lys Val Thr Val Ile Lys Asn Trp Thr Lys Arg Asn Asp His Arg
                965                 970                 975


His His Ala Met Asp Ala Leu Thr Val Ala Phe Thr Lys Pro Ser Tyr
            980                 985                 990


Ile Gln Tyr Leu Asn His Leu Asn  Ala Arg Lys Asp Lys  Asn Asn Lys
        995                 1000                1005


Asn Tyr  Ser Val Ile Leu Ala  Ile Glu Glu Lys Glu  Thr Ile Lys
    1010                1015                1020


Val Pro  Thr Asn Asn Gly Lys  Asn Lys Arg Val Phe  Ile Glu Pro
    1025                1030                1035


Ile Pro  Asn Phe Arg Gln Val  Ala Lys Lys His Leu  Glu Glu Ile
    1040                1045                1050
```

```
Phe Ile  Ser His Lys Ala Lys  Asn Lys Val Val Thr  Lys Asn Thr
    1055                1060                1065

Asn Lys  Pro Ala Gly Thr Asp  Lys Gln Gln Ile Thr  Leu Thr Pro
    1070                1075                1080

Arg Gly  Gln Leu His Lys Glu  Thr Val Tyr Gly Lys  Tyr Gln Tyr
    1085                1090                1095

Tyr Val  Asn Lys Glu Glu Lys  Ile Gly Val Lys Phe  Asp Lys Glu
    1100                1105                1110

Thr Ile  Ala Lys Val Ser Asn  Pro Val Tyr Arg Glu  Ala Leu Leu
    1115                1120                1125

Lys Arg  Leu Gln Ala Asn Asp  Asn Asp Pro Lys Lys  Ala Phe Ala
    1130                1135                1140

Gly Lys  Asn Ala Leu Ser Lys  Asn Pro Ile Tyr Leu  Asp Glu Ala
    1145                1150                1155

Lys Thr  Lys Thr Leu Thr Glu  Lys Val Asn Leu Thr  Tyr Leu Glu
    1160                1165                1170

Glu Asp  Phe Ser Ile Arg Lys  Asp Ile Ser Pro Asp  Asn Phe Lys
    1175                1180                1185

Asp Leu  Lys Ser Ile Glu Lys  Val Ile Asp Gln Gly  Val Lys Arg
    1190                1195                1200

Ile Leu  Ile Lys Arg Leu Gln  Asp Tyr Asp Asn Asp  Pro Lys Lys
    1205                1210                1215

Ala Phe  Val Asp Leu Glu Lys  Asn Pro Ile Trp Leu  Asn Lys Glu
    1220                1225                1230

Lys Gly  Ile Ala Ile Lys Arg  Val Thr Ile Ser Gly  Val Asn Asn
    1235                1240                1245
```

```
Ala Gln  Pro Leu His Ile Gly  Lys Asp His Leu Gly  Lys Thr Thr
    1250                1255                1260

Leu Asn  Lys Glu Gly Lys Glu  Ile Pro Val Asp Tyr  Val Ser Thr
    1265                1270                1275

Gly Asn  Asn His His Val Ala  Ile Tyr Arg Asp Lys  Glu Gly Asn
    1280                1285                1290

Leu Gln  Glu Gln Ile Val Ser  Phe Phe Glu Ala Val  Val Gly Ala
    1295                1300                1305

Gln Gln  Gly Leu Pro Ile Val  Asp Lys Thr Tyr Lys  Gln Ala Glu
    1310                1315                1320

Gly Trp  Gln Phe Leu Phe Thr  Met Lys Gln Asn Glu  Met Phe Val
    1325                1330                1335

Phe Pro  Asn Glu Ala Thr Gly  Phe Asn Pro Ala Glu  Ile Asp Leu
    1340                1345                1350

Leu Asp  Pro Lys Asn Lys Lys  Gln Ile Ser Pro Asn  Leu Phe Arg
    1355                1360                1365

Val Gln  Lys Ile Ala Thr Lys  Asp Tyr Phe Phe Arg  His His Leu
    1370                1375                1380

Glu Thr  Asn Val Asp Thr Asp  Asn Val Leu Lys Asn  Thr Thr Trp
    1385                1390                1395

Lys Arg  Glu Gly Leu Ser Gly  Leu Lys Asp Ile Val  Lys Val Arg
    1400                1405                1410

Ile Asn  His Leu Gly Asp Ile  Val Ser Ile Gly Glu  Tyr
    1415                1420                1425
```

<210> 386
<211> 1450
<212> PRT
<213> Capnocytophaga sp.

<400> 386

Met Lys Arg Ile Leu Gly Leu Asp Leu Gly Ser Asn Ser Ile Gly Trp
1 5 10 15

Ala Phe Val Glu Gln Asp Phe Glu Asn Lys Gln Gly Lys Ile Ile Ala
20 25 30

Thr Gly Ser Arg Ile Ile Pro Met Asp Gln Gly Ile Leu Gly Asp Phe
35 40 45

Glu Lys Gly Asn Thr Val Ser Gln Thr Ala Glu Arg Thr Thr Tyr Arg
50 55 60

Ser Met Arg Arg Leu Arg Glu Arg His Leu Leu Arg Arg Glu Arg Leu
65 70 75 80

His Arg Val Leu His Ile Leu Gly Phe Leu Pro Pro His Tyr Asp Ala
85 90 95

Gln Ile Asp Phe Thr Lys Arg Tyr Gly Lys Phe Ile Asp Asn Ala Glu
100 105 110

Pro Lys Ile Ala Tyr Asn Asn Gly Asn Phe Ile Phe Met Asn Ser Phe
115 120 125

Asn Glu Met Ile Glu Asp Phe Lys Lys Tyr Gln Pro Gln Leu Phe Tyr
130 135 140

Lys Lys Ser Asn Gly Glu Glu Ser Lys Ile Pro Tyr Asp Trp Thr Ile
145 150 155 160

Tyr Tyr Leu Arg Lys Lys Val Leu Ser Gln Lys Ile Thr Gln Gln Glu
165 170 175

```
Leu Ala Trp Leu Ile Leu His Phe Asn Gln Lys Arg Gly Tyr Tyr Gln
            180                 185                 190

Leu Arg Gly Glu Glu Glu Thr Glu Asn Pro Asn Lys Glu Val Ala Phe
        195                 200                 205

His Ser Leu Lys Val Val Asp Val Glu Ala Glu Ala Pro Asn Lys Lys
    210                 215                 220

Gly Glu Ile Trp Tyr Thr Ile Arg Leu Glu Asn Gly Trp Ile Tyr Arg
225                 230                 235                 240

Arg Thr Ser Lys Ile Pro Leu Asp Asp Trp Lys Gly Lys Thr Arg Asp
                245                 250                 255

Phe Ile Val Thr Thr Asp Leu Asn Asp Asp Gly Thr Ile Lys Val Asp
            260                 265                 270

Lys Glu Gly Lys Glu Lys Arg Ser Phe Arg Ala Pro Asp Glu Asn Asp
        275                 280                 285

Trp Asn Leu Leu Lys Lys Lys Thr Glu His Asp Ile Asp Phe Ser Gly
    290                 295                 300

Lys Thr Val Gly Ala Tyr Ile Tyr Asp His Leu Leu Gln Asn Pro Asn
305                 310                 315                 320

Gln Lys Ile Lys Gly Lys Leu Val Arg Thr Ile Glu Arg Lys Tyr Tyr
                325                 330                 335

Lys Asp Glu Leu Lys Ala Ile Leu Ala Lys Gln Ile Ala Leu Gln Pro
            340                 345                 350

Glu Leu Phe Thr Glu Thr Leu Leu Ala Asp Cys Ile Arg Glu Leu Tyr
        355                 360                 365

Arg Lys Asn Glu Thr Gln Gln Gln Asn Leu Leu Ser Lys Asp Phe Leu
```

```
    370                 375                 380

His Leu Phe Val Glu Asp Ile Ile Phe Tyr Gln Arg Pro Leu Arg Ser
385                 390                 395                 400

Lys Lys Ser Thr Ile Ala Asn Cys Thr Leu Glu Lys Arg Ser Tyr Ile
                405                 410                 415

Asp Lys Glu Thr Asn Glu Arg Lys Asp Thr Phe Ile Lys Val Cys Ala
            420                 425                 430

Lys Ser Asn Pro Tyr Tyr Gln Glu Phe Arg Val Leu Gln Trp Leu Gln
        435                 440                 445

Asn Leu Arg Ile Tyr Glu Ile Glu Thr Asp Arg Glu Val Thr Ala Glu
    450                 455                 460

Phe Ile Glu Thr Ala Glu Asp Tyr Glu Ala Leu Phe Asn Phe Leu Met
465                 470                 475                 480

Ser Gln Lys Glu Ile Asp Asn Glu Gly Leu Leu Lys Tyr Phe Leu Phe
                485                 490                 495

Ala Lys Asn Pro Gln Ile Lys Asp Lys Val Ala Lys Ser Glu Leu Lys
            500                 505                 510

Lys Trp Leu Thr Thr Tyr Arg Trp Asn Tyr Val Tyr Asp Ala Ala Asp
        515                 520                 525

Asn Ser Ser Lys Lys Tyr Pro Met Asn Glu Thr Gly Tyr Asp Leu Gln
    530                 535                 540

Arg Tyr Leu Gln Lys Val Glu Gly Leu Pro Ala Asn Phe Leu Thr Phe
545                 550                 555                 560

Asp Ile Thr Tyr Arg Leu Trp His Leu Leu Tyr Ser Val Lys Asp Lys
                565                 570                 575
```

```
Val Glu Phe Glu Lys Ala Leu Lys Lys Phe Ala Gln Glu Tyr Gln Leu
            580                 585                 590

Asp Glu Ala Ser Phe Val Asp Ser Phe Lys Asn Phe Lys Pro Tyr Pro
        595                 600                 605

Asn Glu Tyr Gly Ser Phe Ser Glu Lys Ala Ile Lys Lys Leu Leu Pro
    610                 615                 620

Leu Met Arg Phe Gly Asn His Trp Asp Phe Asn Arg Ile Asp Val Ser
625                 630                 635                 640

Thr Gln Lys Arg Ile Asp Asp Leu Ile Asn Gly Val Ala Asn Asp Glu
                645                 650                 655

Ile Arg Thr Ile Ile Arg Glu Lys Ala Glu Lys Tyr Gln Leu Asn Ser
            660                 665                 670

Glu Ser Cys Phe Gln Gly Leu Pro Leu Trp Leu Ala Gln Tyr Val Val
        675                 680                 685

Tyr Asn Arg His Ala Glu Ala Thr Asp Ile Glu Lys Trp Thr Ser Val
    690                 695                 700

Ser Asp Leu Glu Thr Tyr Leu Glu Asp Phe Lys Gln His Ser Leu Arg
705                 710                 715                 720

Asn Pro Ile Val Glu Gln Val Val Thr Glu Thr Leu Arg Val Val Arg
                725                 730                 735

Asp Ile Trp Gln Gln Tyr Gly Gly Gly Gln Ala Asn Phe Phe Asp Glu
            740                 745                 750

Ile His Ile Glu Leu Gly Arg Glu Leu Lys Lys Thr Ala Glu Glu Arg
        755                 760                 765

Lys Gln Leu Ser Asn Arg Asn Gln Glu Asn Glu Asn Thr Asn Leu Arg
```

```
    770                 775                 780

Ile Lys Lys Leu Leu Ala Glu Leu Lys Glu Asp Ala Ser Ile Gln Asn
785                 790                 795                 800

Val Arg Pro Tyr Ser Pro Val Gln Gln Glu Leu Leu Lys Ile Tyr Glu
                805                 810                 815

Glu Gly Val Phe Ser Ser Thr Asp Gln Val Glu Glu Asp Ile Gln Lys
            820                 825                 830

Ile Arg Lys Lys Ala Glu Pro Thr Thr Pro Glu Ile Gln Arg Tyr Lys
        835                 840                 845

Leu Trp Leu Glu Gln Lys Tyr Lys Ser Pro Tyr Thr Gly Glu Val Ile
    850                 855                 860

Ser Leu Thr Lys Leu Phe Thr Glu Glu Tyr Glu Ile Glu His Ile Ile
865                 870                 875                 880

Pro Gln Ser Arg Tyr Tyr Asp Asp Ser Leu Ser Asn Lys Val Ile Cys
                885                 890                 895

Glu Ser Ala Val Asn Lys Leu Lys Thr Asn Gln Leu Gly Leu Glu Phe
            900                 905                 910

Ile Gln Asn His His Gly Glu Lys Val Arg Ile Thr Gly Asn Lys Glu
        915                 920                 925

Val Thr Ile Phe Thr Glu Glu Gln Tyr Lys Glu Phe Val Lys Lys His
    930                 935                 940

Tyr Ala Asn Asn Ser Ala Lys Gln Gln Lys Leu Leu Leu Asn Glu Ile
945                 950                 955                 960

Pro Glu Lys Met Val Ala Arg Gln Leu Asn Asp Thr Arg Tyr Ile Ser
                965                 970                 975
```

```
Lys Tyr Ile Ser Glu Ile Leu Ser Lys Ile Val Arg Ser Asp Glu Lys
            980                 985                 990

Asp Glu Gly Val Asn Ser Lys Asn  Val Ile Pro Cys Thr  Gly Lys Ile
        995                 1000                1005

Thr Thr  Ala Leu Lys Gln Asp  Trp Gly Leu Asn Asp  Val Trp Asn
    1010                1015                1020

Glu Leu  Ile Leu Pro Arg Phe  Glu Arg Met Asn Gln  Leu Thr Gln
    1025                1030                1035

Thr Gln  Leu Phe Thr Ser Tyr  Asn Asp Arg Phe Gln  Lys Asn Leu
    1040                1045                1050

Pro Thr  Val Pro Ile Glu Tyr  Ser Gln Gly Phe Gln  Lys Lys Arg
    1055                1060                1065

Ile Asp  His Arg His His Ala  Met Asp Ala Leu Val  Ile Ala Cys
    1070                1075                1080

Ala Thr  Arg Glu His Ile Asn  Tyr Met Asn Asn Gln  His Ala Leu
    1085                1090                1095

Asp Lys  Asn Lys Asp Lys Lys  Glu Lys Gln Gln Ser  Arg Ile Asp
    1100                1105                1110

Leu Arg  Thr Ile Leu Cys Glu  Lys Lys Asn Asn Asn  Trp Gln Phe
    1115                1120                1125

Lys Lys  Pro Trp Ser Thr Phe  Thr Gln Glu Thr Lys  Glu Ala Leu
    1130                1135                1140

Glu His  Ile Val Val Ser Phe  Lys Gln Asn Leu Arg  Val Ile Asn
    1145                1150                1155

Lys Ala  Thr Asn Tyr Tyr Glu  Lys Trp Glu Glu Lys  Asn Gly Val
```

```
    1160                1165                1170

Leu Val  Lys Lys Lys Val Lys  Gln Glu Gly Thr Asn  Trp Ala Ile
    1175                1180                1185

Arg Lys  Pro Leu His Lys Glu  Thr Val Ser Gly Lys  Ile Val Leu
    1190                1195                1200

Asp Arg  Lys Ile Gly Lys Asp  Lys Ile Leu Thr Ala  Thr Arg Lys
    1205                1210                1215

Glu Val  Asp Ile Thr Phe Thr  Glu Lys Ile Ile Ser  Ser Ile Thr
    1220                1225                1230

Asp Thr  Gly Ile Gln Lys Ile  Leu Leu Asn Tyr Leu  Asn Tyr Lys
    1235                1240                1245

Gly Ser  Pro Glu Val Ala Phe  Ser Ala Glu Gly Leu  Glu Glu Leu
    1250                1255                1260

Asn Lys  Asn Ile Ala Gln Tyr  Asn Asp Gly Lys Lys  His Gln Pro
    1265                1270                1275

Ile Tyr  Lys Val Arg Ile Phe  Glu Glu Gly Ser Lys  Phe Pro Leu
    1280                1285                1290

Gly Glu  Thr Gly Ala Lys Ala  Thr Lys Phe Val Glu  Ala Ala Lys
    1295                1300                1305

Gly Thr  Asn Leu Phe Phe Gly  Val Tyr Gln Gly Lys  Glu Lys Arg
    1310                1315                1320

Ser Tyr  Ala Thr Ile Pro Leu  Asn Glu Val Ile Glu  Arg Gln Lys
    1325                1330                1335

Gln Gly  Leu Pro Ser Val Pro  Glu Arg Asn Glu Lys  Gly Glu Pro
    1340                1345                1350
```

```
Leu Leu  Phe Ser Leu Ser Pro  Asn Asp Leu Val Tyr  Val Pro Met
    1355                1360                1365


Glu Gly  Glu Ile Ala Glu Thr  Ile Asp Phe Asn Asn  Leu Ser Lys
    1370                1375                1380


Glu Gln  Lys Glu Arg Ile Tyr  Lys Thr Val Ser Phe  Thr Gly Asn
    1385                1390                1395


Gln Cys  Phe Phe Val Gln Glu  Ala Val Ala Thr Pro  Ile Val Asn
    1400                1405                1410


Lys Met  Glu Tyr Ser Pro Leu  Asn Lys Met Glu Arg  Asp Ile Leu
    1415                1420                1425


Gly Thr  Met Ile Lys Glu Val  Cys Ile Lys Leu Lys  Val Asp Arg
    1430                1435                1440


Leu Gly  Asn Ile Thr Lys Ala
    1445                1450
```

<210> 387
<211> 1437
<212> PRT
<213> Capnocytophaga sp.

<400> 387

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Met Lys Tyr Ile Lys Tyr Ile Leu Gly Leu Asp Ile Gly Ser Asn Ser
1               5                   10                  15


Ile Gly Trp Ala Leu Ile Gln Leu Asp Leu Leu Gln Lys Thr Lys Arg
            20                  25                  30


Ile Ile Ala Thr Gly Ser Arg Ile Ile Pro Met Asp Gln Lys Val Leu
        35                  40                  45


Ser Asp Phe Gly Lys Gly Ile Thr Ile Ser Pro Thr Ala Gln Arg Thr
    50                  55                  60
```

```
Ser Tyr Arg Asn Ala Arg His Cys Arg Glu Arg His Leu Leu Arg Arg
65                  70                  75                  80

Glu Arg Leu His Arg Val Leu His Ile Leu Gly Phe Leu Pro Thr His
                85                  90                  95

Tyr Asp Lys Gln Ile Asp Phe Ser Lys Arg Tyr Gly Lys Phe Val Asp
            100                 105                 110

Asn Thr Glu Pro Lys Ile Ala Tyr Asn Glu Arg Lys Phe Leu Phe Met
        115                 120                 125

Asp Ser Phe Gln Glu Met Leu Ala Asp Phe Lys Ile His Gln Pro Asp
    130                 135                 140

Leu Phe Tyr Thr Lys Lys Asn Gly Glu Glu Ser Lys Ile Pro Tyr Asp
145                 150                 155                 160

Trp Thr Ile Tyr Tyr Leu Arg Lys Lys Ala Leu Ser Arg Lys Ile Ser
                165                 170                 175

Lys Glu Glu Leu Ala Trp Ile Ile Leu Asn Phe Asn Gln Lys Arg Gly
            180                 185                 190

Tyr Tyr Gln Leu Arg Glu Glu Glu Glu Glu Asn Lys Glu Asn Asp Phe
        195                 200                 205

Glu Ile Ile Ser Ser Lys Ile Ile Ser Val Ile Lys Lys Asp Lys Asp
    210                 215                 220

Lys Lys Tyr Asn Lys Tyr Trp Tyr Asp Ile Ile Leu Glu Asn Gly Leu
225                 230                 235                 240

Val Tyr Gln Ala Ala Phe Tyr Asn Asp Phe Val Tyr Asn Trp Ile Asn
                245                 250                 255
```

```
Gln Asp Arg Glu Phe Ile Ile Glu Arg Ile Ser Leu Lys Asn Gly Thr
            260                 265                 270

Glu Lys Val Lys Leu Ser Tyr Leu Pro Thr Phe Asp Glu Ile Asp Lys
        275                 280                 285

Met Asp Lys Lys Glu Gln Asp Lys Tyr Tyr Lys Lys Ile Lys Ile Lys
    290                 295                 300

Thr Glu Asn Ser Ile Gly Asn Lys Thr Val Gly Cys Tyr Ile Tyr Asp
305                 310                 315                 320

His Ile Leu Gln Asn Pro Asn Glu Lys Ile Lys Gly Lys Leu Val Arg
                325                 330                 335

Thr Ile Glu Arg Lys Tyr Tyr Lys Glu Glu Leu Lys Ala Ile Leu Glu
            340                 345                 350

Lys Gln Val Ala Leu Gln Pro Glu Leu Phe Thr Asp Gln Leu Phe Ala
        355                 360                 365

Asp Cys Ile Arg Glu Leu Tyr Ser Lys Asn Glu Ala Gln Gln Arg Asn
    370                 375                 380

Leu Ala Ala Arg Asp Phe Val His Leu Phe Val Glu Asp Ile Ile Phe
385                 390                 395                 400

Tyr Gln Arg Ser Leu Arg Arg Gln Lys Ser Thr Leu Ala Asn Cys Ser
                405                 410                 415

Leu Glu Ser Arg Ser Tyr Ile Asp Lys Asp Ser His Thr Arg Lys Glu
            420                 425                 430

Ala Pro Leu Lys Val Cys Pro Lys Ser Asn Pro Tyr Tyr Gln Glu Phe
        435                 440                 445

Arg Val Leu Gln Trp Leu Gln Asn Leu Lys Ile Tyr Glu Ile Asp Thr
    450                 455                 460
```

```
Asp Gln Glu Val Thr His Glu Phe Ile Lys Thr Leu Glu Asp Lys Gln
465                 470                 475                 480

Gln Phe Phe Asp Phe Leu Met Asn Gln Lys Glu Ile Asp Cys Glu Glu
                485                 490                 495

Leu Leu Lys Tyr Phe Leu Asn Gln Thr Tyr Pro Asn Ala Arg Glu Lys
            500                 505                 510

Ala Leu Lys Ser Glu Leu Lys Lys Trp Lys Asp Thr Tyr Arg Trp Asn
        515                 520                 525

Tyr Val Tyr Asp Ile Gly Glu Lys Ser Ser Lys Lys Tyr Pro Met Asn
    530                 535                 540

Glu Thr Arg Tyr Glu Leu Lys Arg His Leu Glu Lys Val Ala Asn Leu
545                 550                 555                 560

Pro Asp Asp Phe Leu Ser Ser Glu Val Glu Tyr Leu Leu Trp His Leu
                565                 570                 575

Ile Tyr Ser Val Lys Asp Lys Val Ala Tyr Glu Lys Gly Leu Lys Thr
            580                 585                 590

Phe Ala Gln Lys His His Leu Asp Lys Asp Ser Phe Val Glu Ser Phe
        595                 600                 605

Lys Lys Phe Lys Pro Tyr Pro Ser Glu Tyr Gly Ser Phe Ser Glu Lys
    610                 615                 620

Ala Ile Arg Lys Leu Leu Pro Leu Met Arg Phe Gly Ser Tyr Trp Asp
625                 630                 635                 640

Phe Asn His Ile Asp Lys Asn Thr Gln Lys Arg Ile Glu Asp Leu Ile
                645                 650                 655
```

```
Thr Gly Val Glu Asn Glu Glu Ile Arg Thr Ile Leu Arg Glu Lys Ala
            660                 665                 670

Glu Lys Tyr Gln Leu Glu Lys Glu Thr Asp Phe Gln Asp Leu Pro Leu
        675                 680                 685

Trp Leu Ala Gln Tyr Ile Val Tyr Asn Arg His Ala Glu Ala Ser Ser
    690                 695                 700

Leu Glu Lys Trp Thr Ser Val Asn Asp Leu Glu Thr Tyr Leu Asn Glu
705                 710                 715                 720

Phe Lys Gln Tyr Ser Leu Arg Asn Pro Ile Val Glu Gln Val Val Met
                725                 730                 735

Glu Thr Leu Arg Val Val Arg Asp Ile Trp Gln Gln Tyr Gly Gln Gly
            740                 745                 750

Gln Ala Ser Phe Phe Asp Glu Ile His Ile Glu Leu Gly Arg Glu Leu
        755                 760                 765

Lys Lys Thr Ala Lys Glu Arg Glu Lys Leu Ser Lys Gln Asn Gln Lys
    770                 775                 780

Asn Glu Asp Ile Asn Leu Ser Ile Lys Glu Lys Leu Lys Glu Leu Glu
785                 790                 795                 800

Lys Tyr Asn Thr Arg Ala Tyr Ser Ile Thr His Gln Glu Lys Tyr Lys
                805                 810                 815

Leu Trp Leu Glu Gln Lys His Ile Ser Pro Tyr Thr Gly Gln Ile Ile
            820                 825                 830

Ser Pro Glu Asn Leu Phe Thr Asp Asn Tyr Glu Ile Glu His Ile Ile
        835                 840                 845

Pro Gln Ser Arg Phe Phe Asp Asp Ser Leu Ser Asn Lys Val Val Cys
    850                 855                 860
```

```
Glu Ser Ile Val Asn Lys Ala Pro Tyr Lys Asp Arg Gln Leu Gly Leu
865                 870                 875                 880


Glu Phe Ile Lys Asn Gln Gly Gly Arg Ile Val Lys Glu Leu Ser Thr
                885                 890                 895


Glu Asn Lys Thr Ile Lys Ile Phe Thr Glu Glu Gln Tyr Arg Thr Phe
            900                 905                 910


Ile Lys Glu His Tyr Ser Asn Asn Pro Glu Lys Thr Lys Lys Leu Leu
        915                 920                 925


Leu Glu Glu Ile Pro Glu Lys Met Val Ala Arg Gln Met Asn Asp Thr
    930                 935                 940


Cys Tyr Ile Ser Lys Phe Ile Ser Glu Ile Leu Ser Lys Ile Val Arg
945                 950                 955                 960


Ser Asp Glu Gln Asp Glu Gly Val His Ser Lys Asn Val Ile Leu Cys
                965                 970                 975


Thr Gly Lys Ile Thr Ser Ala Leu Lys Gln Asp Trp Gly Val Asn Asp
            980                 985                 990


Val Trp Asn Asp Leu Ile Leu Pro  Arg Phe Glu Arg Met  Asn Asp Leu
        995                 1000                1005


Thr Gln  Ser Thr Leu Phe Thr  Thr Tyr Asn Glu Lys  Tyr Gln Lys
    1010                1015                1020


Tyr Leu  Pro Thr Val Pro Met  Glu Tyr Ser Asn Gly  Phe Gln Lys
    1025                1030                1035


Lys Arg  Ile Asp His Arg His  His Ala Met Asp Ala  Ile Ile Ile
    1040                1045                1050
```

```
Ala Cys  Ala Thr Arg Glu His  Ile Asn Tyr Ile Asn  Asn Gln His
    1055                 1060                 1065

Ala Leu  Glu Lys Gly Lys Asp  Lys Lys Glu Lys Gln  Lys Glu His
    1070                 1075                 1080

Asp Lys  Leu Arg Glu Lys Leu  Cys Ile Lys Lys Asp  Asn Lys Gly
    1085                 1090                 1095

Ser Glu  Glu Asn Tyr Ser Trp  Ile Phe Lys Lys Pro  Trp Asp Thr
    1100                 1105                 1110

Phe Thr  Gln Glu Val Gln Ala  Ala Leu Glu Gly Ile  Val Val Ser
    1115                 1120                 1125

Phe Lys  Gln Asn Leu Arg Val  Ile Asn Lys Ala Thr  Asn Tyr Tyr
    1130                 1135                 1140

Glu Arg  Trp Val Glu Glu Asn  Gly Lys Tyr Ile Lys  Lys Met Val
    1145                 1150                 1155

Lys Gln  Glu Gly Thr Asn Trp  Ala Ile Arg Lys Pro  Leu His Glu
    1160                 1165                 1170

Glu Thr  Ile Ser Gly Lys Ile  Tyr Leu Asp Arg Glu  Glu Ile Thr
    1175                 1180                 1185

Lys Asn  Asp Ile Leu Thr Ala  Thr Arg Lys Thr Val  Asp Ser Ser
    1190                 1195                 1200

Phe Asp  Glu Lys Arg Ile Lys  Lys Ile Thr Asp Thr  Gly Ile Gln
    1205                 1210                 1215

Lys Ile  Leu Leu Asn Tyr Leu  Lys Tyr Lys Gly Ser  Pro Glu Ile
    1220                 1225                 1230

Ala Phe  Ser Pro Glu Gly Leu  Glu Glu Leu Asn Lys  Asn Leu Ser
    1235                 1240                 1245
```

```
Ile Tyr  Asn Asp Gly Lys Pro  His Lys Pro Ile Tyr  Lys Val Arg
    1250                1255                1260

Ile Tyr  Glu Lys Gly Ser Gly  Arg Phe Ala Leu Gly  Glu Lys Gly
    1265                1270                1275

Arg Lys  Tyr Lys Lys Tyr Val  Gln Gly Ala Pro Asn  Leu Tyr Phe
    1280                1285                1290

Gly Ile  Tyr Gln Gly Ala Asn  Lys Arg Ser Phe Ala  Thr Ile Pro
    1295                1300                1305

Leu Asn  Glu Val Ile Glu Arg  Gln Lys Gln Gly Arg  Pro Ser Ile
    1310                1315                1320

Pro Glu  Tyr Asn Glu Lys Gly  Asp Pro Leu Leu Phe  Ser Leu Ser
    1325                1330                1335

Pro Asn  Asp Leu Val Tyr Val  Pro Val Glu Gly Glu  Ile Ile Glu
    1340                1345                1350

Asp Ile  Asp Phe Gln Asn Leu  Ser Lys Glu Gln Lys  Glu Arg Ile
    1355                1360                1365

Tyr Asn  Val Asn Asp Phe Ser  Ser Thr Cys Tyr Phe  Thr Pro Asn
    1370                1375                1380

Arg Ile  Ala Lys Ala Ile Phe  Pro Lys Glu Val Asp  Leu Gln Arg
    1385                1390                1395

Lys Gly  Asp Lys Leu Pro Gly  Ser Tyr Asp Thr Lys  Thr Ala Ser
    1400                1405                1410

Leu Glu  Gly Ile Gln Ile Lys  Glu Val Cys Ile Lys  Leu Lys Ile
    1415                1420                1425
```

```
Asp Arg  Leu Gly Asn Ile Ser  Lys Ala
    1430                1435


<210>  388
<211>  1140
<212>  PRT
<213>  Catellicoccus marimammalium

<400>  388

Met Lys Asn Met Thr Lys Val Asn Val Gly Leu Asp Val Gly Ile Ser
1               5                   10                  15


Ser Ala Gly Trp Ser Val Ile Asn Ala Glu Thr Asn Gln Ile Leu Glu
            20                  25                  30


Ser Gly Val Arg Leu Phe Ser Gly Ser Asp Ala Asp Glu Asn Val Asn
        35                  40                  45


Arg Arg Asn Gln Arg Gln Gly Arg Arg Leu Phe Arg Arg Arg Lys Leu
    50                  55                  60


Arg Ile Gln Glu Ala Lys Lys Tyr Leu Glu Asn Val Phe Gln Leu Lys
65                  70                  75                  80


Asp Ile Glu Pro Lys Asp Glu Trp Asn Pro Tyr Glu Ile Arg Val Arg
                85                  90                  95


Ala Leu Asn Glu Lys Val Ser Lys Glu Glu Leu Ser Ile Ala Leu Leu
            100                 105                 110


Asn Ile Val Lys His Arg Gly Ile Ser Tyr Glu Leu Glu Asp Val Thr
        115                 120                 125


Asp Glu Glu Gly Thr Asn Thr Gln Ser Phe Gln Ser Gly Leu Asp Tyr
    130                 135                 140


Asn Arg Arg Leu Leu Lys Thr Lys Thr Val Gly Glu Ile Gln Tyr Asp
145                 150                 155                 160
```

```
Arg Leu Gln Lys Tyr Gly Gln Val Arg Gly Gln Ile Gln Thr Glu Asp
                165                 170                 175

Gly Leu Leu Ile Asn Ile Phe Pro Thr Lys Asn Tyr Val Glu Glu Val
            180                 185                 190

Glu Arg Ile Leu Glu Thr Gln Lys Lys Tyr His Pro Glu Ile Asp Asp
        195                 200                 205

Val Phe Ile Glu Lys Ile Ile Ser Phe Val Thr Arg Lys Arg Glu Tyr
    210                 215                 220

Phe Val Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Ile Tyr
225                 230                 235                 240

Arg Glu Asn Gly Glu Thr Leu Asp Asn Leu Phe Glu Ile Leu Ile Gly
                245                 250                 255

Lys Asp Lys Phe Tyr Pro Glu Glu Tyr Arg Ala Ala Gly Ser Ser Tyr
            260                 265                 270

Thr Ala Gln Ile Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Arg Ile
        275                 280                 285

Pro Thr Thr Glu Asp His His Leu Thr Lys Ala Gln Lys Glu Glu Ile
    290                 295                 300

Ile Thr Glu Leu Lys Asn Thr Ser Arg Leu Ser Gly Gly Met Leu Lys
305                 310                 315                 320

Leu Ile Ser Lys Val Thr Lys Ala Pro Lys Glu Glu Ile Ser Gly Tyr
                325                 330                 335

Arg Lys Asp Glu Lys Asp Lys Pro Asp Leu His Ser Leu Ala Tyr Tyr
            340                 345                 350

Arg Lys Gln Lys Asn Met Leu Glu Lys Glu Gly Ile Gln Ile Ala Asp
```

```
        355                 360                 365

Phe Ser Glu Glu Leu Leu Asp Glu Leu Ala Thr Met Met Thr Leu Asn
    370                 375                 380

Thr Glu Pro Gly Glu Ile Arg Lys Gln Leu Asn Lys Ile Thr Asn Gln
385                 390                 395                 400

Tyr Asp Ile Leu Thr Pro Glu Val Ile Glu Val Leu Val Lys Asn His
                405                 410                 415

Thr Ala Phe Val Ala Thr Ser Asn His Lys Trp His Arg Phe Ser Leu
            420                 425                 430

Lys Leu Met Lys Glu Phe Ile Pro Glu Leu Leu Glu Thr Ser Lys Glu
        435                 440                 445

Gln Ser Thr Ile Leu Cys Glu Arg Gly Phe Ile Gln Asn Arg Ala Ser
    450                 455                 460

Tyr Leu Asp Glu Asn His His Phe Asn Tyr Ala Glu Leu Arg Glu Asn
465                 470                 475                 480

Leu Tyr Asn Pro Val Val Arg Lys Ser Thr Cys Glu Met Leu Lys Val
                485                 490                 495

Phe Thr Ala Ile Gln Glu Lys Tyr Pro Asn Ile Gln Asn Val Ile Val
            500                 505                 510

Glu Leu Pro Arg Glu Thr Asn Glu Asp Glu Gln Lys Arg Lys Ile Lys
        515                 520                 525

Lys Ile Asn Asp Asn Asn Ala Lys Arg Lys Lys Glu Ile Leu Lys Glu
    530                 535                 540

Ala Gln Ala Gln Ser Gly Leu Ser Glu Glu Ala Leu Glu Glu Lys Leu
545                 550                 555                 560
```

```
Leu Lys Thr Lys Gly Leu Tyr Leu Lys Leu Met Leu Trp Tyr Glu Gln
               565                 570                 575

Glu Gly Lys Cys Val Tyr Ser Gly Gln Glu Ile Pro Leu Ser Asp Leu
            580                 585                 590

Leu Gln Asn Lys Gly Gly Tyr Glu Val Asp His Ile Ile Pro Ile Ser
        595                 600                 605

Ile Ser Phe Asp Asp Arg Leu Cys Asn Lys Val Leu Val Arg Gln Gln
    610                 615                 620

Leu Asn Ser Gln Lys Ser Asn Gln Thr Pro Phe Glu Tyr Met Thr Thr
625                 630                 635                 640

His Thr Asp Gly His Leu Ser Phe His Glu Leu Lys Glu Leu Val Gly
               645                 650                 655

Lys Asn Lys Arg Phe Ser Lys Glu Lys Arg Glu Leu Leu Leu Ala Glu
            660                 665                 670

Ile Tyr Ser Asn Asp Ile Glu Thr Arg Lys Arg Phe Ile Asn Arg Asn
        675                 680                 685

Leu Val Asp Thr Ser Tyr Thr Ala Arg Ile Val Leu Asn Ala Leu Gln
    690                 695                 700

Gln Tyr Lys Lys Glu Asn Gln Leu Ser Met Asn Val Ser Val Val Arg
705                 710                 715                 720

Gly Ala Met Thr Asn Ile Leu Arg Lys Lys Val Lys Leu Asp Lys Thr
               725                 730                 735

Arg Glu Thr Phe His His His Ala Ile Asp Ala Ser Leu Met Ala Val
            740                 745                 750

Ile Pro Asn Ile Glu Phe Phe Lys Glu Arg Lys Glu Trp Leu Pro Lys
```

```
        755                 760                 765

Ser Ala Asn Glu Glu Val Val Glu Val Glu Val Ser Glu Glu Glu Thr
    770                 775                 780

Met Pro Glu Lys Glu Phe Lys Val Lys Met Arg Leu Pro Glu Ser Phe
785                 790                 795                 800

Ile Gln Asp Val Gln Ile Leu Gln Arg Asn Ser Phe Ala Lys Glu Glu
                805                 810                 815

Val Ser Gly Pro Gln Thr Arg Glu Arg Asn Leu Lys Ile Lys Phe Ser
            820                 825                 830

His Gln Val Asp Gln Lys Met Asn Arg Lys Val Ala Asp Asp Thr Ile
        835                 840                 845

Tyr Gly Thr Arg Gln Ala Gln Leu Gly Lys Asp Lys Lys Glu Glu Thr
    850                 855                 860

Tyr Val Ile Gly Lys Ile Lys Asp Ile Tyr Asn Tyr Asp Glu Tyr Val
865                 870                 875                 880

Arg Phe Lys Lys Arg Tyr Asp Lys Asn Lys Glu Ser Phe Leu Met Tyr
                885                 890                 895

His His Asp Pro Gln Thr Phe Glu Lys Leu Glu Glu Ile Leu Ala Gln
            900                 905                 910

Tyr Pro Glu Tyr Ile Glu Asp Glu Lys Gly Lys Lys Lys Lys Val Ser
        915                 920                 925

Pro Phe Ala Leu Tyr Arg Glu Glu Asn Gly Pro Val Thr Lys Tyr Ala
    930                 935                 940

Lys Lys Asn Asn Gly Pro Val Ile Lys Gln Leu Lys Tyr Tyr Asp Ser
945                 950                 955                 960
```

```
Lys Leu Asn Arg Lys Ile Asp Ile Ser His Lys Tyr Ser Thr Lys Asn
               965                 970                 975

Arg Gln Val Val Leu Gln Ser Leu Lys Pro Tyr Arg Thr Asp Val Tyr
            980                 985                 990

Arg Asn Gln Asp Thr Gly Glu Tyr  Thr Leu Val Gly Ile  Asp Gln Asn
        995                 1000                1005

Asp Gly  Lys Phe Val Asn Gly  His Tyr Gly Ile Pro  Lys Ser Arg
    1010                1015                1020

Tyr Glu  Glu Ile Lys Ala Asn  Asn Lys Leu Ser Glu  His Asp Glu
    1025                1030                1035

Phe Val  Phe Ser Leu Tyr Lys  Asn Ser Met Val Lys  Val Ile Asp
    1040                1045                1050

Glu Asn  Gly Glu Ser Ile Val  Val Arg Tyr Leu Ser  Arg Ser Met
    1055                1060                1065

Pro Asn  Arg Lys Asn Asn Ala  Glu Ile Lys Pro Val  Glu Lys Tyr
    1070                1075                1080

Gln Phe  Glu Asp Gly Glu Val  Val Pro Val Tyr Gly  Lys Cys Arg
    1085                1090                1095

Lys Gln  Met Gln Thr Val Phe  Val Lys Lys Gly Trp  Thr Leu Leu
    1100                1105                1110

Lys Gly  Asn Thr Asp Ile Leu  Gly Asn Thr Tyr Phe  Val Glu Lys
    1115                1120                1125

Glu Ser  Glu Asn Pro Lys Lys  Met Ile Asp Asp Lys
    1130                1135                1140
```

<210> 389

<211> 1419
<212> PRT
<213> Chryseobacterium sp.

<400> 389

```
Met Met Ile Lys Asn Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile
1               5                  10                  15


Gly Trp Ala Leu Ile Lys Gln Asn Phe Glu Asn Lys Tyr Gly Glu Ile
            20                  25                  30


Leu Gly Met Gly Ser Arg Ile Ile Pro Met Ser Gln Asp Val Leu Gly
        35                  40                  45


Glu Phe Gly Lys Gly Asn Ser Val Ser Gln Thr Ala Ala Arg Thr Gly
    50                  55                  60


Tyr Arg Gly Val Arg Arg Leu Arg Glu Arg Phe Leu Leu Arg Arg Glu
65                  70                  75                  80


Arg Leu His Arg Val Leu Asn Val Leu Asn Phe Leu Pro Glu His Tyr
                85                  90                  95


Ala Ser Gln Ile Asp Phe Glu Lys Arg Phe Gly Lys Phe Lys Tyr Glu
            100                 105                 110


Thr Glu Pro Lys Leu Ala Tyr Asn Asn Asp Gly Phe Phe Phe Lys Asn
        115                 120                 125


Ser Phe Asp Glu Met Leu Gly Asp Phe Lys Asp His Gln Phe His Leu
    130                 135                 140


Leu Glu Asn Gly Arg Lys Val Pro Tyr Asp Trp Thr Ile Tyr Tyr Leu
145                 150                 155                 160


Arg Lys Lys Ala Leu Ser Gln Lys Ile Glu Lys Glu Glu Leu Ala Trp
                165                 170                 175
```

```
Ile Leu Leu Asn Phe Asn Gln Lys Arg Gly Tyr Tyr Gln Leu Arg Gly
            180                 185                 190

Glu Asp Phe Glu Glu Glu Lys Asp Arg Val Phe Val Arg Leu Lys Val
        195                 200                 205

Asp Arg Val Val Asp Ser Gly Glu Asn Ile Lys Gly Lys Ile Leu Tyr
    210                 215                 220

Asp Val Tyr Phe Glu Asn Gly Trp Lys Tyr Glu Lys Gln Ile Val Lys
225                 230                 235                 240

Thr Glu Asp Trp Ile Gly Arg Thr Lys Glu Phe Ile Val Thr Glu Ser
                245                 250                 255

Ile Leu Lys Asn Gly Asp Thr Lys Arg Thr Phe Lys Ala Val Asp Ser
            260                 265                 270

Glu Lys Asp Trp Ile Ala Ile Lys Thr Lys Thr Glu Gln Glu Ile Asp
        275                 280                 285

Lys Ser His Lys Thr Val Gly Ala Tyr Ile Tyr Glu Ala Leu Leu Gln
    290                 295                 300

Asn Pro Lys Gln Lys Ile Lys Gly Lys Leu Val Arg Thr Ile Glu Arg
305                 310                 315                 320

Lys Phe Tyr Arg Glu Glu Leu Lys Lys Ile Leu Glu Arg Gln Lys Glu
                325                 330                 335

Phe His Pro Glu Leu Gln Ser Asp Asp Leu Tyr Asn Asp Cys Ile Arg
            340                 345                 350

Glu Leu Tyr Arg Asn Asn Glu Ala His Gln Ile Thr Leu Ser Lys Lys
        355                 360                 365

Asp Phe Val His Leu Leu Leu Asn Asp Leu Ile Phe Tyr Gln Arg Pro
    370                 375                 380
```

```
Leu Arg Ser Gln Lys Ser Ser Val Ser Asn Cys Thr Leu Glu Phe Arg
385                 390                 395                 400

Lys Tyr Lys Asp Glu Asn Gly Val Glu His Ala Gln Tyr Leu Lys Thr
                405                 410                 415

Ile Pro Lys Ser Asn Pro Tyr Tyr Gln Glu Phe Arg Val Trp Gln Trp
            420                 425                 430

Met Phe Asn Leu Asn Ile Tyr Arg Lys Asp Asp Asp Thr Asn Val Thr
        435                 440                 445

Lys Glu Phe Leu Ser Ser Thr Glu Asp Tyr Glu Thr Leu Phe Glu Phe
    450                 455                 460

Leu Asn Asn Arg Lys Glu Val Asp Gln Lys Ala Leu Leu Arg His Phe
465                 470                 475                 480

Lys Leu Asn Glu Lys Thr His Arg Trp Asn Tyr Val Glu Asp Lys Lys
                485                 490                 495

Tyr Pro Cys Asn Glu Thr Lys Thr Met Ile Ser Thr Arg Leu Glu Lys
            500                 505                 510

Val Glu Asn Tyr Pro Ser Asp Phe Leu Thr Arg Glu Met Glu Gln Asn
        515                 520                 525

Ile Trp His Ile Ile Tyr Ser Val Asn Asp Lys Ile Glu Tyr Glu Lys
    530                 535                 540

Ala Leu Lys Ser Phe Ala His Lys Asn Asn Leu Asp Glu Asn Ser Phe
545                 550                 555                 560

Phe Glu Ala Phe Lys Lys Phe Pro Pro Phe Lys Ser Glu Tyr Gly Ser
                565                 570                 575
```

```
Phe Ser Glu Lys Ala Ile Lys Lys Leu Leu Pro Leu Leu Arg Leu Gly
            580                 585                 590

Lys Tyr Trp Asn Trp Glu Ser Ile Asp Arg Lys Ser Gln Gly Arg Ile
        595                 600                 605

Glu Lys Ile Ile Thr Gly Glu Phe Asp Gly Asn Ile Lys Asp Lys Val
    610                 615                 620

Arg Glu Lys Ala Ile His Leu Thr Ala Glu Asn Asp Phe Gln Gly Leu
625                 630                 635                 640

Gln Leu Trp Leu Ala Gln Tyr Ile Val Tyr Gly Arg His Ser Glu Ala
                645                 650                 655

Ser Met Ile Gly Lys Trp Asn Ser Ala Asp Asp Leu Glu Glu Phe Leu
            660                 665                 670

Lys Gly Phe Lys Gln His Ser Leu Arg Asn Pro Ile Val Glu Gln Val
        675                 680                 685

Ile Thr Glu Thr Leu Arg Val Val Lys Asp Ile Trp Leu Lys Tyr Gly
    690                 695                 700

Asn Gly Ala Lys Asp Phe Phe Ser Glu Ile His Ile Glu Leu Gly Arg
705                 710                 715                 720

Glu Met Lys Gln Thr Lys Asp Glu Arg Val Asp Ala Thr Lys Arg Ile
                725                 730                 735

Thr Glu Asn Glu Asn Thr Asn Leu Arg Ile Lys Ala Leu Leu Ala Glu
            740                 745                 750

Met Met Asn Asp Asn Ser Val Glu Asn Ile Arg Pro Tyr Ser Pro Met
        755                 760                 765

Gln Gln Glu Ile Leu Lys Ile Tyr Glu Asp Gly Ile Leu Lys Ser Asp
    770                 775                 780
```

```
Ile Glu Ile Asp Asp Asp Ile Leu Lys Ile Ser Lys Thr Ala Gln Pro
785                 790                 795                 800

Ser Ser Ser Asp Leu Lys Arg Tyr Lys Leu Trp Leu Glu Gln Arg Tyr
                805                 810                 815

Lys Ser Pro Tyr Thr Gly Gln Ile Ile Pro Leu Asn Lys Leu Phe Thr
            820                 825                 830

Ser Glu Tyr Glu Ile Glu His Ile Ile Pro Gln Ser Arg Tyr Phe Asp
        835                 840                 845

Asp Ser Phe Ser Asn Lys Ile Ile Cys Glu Ser Ala Val Asn Lys Leu
    850                 855                 860

Lys Asp Asn Tyr Ile Gly Leu Gly Phe Ile Lys Gln Phe Gly Gly Met
865                 870                 875                 880

Ile Val Glu Cys Gly Phe Gly Lys Ser Val Glu Ile Phe Lys Ala Glu
                885                 890                 895

Glu Tyr Glu Asp Phe Val Lys Lys His Tyr Ala Asn Asn Arg Ser Lys
            900                 905                 910

Arg Asn Lys Leu Leu Leu Glu Glu Ile Pro Glu Lys Met Ile Asp Arg
        915                 920                 925

Gln Leu Asn Asp Thr Arg His Ile Ser Lys Tyr Ile Ser Gly Val Leu
    930                 935                 940

Ser Asn Ile Val Arg Gln Glu Asp Gly Thr Asp Glu Gly Val Asn Ser
945                 950                 955                 960

Lys Asn Ile Val Pro Gly Asn Gly Lys Ile Thr Thr Gln Leu Lys Gln
                965                 970                 975
```

```
Asp Trp Gly Leu Asn Asp Val Trp Asn Glu Leu Ile Leu Pro Arg Phe
            980                 985                 990

Glu Arg Met Asn Gln Leu Thr Asn  Ser Thr Asp Phe Thr  Ser Trp Asn
        995                 1000                1005

Lys Asn  His Gln Lys Phe Leu  Pro Thr Val Pro Ile  Glu Phe Ser
    1010                1015                1020

Lys Gly  Phe Ser Lys Lys Arg  Ile Asp His Arg His  His Ala Met
    1025                1030                1035

Asp Ala  Leu Val Ile Ala Cys  Ala Thr Lys Asp His  Ile Asn Leu
    1040                1045                1050

Leu Asn  Asn Gln Ser Ala Lys  Ser Asp Thr Lys Arg  Tyr Asp Leu
    1055                1060                1065

Lys Arg  Lys Leu Met Lys Phe  Glu Arg Val Val Tyr  Ser His Ser
    1070                1075                1080

Lys Thr  Gly Glu Lys Ile Glu  Lys Glu Val Pro Lys  Gln Phe Leu
    1085                1090                1095

Lys Pro  Trp Asp Asn Phe Thr  Val Asp Ala Lys Asn  Lys Met Glu
    1100                1105                1110

Thr Ile  Ile Val Ser Phe Lys  Gln Asn Leu Arg Val  Ile Asn Lys
    1115                1120                1125

Ala Thr  Asn His Tyr Glu Lys  Trp Ile Glu Lys Asp  Gly Ile Lys
    1130                1135                1140

Arg Lys  Glu Leu Ile Lys Gln  Glu Gly Thr Asn Trp  Ala Ile Arg
    1145                1150                1155

Lys Pro  Met His Lys Glu Thr  Val Ser Gly Lys Val  Asp Leu Pro
    1160                1165                1170
```

```
Gly Ile  Lys Ile Pro Lys Gly  Lys Ile Leu Thr Ala  Thr Arg Lys
    1175                1180                1185

Ser Leu  Asp Thr Ser Phe Asp  Leu Lys Thr Ile Asn  Ser Ile Thr
    1190                1195                1200

Asp Thr  Gly Ile Gln Lys Ile  Leu Lys Asn Tyr Leu  Glu Phe Lys
    1205                1210                1215

Gly Ser  Ser Glu Leu Ala Phe  Ser Pro Glu Gly Ile  Glu Asp Met
    1220                1225                1230

Asn Lys  Asn Ile Glu Lys Phe  Asn Asp Gly Lys Pro  His Gln Ser
    1235                1240                1245

Ile Asn  Lys Val Arg Ile Phe  Glu Leu Gly Ser Lys  Phe Ser Val
    1250                1255                1260

Gly Gln  Thr Gly Asn Lys Lys  Asp Lys Tyr Val Glu  Ala Ala Lys
    1265                1270                1275

Gly Thr  Asn Leu Phe Phe Ala  Val Tyr Glu Asp Lys  Asn Gly Lys
    1280                1285                1290

Arg Ser  Tyr Glu Thr Ile Pro  Leu Asn Glu Val Ile  Glu Arg Gln
    1295                1300                1305

Lys Gln  Gly Leu Asp Ser Val  Ser Phe Lys Asn Lys  Glu Asp Phe
    1310                1315                1320

Leu Leu  Cys Pro Asn Asp Leu  Val Tyr Val Pro Ser  Glu Asp Glu
    1325                1330                1335

Leu Glu  Asn Ile Tyr Asn Ile  Asp Phe Lys Asn Leu  Thr Thr Glu
    1340                1345                1350
```

```
Lys Thr  Gly Asn Ile Tyr Lys  Val Val Ser Phe Ser  Gly Asn Gln
    1355                 1360                 1365


Ile Phe  Phe Ile Arg Gln Asp  Ile Ala Ile Ser Ile  Val Asn Lys
    1370                 1375                 1380


Ala Glu  Phe Ser Thr Leu Asn  Lys Met Glu Arg Ala  Ile Asp Gly
    1385                 1390                 1395


Ser Met  Ile Lys Glu Asn Cys  Ile Lys Leu Lys Ile  Asp Arg Leu
    1400                 1405                 1410


Gly Asn  Ile Ala Lys Ile
    1415
```

<210> 390
<211> 1065
<212> PRT
<213> Clostridium perfringens

<400> 390

```
Met Asn Lys Asp Ile Asn Tyr Ala Leu Gly Leu Asp Ile Gly Ile Thr
1               5                   10                  15


Ser Val Gly Trp Ala Val Ile Asn Leu Asp Leu Asn Arg Ile Glu Asp
            20                  25                  30


Leu Gly Val Arg Ile Phe Asn Ala Ala Glu Asn Pro Lys Asp Gly Ser
        35                  40                  45


Ser Leu Ala Leu Pro Arg Arg Leu Ala Arg Gly Arg Arg Arg Leu Leu
    50                  55                  60


Arg Arg Lys Ala Tyr Arg Val Glu Arg Val Arg Lys Leu Ile Val Lys
65                  70                  75                  80


Asn Asn Ile Leu Thr Lys Glu Glu Leu Glu Gly Leu Phe Lys Asn Lys
                85                  90                  95
```

```
Glu Val Ile Asp Val Trp Glu Ala Arg Val Lys Gly Leu Asp Tyr Lys
            100                 105                 110

Leu Ser Arg Glu Glu Trp Ala Lys Ile Leu Ile Asn Phe Cys Lys Arg
        115                 120                 125

Arg Gly Phe Lys Ser Asn Arg Lys Asn Glu Thr Lys Asp Lys Glu Ala
    130                 135                 140

Gly Gln Ile Leu Ser Ser Ile Ser Tyr Asn Ile Glu Lys Met Lys Glu
145                 150                 155                 160

Thr Asn Ser Arg Thr Ile Gly Glu Tyr Ile Tyr Asn Glu Val Lys Asn
                165                 170                 175

Ser Asp Asp Ser Tyr Ala Pro Leu Arg Asn Lys Phe Gly Glu Tyr Lys
            180                 185                 190

Met Cys Val Ser Arg Asp Val Leu Arg Glu Glu Ile His Thr Leu Phe
        195                 200                 205

Glu Lys Gln Arg Glu Leu Gly Asn Asn Phe Ala Ser Asp Glu Ile Glu
    210                 215                 220

Asp Lys Tyr Phe Glu Ile Phe Asn Ser Gln Arg Pro Phe Ser Asn Phe
225                 230                 235                 240

Glu Asp Leu Glu Lys Leu Val Gly Phe Cys Thr Phe Glu Arg Lys Lys
                245                 250                 255

His Lys Arg Ala Pro Lys His Cys Ile Ser Ser Glu Glu Phe Thr Leu
            260                 265                 270

Tyr Glu Gly Ile Asn Lys Leu Ser Ile Ile Lys Asp Gly Glu Lys Arg
        275                 280                 285

Lys Leu Ser Glu Glu Glu Arg Thr Leu Val Val Asn Glu Ala Phe Asn
```

```
    290                 295                 300

Lys Lys Glu Ile Lys Tyr Thr Thr Leu Arg Lys Leu Leu Gly Leu Ser
305                 310                 315                 320

Glu Asp Glu Leu Phe Ser Thr Leu Thr Tyr Ser Ile Asp Lys Asp Ile
                325                 330                 335

Ser Lys Thr Glu Asn Thr Lys Phe Val Ser Leu Lys Gly Tyr His Glu
            340                 345                 350

Ile Lys Arg Ala Ile Glu Lys Gly Val Ser Lys Lys Ala Trp Gln Asp
        355                 360                 365

Ile Glu Asn Asn Arg Asn Leu Leu Asn Asp Ile Ala Tyr Val Leu Thr
    370                 375                 380

Leu Gly Lys Thr Asp Asp Glu Ile Glu Lys Gln Leu Arg Leu Arg Asn
385                 390                 395                 400

Val Pro Glu Glu Leu Phe Glu Ser Leu Leu Asp Met Ser Phe Ser Lys
                405                 410                 415

Phe Asn Asn Leu Ser Ile Tyr Ala Leu Glu Lys Ile Leu Pro Phe Met
            420                 425                 430

Lys Glu Gly Tyr Gln Tyr Asn Glu Ala Cys Glu Lys Ala Gly Tyr Asn
        435                 440                 445

Phe Lys Ala Ile Tyr Glu Gly Val Arg Thr Lys Lys Leu Pro Val Ile
    450                 455                 460

Glu Ile Asp Glu Ile Val Asn Pro Val Val Asn Arg Ala Leu Ala Gln
465                 470                 475                 480

Thr Arg Lys Val Ile Asn Ser Val Ile Asp Lys Tyr Gly Ser Pro Val
                485                 490                 495
```

```
Arg Ile Asn Ile Glu Leu Ala Arg Asp Leu Ala Lys Asn Phe Lys Asp
            500                 505                 510

Arg Lys Leu Ile Glu Lys Glu Gln Lys Glu Asn Arg Ala Asn Leu Asp
        515                 520                 525

Lys Ile Arg Glu Asn Leu Arg Glu Leu Met Asp Lys Glu Pro Thr Ala
    530                 535                 540

Val Glu Val Leu Lys Tyr Arg Leu Trp Glu Gln Gln Arg Gly Glu Cys
545                 550                 555                 560

Ala Tyr Thr Gln Ser Gln Ile Ala Leu Glu Arg Leu Phe Ser Pro Gly
                565                 570                 575

Tyr Cys Glu Ile Asp His Ile Ile Pro Phe Ser Arg Ser Phe Asp Asp
            580                 585                 590

Ser Leu Ser Asn Lys Ile Leu Val Leu Gly Ser Glu Asn Gln Arg Lys
        595                 600                 605

Gly Asn Lys Ile Pro Tyr Glu Tyr Phe Gly Glu Asp Ser Glu Arg Trp
    610                 615                 620

Asn Ser Phe Glu Ile Trp Val Lys Gly Ser Tyr Leu Asn Tyr Lys Lys
625                 630                 635                 640

Lys Ala Asn Leu Leu Lys Lys Lys Phe Thr Glu Glu Glu Gln Arg Asp
                645                 650                 655

Trp Lys Ala Arg Asn Leu Gln Asp Thr Lys Tyr Ile Cys Arg Tyr Ile
            660                 665                 670

Ser Asn Phe Val Asn Asn Arg Leu Glu Phe Lys Glu Ser Glu Asn Lys
        675                 680                 685

Gln Lys Val Ile Thr Val Asn Gly Arg Ala Thr Ala Tyr Leu Arg Ser
```

```
    690                 695                 700

Arg Trp Gly Leu Asn Lys Val Arg Glu Asp Gly Asp Lys His His Ala
705                 710                 715                 720

Leu Asp Ala Ala Val Val Gly Val Thr Thr Gln Gly Met Val Gln Lys
                725                 730                 735

Ile Ser Lys Tyr Ser Lys Ala His Glu Leu Tyr Thr Val Arg Lys Asn
            740                 745                 750

Asp Glu Phe Val Asp Val Glu Thr Gly Glu Cys Val Asp Val Asp Glu
        755                 760                 765

Tyr Lys Glu Ile Arg Lys Asp Ile Leu Pro Arg Pro Trp Arg Gly Phe
    770                 775                 780

Ser Glu Glu Leu Lys Leu Arg Leu Ser Asp Asn Pro Leu Glu Glu Leu
785                 790                 795                 800

Lys Lys Leu Pro Ile Glu Thr Tyr Asn Glu Glu Phe Ile Lys Glu Asn
                805                 810                 815

Val Lys Pro Ile Phe Val Ser Arg Val Pro Phe Arg Lys Ile Ser Gly
            820                 825                 830

Lys Leu Phe Lys Glu Thr Ile Tyr Ser Glu Arg Ala Phe Lys Asp Gly
        835                 840                 845

Tyr Phe Val Ser Lys Lys Ser Leu Val Asp Leu Lys Arg Gly Asp Leu
    850                 855                 860

Asp Asn Phe Tyr Asn Tyr Glu Cys Asp Lys Lys Leu Tyr Asp Ala Ile
865                 870                 875                 880

Ser Glu Arg Met Lys Glu Phe Asn Tyr Asn Gly Lys Lys Ala Phe Glu
                885                 890                 895
```

```
Ser Pro Phe Arg Lys Pro Thr Lys Ser Gly Lys Glu Gly Pro Val Val
            900                 905                 910

Arg Ser Val Lys Ile Lys Ser Ala Ala Pro Phe Lys Asp Gly Ile Pro
        915                 920                 925

Met Asn Glu Gly Leu Val Ala Lys Glu Gly Met Val Arg Ile Asp Ile
    930                 935                 940

Tyr Glu Lys Glu Gly Lys Tyr Phe Val Val Pro Val Tyr Arg Tyr Gln
945                 950                 955                 960

Leu Ala Lys Gly Ile Val Pro Lys Arg Ala Ala Ile Ala Gly Lys Ser
                965                 970                 975

Glu Leu Lys Trp Pro Ile Met Asp Gln Thr Tyr Asn Phe Lys Phe Ser
            980                 985                 990

Ile Phe Lys Asn Asp Leu Ile Glu  Ile Lys Tyr Ala Lys  Lys Asp Gly
        995                 1000                1005

Tyr Phe  Gly Tyr Tyr Asp Gly  Phe Asp Arg His Thr  Ala Ser Leu
    1010                1015                1020

Val Ile  Glu Asn His Asp Asn  Ser Asp Arg Tyr Arg  Gly Ile Gly
    1025                1030                1035

Val Lys  Thr Gly Val Val Glu  Phe Asn Lys Tyr Glu  Val Asp Val
    1040                1045                1050

Leu Gly  Asn Tyr His Lys Val  Asn Leu Gly Gly Asn
    1055                1060                1065
```

<210> 391
<211> 1099
<212> PRT
<213> Corynebacterium accolens

<400> 391

```
Met Ser Leu Ser Tyr Arg Val Gly Ile Asp Val Gly Thr Tyr Ser Leu
1               5                  10                  15

Gly Cys Thr Ala Ile Glu Val Asp Asp Asn Asp Gln Pro Val Asn Ile
            20                  25                  30

Leu Ser Ser Val Ser Leu Ile His Asp Ser Gly Leu Asp Pro Asp Gln
        35                  40                  45

Gln Lys Arg Ala Val Thr Arg Leu Ala Ser Ser Gly Val Ala Arg Arg
    50                  55                  60

Thr Arg Arg Leu Tyr Arg Arg Arg Arg Arg Arg Met Ile Asn Leu Glu
65                  70                  75                  80

Lys Phe Leu Thr Ser Gln Gly Trp Glu Thr Arg Pro Phe Glu His Tyr
                85                  90                  95

Ser Asp Pro Tyr Leu Pro Trp Asn Ala Arg Val Ala Leu Val Asn Gly
            100                 105                 110

Tyr Ile Ser Asp Asp Ala Gln Arg Gly Met Tyr Leu Ser Ile Ala Phe
        115                 120                 125

Arg His Ile Ala Asn His Arg Gly Trp Arg Asn Pro Tyr Trp Lys Val
    130                 135                 140

Ser Ser Leu Tyr Ser Pro Asp Lys Pro Ser Asp Ala Phe Glu Gln Ile
145                 150                 155                 160

Arg Lys Glu Leu Glu Glu Ser Thr Gly His Lys Ile Pro Glu Thr Val
                165                 170                 175

Thr Val Gly Gln Leu Ile Ser Phe Ala Gln Phe Gly Lys Asp Arg Leu
            180                 185                 190
```

```
Arg Gly Gly Gly Lys Lys Lys Asp Glu Lys Lys Pro Gln Glu Gln Val
        195                 200                 205

Asn Gln Ala Val Ile Ser Ala Arg Leu His Gln Ile Asp His Ala Arg
    210                 215                 220

Glu Ile Asn Glu Ile Cys Arg Val Gln Lys Ile Asp Asp Ala Leu Arg
225                 230                 235                 240

Lys Gln Ile Leu Asp Leu Val Phe Ala Ala Glu Ser Pro Lys Gly Ala
                245                 250                 255

Gln Ile Gly Arg Val Gly Lys Asp Pro Leu Gln Pro Lys Leu Pro Arg
            260                 265                 270

Ala Leu Lys Ala Ser Asp Ala Phe Gln Gln Tyr Arg Ile Val Ala Leu
        275                 280                 285

Ala Gly Asn Leu Arg Ile Tyr Arg Asp Gly Val Ser Thr Pro Leu Asp
    290                 295                 300

Arg Asp Glu Lys Leu Ile Val Phe Asn Tyr Leu Ile Asn Leu Ser His
305                 310                 315                 320

Lys Glu Glu Pro Ser Trp Leu Lys Val Ala Glu Val Leu Asn Ile Asp
                325                 330                 335

Arg Gly Gln Leu His Gly Thr Ala Thr Met Thr Asp Asp Gly Glu Arg
            340                 345                 350

Ala Gly Ala Ala Pro Pro Val His Asp Thr Asn Arg Thr Ile Leu Gly
        355                 360                 365

Cys Lys Ile Lys Pro Leu Val His Trp Trp Glu Gly Ala Asn Asp Asp
    370                 375                 380

Glu Arg Ala Ala Met Leu Lys Ala Leu Ser Asn Ser Glu Val Glu Asp
385                 390                 395                 400
```

```
Phe Asp Ser Pro Ala Gly Ala Gln Thr Gln Ala Phe Phe Ala Asn Leu
               405                 410                 415

Asp Glu Ser Glu Gln Glu Lys Leu Asp Ser Leu His Leu Pro Ile Gly
            420                 425                 430

Arg Ala Ala Tyr Ser Glu Asp Thr Leu Met Arg Leu Thr Ser Arg Met
        435                 440                 445

Leu Asp Glu Asn Leu Asp Leu Tyr Glu Ala Arg Leu Ala Glu Phe Asp
    450                 455                 460

Ile Pro Lys Asp Trp Ala Pro Pro Ala Pro Arg Ile Gly Glu Pro Val
465                 470                 475                 480

Gly Asn Pro Ala Val Asp Arg Val Leu Lys Gly Val Ala Arg Trp Leu
               485                 490                 495

Glu Ala Ala Ala Asp Glu Trp Gly Ala Pro Lys Ser Val Val Ile Glu
            500                 505                 510

His Val Arg Asp Gly Phe Ile Ser Lys Ser Lys Ala Asn Glu Ile Asp
        515                 520                 525

Arg Ala Asn Asn Ala Arg His Lys Arg Asn Arg Glu Leu Phe Lys Gln
    530                 535                 540

Met Gln Glu Asn Leu Gly Ile Asp Gly Lys Leu Arg Ser Ser Asp Leu
545                 550                 555                 560

Trp Arg Tyr Gln Ser Val Gln Arg Gln Asn Cys Gln Cys Ala Tyr Cys
               565                 570                 575

Gly Ser Pro Ile Thr Tyr Thr Thr Cys Glu Met Asp His Ile Val Pro
            580                 585                 590
```

```
Arg Ala Gly Glu Gly Ser Thr Asn Thr Arg Asp Asn Leu Val Ala Thr
        595                 600                 605

Cys His Arg Cys Asn Leu Ala Lys Lys Asn Ile Pro Phe Ala Val Trp
    610                 615                 620

Ala Ala Gln Thr Asn Ile Pro Gly Val Ser Val Lys Glu Ala Leu Asp
625                 630                 635                 640

Arg Thr Arg His Trp Ser Glu Asp Ser Gly Met Thr Ser Lys Asp Phe
                645                 650                 655

Lys Lys Phe Arg Lys Asn Val Cys Asp Arg Leu Lys Arg Thr Val Val
            660                 665                 670

Asp Glu Pro Leu Asp Ala Arg Ser Met Glu Ser Val Ala Trp Met Ala
        675                 680                 685

Asn Glu Leu Arg Gly Arg Val Ala Gln Arg Phe Gln Glu Glu Asn Thr
    690                 695                 700

Val Val Asn Val Tyr Arg Gly Glu Leu Thr Ala Glu Ala Arg Arg Ala
705                 710                 715                 720

Ala Gly Ile Ser Asp Lys Leu Arg Phe Ile Asp Gly Thr Gly Lys Ser
                725                 730                 735

Arg Leu Asp Arg Arg His His Ala Val Asp Ala Ala Val Val Ala Phe
            740                 745                 750

Thr Gln Asn Tyr Val Ala Glu Thr Leu Ala Ile Arg Ser Asn Lys Lys
        755                 760                 765

Arg Glu Ala Gln Leu Leu Gln Ala Ala Glu Gln Trp Lys Glu Phe Thr
    770                 775                 780

Gly Ser Asp Ala Glu His Arg Ala Ala Trp Asn Ala Trp Leu Pro Lys
785                 790                 795                 800
```

```
Met Gln Lys Leu Ala Val Leu Leu Gln Lys Ala Leu Asp Glu Asp Arg
                805                 810                 815

Ile Ala Val Thr Ser Asn Leu Arg Leu Arg Leu Gly Asn Gly Arg Ala
            820                 825                 830

His Glu Asp Ser Ile Gly Glu Leu Lys Thr Ile Arg Val Gly Asp Ala
        835                 840                 845

Ile Ser Val Thr Asp Ile Asp Arg Ala Ser Ser Glu Ala Leu Trp Cys
    850                 855                 860

Ala Leu Thr Arg Glu Pro Asp Phe Asp Glu Asn Asn Gly Leu Pro Glu
865                 870                 875                 880

Asn Pro Asp Arg Arg Ile Arg Ile His Gly Thr Trp Tyr Asp Ala Glu
                885                 890                 895

Asp Asp Ile Glu Val Phe Pro Val Gly Ala Gly Ala Ile Lys Val Arg
            900                 905                 910

Gly Gly Tyr Ala Glu Leu Ser Arg Phe His His Ala Arg Ile Tyr Lys
        915                 920                 925

Ile Pro Gly Lys Lys Ala Pro Val Tyr Cys Met Leu Arg Val Tyr Asn
    930                 935                 940

Ala Asp Leu Ile Arg His Arg His Glu Asp Leu Phe Ser Val Glu Ile
945                 950                 955                 960

Lys Pro Gln Thr Met Ser Val Arg Gln Ala Glu Pro Lys Leu Arg Lys
                965                 970                 975

Ala Leu Ala Glu Asn Thr Ala Glu Tyr Leu Gly Trp Leu Val Thr Asp
            980                 985                 990
```

```
Asp Glu Leu Val Ile Asp Thr Ser  Asn Phe Asn Thr Gly  Gln Ile Ala
        995                 1000                1005


Glu Met  Gln Ser Glu Leu Gly  Gln Val Arg Arg Trp  Arg Leu Asp
    1010                1015                1020


Gly Phe  Tyr Ser Pro Ser Thr  Leu Arg Leu Arg Pro  Leu Gln Met
    1025                1030                1035


Ser Ala  Glu Gly Leu Arg Glu  Asp Thr Ser Ile Gly  Ala Lys Lys
    1040                1045                1050


Ile Ile  Asp Arg Pro Gly Trp  Leu Pro Ala Ile Asn  Lys Leu Phe
    1055                1060                1065


Gly Glu  Gly His Val Thr Val  Val Arg Arg Asp Ala  Leu Gly Arg
    1070                1075                1080


Ala Arg  Leu Thr Ser Asn Ala  His Leu Pro Ile Ser  Trp Lys Ala
    1085                1090                1095


Glu
```

<210> 392
<211> 1084
<212> PRT
<213> Corynebacterium diphtheriae

<400> 392

```
Met Lys Tyr His Val Gly Ile Asp Val Gly Thr Phe Ser Val Gly Leu
1               5                   10                  15


Ala Ala Ile Glu Val Asp Asp Ala Gly Met Pro Ile Lys Thr Leu Ser
            20                  25                  30


Leu Val Ser His Ile His Asp Ser Gly Leu Asp Pro Asp Glu Ile Lys
        35                  40                  45
```

```
Ser Ala Val Thr Arg Leu Ala Ser Ser Gly Ile Ala Arg Arg Thr Arg
    50                  55                  60

Arg Leu Tyr Arg Arg Lys Arg Arg Arg Leu Gln Gln Leu Asp Lys Phe
65                  70                  75                  80

Ile Gln Arg Gln Gly Trp Pro Val Ile Glu Leu Glu Asp Tyr Ser Asp
                85                  90                  95

Pro Leu Tyr Pro Trp Lys Val Arg Ala Glu Leu Ala Ala Ser Tyr Ile
            100                 105                 110

Ala Asp Glu Lys Glu Arg Gly Glu Lys Leu Ser Val Ala Leu Arg His
        115                 120                 125

Ile Ala Arg His Arg Gly Trp Arg Asn Pro Tyr Ala Lys Val Ser Ser
    130                 135                 140

Leu Tyr Leu Pro Asp Gly Pro Ser Asp Ala Phe Lys Ala Ile Arg Glu
145                 150                 155                 160

Glu Ile Lys Arg Ala Ser Gly Gln Pro Val Pro Glu Thr Ala Thr Val
                165                 170                 175

Gly Gln Met Val Thr Leu Cys Glu Leu Gly Thr Leu Lys Leu Arg Gly
            180                 185                 190

Glu Gly Gly Val Leu Ser Ala Arg Leu Gln Gln Ser Asp His Ala Arg
        195                 200                 205

Glu Ile Gln Glu Ile Cys Arg Met Gln Glu Ile Gly Gln Glu Leu Tyr
    210                 215                 220

Arg Lys Ile Ile Asp Val Val Phe Ala Ala Glu Ser Pro Lys Gly Ser
225                 230                 235                 240

Ala Ser Ser Arg Val Gly Lys Asp Pro Leu Gln Pro Gly Lys Asn Arg
```

```
                245                 250                 255

Ala Leu Lys Ala Ser Asp Ala Phe Gln Arg Tyr Arg Ile Ala Ala Leu
            260                 265                 270

Ile Gly Asn Leu Arg Val Trp Val Asp Gly Glu Lys Arg Ile Leu Ser
        275                 280                 285

Val Glu Glu Lys Asn Leu Val Phe Asp His Leu Val Asn Leu Thr Pro
    290                 295                 300

Lys Lys Glu Pro Glu Trp Val Thr Ile Ala Glu Ile Leu Gly Ile Asp
305                 310                 315                 320

Arg Gly Gln Leu Ile Gly Thr Ala Thr Met Thr Asp Asp Gly Glu Arg
                325                 330                 335

Ala Gly Ala Arg Pro Pro Thr His Asp Thr Asn Arg Ser Ile Val Asn
            340                 345                 350

Ser Arg Ile Ala Pro Leu Val Asp Trp Trp Lys Thr Ala Ser Ala Leu
        355                 360                 365

Glu Gln His Ala Met Val Lys Ala Leu Ser Asn Ala Glu Val Asp Asp
    370                 375                 380

Phe Asp Ser Pro Glu Arg Ala Lys Val Gln Ala Phe Phe Ala Asp Leu
385                 390                 395                 400

Asp Asp Asp Val His Ala Lys Leu Asp Ser Leu His Leu Pro Val Gly
                405                 410                 415

Arg Ala Ala Tyr Ser Glu Asp Thr Leu Val Arg Leu Thr Arg Arg Met
            420                 425                 430

Leu Ser Asp Gly Val Asp Leu Tyr Thr Ala Arg Leu Gln Glu Phe Gly
        435                 440                 445
```

```
Ile Glu Pro Ser Trp Thr Pro Pro Thr Pro Arg Ile Gly Glu Pro Val
    450                 455                 460

Gly Asn Pro Ala Val Asp Arg Val Leu Lys Thr Val Ser Arg Trp Leu
465                 470                 475                 480

Glu Ser Ala Thr Lys Thr Trp Gly Ala Pro Glu Arg Val Ile Ile Glu
                485                 490                 495

His Val Arg Glu Gly Phe Val Thr Glu Lys Arg Ala Arg Glu Met Asp
            500                 505                 510

Gly Asp Met Arg Arg Arg Ala Ala Arg Asn Ala Lys Leu Phe Gln Glu
        515                 520                 525

Met Gln Glu Lys Leu Asn Val Gln Gly Lys Pro Ser Arg Ala Asp Leu
    530                 535                 540

Trp Arg Tyr Gln Ser Val Gln Arg Gln Asn Cys Gln Cys Ala Tyr Cys
545                 550                 555                 560

Gly Ser Pro Ile Thr Phe Ser Asn Ser Glu Met Asp His Ile Val Pro
                565                 570                 575

Arg Ala Gly Gln Gly Ser Thr Asn Thr Arg Glu Asn Leu Val Ala Val
            580                 585                 590

Cys His Arg Cys Asn Gln Ser Lys Gly Asn Thr Pro Phe Ala Ile Trp
        595                 600                 605

Ala Lys Asn Thr Ser Ile Glu Gly Val Ser Val Lys Glu Ala Val Glu
    610                 615                 620

Arg Thr Arg His Trp Val Thr Asp Thr Gly Met Arg Ser Thr Asp Phe
625                 630                 635                 640

Lys Lys Phe Thr Lys Ala Val Val Glu Arg Phe Gln Arg Ala Thr Met
```

```
               645                 650                 655

Asp Glu Glu Ile Asp Ala Arg Ser Met Glu Ser Val Ala Trp Met Ala
            660                 665                 670

Asn Glu Leu Arg Ser Arg Val Ala Gln His Phe Ala Ser His Gly Thr
        675                 680                 685

Thr Val Arg Val Tyr Arg Gly Ser Leu Thr Ala Glu Ala Arg Arg Ala
    690                 695                 700

Ser Gly Ile Ser Gly Lys Leu Glu Phe Leu Asp Gly Val Gly Lys Ser
705                 710                 715                 720

Arg Leu Asp Arg Arg His His Ala Ile Asp Ala Ala Val Ile Ala Phe
               725                 730                 735

Thr Ser Asp Tyr Val Ala Glu Thr Leu Ala Val Arg Ser Asn Leu Lys
            740                 745                 750

Gln Ser Gln Ala His Arg Gln Glu Ala Pro Gln Trp Arg Glu Phe Thr
        755                 760                 765

Gly Lys Asp Ala Glu His Arg Ala Thr Trp Arg Val Trp Cys Gln Lys
    770                 775                 780

Met Glu Lys Leu Ser Ala Leu Leu Thr Glu Asp Leu Arg Asp Asp Arg
785                 790                 795                 800

Val Val Val Met Ser Asn Val Arg Leu Arg Leu Gly Asn Gly Ser Ala
               805                 810                 815

His Glu Glu Thr Ile Gly Lys Leu Ser Lys Val Lys Leu Gly Ser Gln
            820                 825                 830

Leu Ser Val Ser Asp Ile Asp Lys Ala Ser Ser Glu Ala Leu Trp Cys
        835                 840                 845
```

```
Ala Leu Thr Arg Glu Pro Asp Phe Asp Pro Lys Asp Gly Leu Pro Ala
    850                 855                 860

Asn Pro Glu Arg His Ile Arg Val Asn Gly Thr His Val Tyr Ala Gly
865                 870                 875                 880

Asp Asn Ile Gly Leu Phe Pro Val Ser Ala Gly Ser Ile Ala Leu Arg
                885                 890                 895

Gly Gly Tyr Ala Glu Leu Gly Ser Ser Phe His His Ala Arg Val Tyr
            900                 905                 910

Lys Ile Thr Ser Gly Lys Lys Pro Ala Phe Ala Met Leu Arg Val Tyr
        915                 920                 925

Thr Ile Asp Leu Leu Pro Tyr Arg Asn Gln Asp Leu Phe Ser Val Glu
    930                 935                 940

Leu Lys Pro Gln Thr Met Ser Met Arg Gln Ala Glu Lys Lys Leu Arg
945                 950                 955                 960

Asp Ala Leu Ala Thr Gly Asn Ala Glu Tyr Leu Gly Trp Leu Val Val
                965                 970                 975

Asp Asp Glu Leu Val Val Asp Thr Ser Lys Ile Ala Thr Asp Gln Val
            980                 985                 990

Lys Ala Val Glu Ala Glu Leu Gly  Thr Ile Arg Arg Trp  Arg Val Asp
        995                 1000                1005

Gly Phe  Phe Gly Asp Thr Arg  Leu Arg Leu Arg Pro  Leu Gln Met
    1010                1015                1020

Ser Lys  Glu Gly Ile Lys Lys  Glu Ser Ala Pro Glu  Leu Ser Lys
    1025                1030                1035

Ile Ile  Asp Arg Pro Gly Trp  Leu Pro Ala Val Asn  Lys Leu Phe
```

```
    1040                1045                1050

Ser Glu  Gly Asn Val Thr Val  Val Arg Arg Asp Ser  Leu Gly Arg
    1055                1060                1065

Val Arg  Leu Glu Ser Thr Ala  His Leu Pro Val Thr  Trp Lys Val
    1070                1075                1080

Gln
```

<210> 393
<211> 1084
<212> PRT
<213> Corynebacterium diphtheriae

<400> 393

```
Met Lys Tyr His Val Gly Ile Asp Val Gly Thr Phe Ser Val Gly Leu
1               5                   10                  15

Ala Ala Ile Glu Val Asp Asp Ala Gly Met Pro Ile Lys Thr Leu Ser
            20                  25                  30

Leu Val Ser His Ile His Asp Ser Gly Leu Asp Pro Asp Glu Ile Lys
        35                  40                  45

Ser Ala Val Thr Arg Leu Ala Ser Ser Gly Ile Ala Arg Arg Thr Arg
    50                  55                  60

Arg Leu Tyr Arg Arg Lys Arg Arg Arg Leu Gln Gln Leu Asp Lys Phe
65                  70                  75                  80

Ile Gln Arg Gln Gly Trp Pro Val Ile Glu Leu Glu Asp Tyr Ser Asp
                85                  90                  95

Pro Leu Tyr Pro Trp Lys Val Arg Ala Glu Leu Ala Ala Ser Tyr Ile
            100                 105                 110
```

```
Ala Asp Glu Lys Glu Arg Gly Glu Lys Leu Ser Val Ala Leu Arg His
        115                 120                 125

Ile Ala Arg His Arg Gly Trp Arg Asn Pro Tyr Ala Lys Val Ser Ser
    130                 135                 140

Leu Tyr Leu Pro Asp Gly Pro Ser Asp Ala Phe Lys Ala Ile Arg Glu
145                 150                 155                 160

Glu Ile Lys Arg Ala Ser Gly Gln Pro Val Pro Glu Thr Ala Thr Val
                165                 170                 175

Gly Gln Met Val Thr Leu Cys Glu Leu Gly Thr Leu Lys Leu Arg Gly
            180                 185                 190

Glu Gly Gly Val Leu Ser Ala Arg Leu Gln Gln Ser Asp His Ala Arg
        195                 200                 205

Glu Ile Gln Glu Ile Cys Arg Met Gln Glu Ile Gly Gln Glu Leu Tyr
    210                 215                 220

Arg Lys Ile Ile Asp Val Val Phe Ala Ala Glu Ser Pro Lys Gly Ser
225                 230                 235                 240

Ala Ser Ser Arg Val Gly Lys Asp Pro Leu Gln Pro Gly Lys Asn Arg
                245                 250                 255

Ala Leu Lys Ala Ser Asp Ala Phe Gln Arg Tyr Arg Ile Ala Ala Leu
            260                 265                 270

Ile Gly Asn Leu Arg Val Arg Val Asp Gly Glu Lys Arg Ile Leu Ser
        275                 280                 285

Val Glu Glu Lys Asn Leu Val Phe Asp His Leu Val Asn Leu Ala Pro
    290                 295                 300

Lys Lys Glu Pro Glu Trp Val Thr Ile Ala Glu Ile Leu Gly Ile Asp
305                 310                 315                 320
```

```
Arg Gly Gln Leu Ile Gly Thr Ala Thr Met Thr Asp Asp Gly Glu Arg
                325                 330                 335

Ala Gly Ala Arg Pro Pro Thr His Asp Thr Asn Arg Ser Ile Val Asn
            340                 345                 350

Ser Arg Ile Ala Pro Leu Val Asp Trp Trp Lys Thr Ala Ser Ala Leu
        355                 360                 365

Glu Gln His Ala Met Val Lys Ala Leu Ser Asn Ala Glu Val Asp Asp
    370                 375                 380

Phe Asp Ser Pro Glu Gly Ala Lys Val Gln Ala Phe Phe Ala Asp Leu
385                 390                 395                 400

Asp Asp Asp Val His Ala Lys Leu Asp Ser Leu His Leu Pro Val Gly
                405                 410                 415

Arg Ala Ala Tyr Ser Glu Asp Thr Leu Val Arg Leu Thr Arg Arg Met
            420                 425                 430

Leu Ala Asp Gly Val Asp Leu Tyr Thr Ala Arg Leu Gln Glu Phe Gly
        435                 440                 445

Ile Glu Pro Ser Trp Thr Pro Pro Ala Pro Arg Ile Gly Glu Pro Val
    450                 455                 460

Gly Asn Pro Ala Val Asp Arg Val Leu Lys Thr Val Ser Arg Trp Leu
465                 470                 475                 480

Glu Ser Ala Thr Lys Thr Trp Gly Ala Pro Glu Arg Val Ile Ile Glu
                485                 490                 495

His Val Arg Glu Gly Phe Val Thr Glu Lys Arg Ala Arg Glu Met Asp
            500                 505                 510
```

```
Gly Asp Met Gln Arg Arg Ala Ala Arg Asn Ala Lys Leu Phe Gln Glu
        515                 520                 525

Met Gln Glu Lys Leu Asn Val Gln Gly Lys Pro Ser Arg Ala Asp Leu
    530                 535                 540

Trp Arg Tyr Gln Ser Val Gln Arg Gln Asn Cys Gln Cys Ala Tyr Cys
545                 550                 555                 560

Gly Ser Pro Ile Thr Phe Ser Asn Ser Glu Met Asp His Ile Val Pro
                565                 570                 575

Arg Ala Gly Gln Gly Ser Thr Asn Thr Arg Glu Asn Leu Val Ala Val
            580                 585                 590

Cys His Arg Cys Asn Gln Ser Lys Gly Asn Thr Pro Phe Ala Ile Trp
        595                 600                 605

Ala Lys Asn Thr Ser Ile Glu Gly Val Ser Val Lys Glu Ala Val Glu
    610                 615                 620

Arg Thr Arg His Trp Val Thr Asp Thr Gly Met Arg Ser Pro Asp Phe
625                 630                 635                 640

Lys Lys Phe Thr Lys Ala Val Val Glu Arg Phe Gln Arg Ala Thr Met
                645                 650                 655

Asp Glu Glu Ile Asp Ala Arg Ser Met Glu Ser Val Ala Trp Met Ala
            660                 665                 670

Asn Glu Leu Arg Ser Arg Val Ala Gln His Phe Ala Ser His Gly Thr
        675                 680                 685

Thr Val Arg Val Tyr Arg Gly Ser Leu Thr Ala Glu Ala Arg Arg Ala
    690                 695                 700

Ser Gly Ile Ser Gly Lys Leu Lys Phe Phe Asp Gly Val Gly Lys Ser
705                 710                 715                 720
```

```
Arg Leu Asp Arg Arg His His Ala Ile Asp Ala Ala Val Ile Ala Phe
                725                 730                 735

Thr Ser Asp Tyr Val Ala Glu Thr Leu Ala Val Arg Ser Asn Leu Lys
            740                 745                 750

Gln Ser Gln Ala His Arg Gln Glu Ala Pro Gln Trp Arg Glu Phe Thr
        755                 760                 765

Gly Lys Asp Ala Glu His Arg Ala Ala Trp Arg Val Trp Cys Gln Lys
    770                 775                 780

Met Glu Lys Leu Ser Ala Leu Leu Thr Glu Asp Leu Arg Asp Asp Arg
785                 790                 795                 800

Val Val Val Met Ser Asn Val Arg Leu Arg Leu Gly Asn Gly Ser Ala
                805                 810                 815

His Lys Glu Thr Ile Gly Lys Leu Ser Lys Val Lys Leu Gly Ser Gln
            820                 825                 830

Leu Ser Val Ser Asp Ile Asp Lys Ala Ser Ser Glu Ala Leu Trp Cys
        835                 840                 845

Ala Leu Thr Arg Glu Pro Asp Phe Asp Pro Lys Glu Gly Leu Pro Ala
    850                 855                 860

Asn Pro Glu Arg His Ile Arg Val Asn Gly Thr His Val Tyr Ala Gly
865                 870                 875                 880

Asp Asn Ile Gly Leu Phe Pro Val Ser Ala Gly Ser Ile Ala Leu Arg
                885                 890                 895

Gly Gly Tyr Ala Glu Leu Gly Ser Ser Phe His His Ala Arg Val Tyr
            900                 905                 910
```

```
Lys Ile Thr Ser Gly Lys Lys Pro Ala Phe Ala Met Leu Arg Val Tyr
        915                 920                 925

Thr Ile Asp Leu Leu Pro Tyr Arg Asn Gln Asp Leu Phe Ser Val Glu
    930                 935                 940

Leu Lys Pro Gln Thr Met Ser Met Arg Gln Ala Glu Lys Lys Leu Arg
945                 950                 955                 960

Asp Ala Leu Ala Thr Gly Asn Ala Glu Tyr Leu Gly Trp Leu Val Val
                965                 970                 975

Asp Asp Glu Leu Val Val Asp Thr Ser Lys Ile Ala Thr Asp Gln Val
            980                 985                 990

Lys Ala Val Glu Ala Glu Leu Gly  Thr Ile Arg Arg Trp  Arg Val Asp
        995                 1000                1005

Gly Phe  Phe Ser Pro Ser Lys  Leu Arg Leu Arg Pro  Leu Gln Met
    1010                1015                1020

Ser Lys  Glu Gly Ile Lys Lys  Glu Ser Ala Pro Glu  Leu Ser Lys
    1025                1030                1035

Ile Ile  Asp Arg Pro Gly Trp  Leu Pro Ala Val Asn  Lys Leu Phe
    1040                1045                1050

Ser Asp  Gly Asn Val Thr Val  Val Arg Arg Asp Ser  Leu Gly Arg
    1055                1060                1065

Val Arg  Leu Glu Ser Thr Ala  His Leu Pro Val Thr  Trp Lys Val
    1070                1075                1080

Gln
```

<210> 394
<211> 1084

<212> PRT
<213> Corynebacterium diphtheriae

<400> 394

```
Met Lys Tyr His Val Gly Ile Asp Val Gly Thr Phe Ser Val Gly Leu
1               5                   10                  15


Ala Ala Ile Glu Val Asp Asp Ala Gly Met Pro Ile Lys Thr Leu Ser
            20                  25                  30


Leu Val Ser His Ile His Asp Ser Gly Leu Asp Pro Asp Lys Ile Lys
        35                  40                  45


Ser Ala Val Thr Arg Leu Ala Ser Ser Gly Ile Ala Arg Arg Thr Arg
    50                  55                  60


Arg Leu Tyr Arg Arg Lys Arg Arg Arg Leu Gln Gln Leu Asp Lys Phe
65                  70                  75                  80


Ile Gln Arg Gln Gly Trp Pro Val Ile Glu Leu Glu Asp Tyr Ser Asp
                85                  90                  95


Pro Leu Tyr Pro Trp Lys Val Arg Ala Glu Leu Ala Ala Ser Tyr Ile
            100                 105                 110


Ala Asp Glu Lys Glu Arg Gly Glu Lys Leu Ser Val Ala Leu Arg His
        115                 120                 125


Ile Ala Arg His Arg Gly Trp Arg Asn Pro Tyr Ala Lys Val Ser Ser
    130                 135                 140


Leu Tyr Leu Pro Asp Glu Pro Ser Asp Ala Phe Lys Ala Ile Arg Glu
145                 150                 155                 160


Glu Ile Lys Arg Ala Ser Gly Gln Pro Val Pro Glu Thr Ala Thr Val
                165                 170                 175


Gly Gln Met Val Thr Leu Cys Glu Leu Gly Thr Leu Lys Leu Arg Gly
```

```
            180                 185                 190

Glu Gly Gly Val Leu Ser Ala Arg Leu Gln Gln Ser Asp His Ala Arg
        195                 200                 205

Glu Ile Gln Glu Ile Cys Arg Met Gln Glu Ile Gly Gln Glu Leu Tyr
    210                 215                 220

Arg Lys Ile Ile Asp Val Val Phe Ala Ala Glu Ser Pro Lys Gly Ser
225                 230                 235                 240

Ala Ser Ser Arg Val Gly Lys Asp Pro Leu Gln Pro Gly Lys Asn Arg
                245                 250                 255

Ala Leu Lys Ala Ser Asp Ala Phe Gln Arg Tyr Arg Ile Ala Ala Leu
            260                 265                 270

Ile Gly Asn Leu Arg Val Arg Val Asp Gly Glu Lys Arg Ile Leu Ser
        275                 280                 285

Val Glu Glu Lys Asn Leu Val Phe Asp His Leu Val Asn Leu Ala Pro
    290                 295                 300

Lys Lys Glu Pro Glu Trp Val Thr Ile Ala Glu Ile Leu Gly Ile Asp
305                 310                 315                 320

Arg Gly Gln Leu Ile Gly Thr Ala Thr Met Thr Asp Asp Gly Glu Arg
                325                 330                 335

Ala Gly Ala Arg Pro Pro Thr His Asp Thr Asn Arg Ser Ile Val Asn
            340                 345                 350

Ser Arg Ile Ala Pro Leu Val Asp Trp Trp Lys Thr Ala Ser Ala Leu
        355                 360                 365

Glu Gln His Ala Met Val Lys Ala Leu Ser Asn Ala Glu Val Asp Asp
    370                 375                 380
```

```
Phe Asp Ser Pro Glu Gly Ala Lys Val Gln Ala Phe Phe Ala Asp Leu
385                 390                 395                 400

Asp Asp Asp Val His Ala Lys Leu Asp Ser Leu His Leu Pro Val Gly
                405                 410                 415

Arg Ala Ala Tyr Ser Glu Asp Thr Leu Val Arg Leu Thr Arg Arg Met
            420                 425                 430

Leu Ala Asp Gly Val Asp Leu Tyr Thr Ala Arg Leu Gln Glu Phe Gly
        435                 440                 445

Ile Glu Pro Ser Trp Thr Pro Pro Ala Pro Arg Ile Gly Glu Pro Val
    450                 455                 460

Gly Asn Pro Ala Val Asp Arg Val Leu Lys Thr Val Ser Arg Trp Leu
465                 470                 475                 480

Lys Ser Ala Thr Lys Thr Trp Gly Ala Pro Glu Arg Val Ile Ile Glu
                485                 490                 495

His Val Arg Glu Gly Phe Val Thr Glu Lys Arg Ala Arg Glu Met Asp
            500                 505                 510

Gly Asp Met Arg Arg Arg Ala Ala Arg Asn Ala Lys Leu Phe Gln Glu
        515                 520                 525

Met Gln Glu Lys Leu Asn Val Gln Gly Lys Pro Ser Arg Ala Asp Leu
    530                 535                 540

Trp Arg Tyr Gln Ser Val Gln Arg Gln Asn Cys Gln Cys Ala Tyr Cys
545                 550                 555                 560

Gly Ser Pro Ile Thr Phe Ser Asn Ser Glu Met Asp His Ile Val Pro
                565                 570                 575

Arg Ala Gly Gln Gly Ser Thr Asn Thr Arg Glu Asn Leu Val Ala Val
```

```
            580                 585                 590

Cys His Arg Cys Asn Gln Ser Lys Gly Asn Thr Pro Phe Ala Ile Trp
        595                 600                 605

Ala Lys Asn Thr Ser Ile Glu Gly Val Ser Val Lys Glu Ala Val Glu
    610                 615                 620

Arg Thr Arg His Trp Val Thr Asp Thr Gly Met Arg Ser Thr Asp Phe
625                 630                 635                 640

Lys Lys Phe Thr Lys Ala Val Val Glu Arg Phe Gln Arg Ala Thr Met
                645                 650                 655

Asp Glu Glu Ile Asp Ala Arg Ser Met Glu Ser Val Ala Trp Met Ala
            660                 665                 670

Asn Glu Leu Arg Ser Arg Val Ala Gln His Phe Ala Ser His Gly Thr
        675                 680                 685

Thr Val Arg Val Tyr Arg Gly Ser Leu Thr Ala Glu Ala Arg Arg Ala
    690                 695                 700

Ser Gly Ile Ser Gly Lys Leu Glu Phe Leu Asp Gly Val Gly Lys Ser
705                 710                 715                 720

Arg Leu Asp Arg Arg His His Ala Ile Asp Ala Ala Val Ile Ala Phe
                725                 730                 735

Thr Ser Asp Tyr Val Ala Glu Thr Leu Ala Val Arg Ser Asn Leu Lys
            740                 745                 750

Gln Ser Gln Ala His Arg Gln Glu Ala Pro Gln Trp Arg Glu Phe Thr
        755                 760                 765

Gly Lys Asp Ala Glu His Arg Ala Ala Trp Arg Val Trp Cys Gln Lys
    770                 775                 780
```

```
Met Glu Lys Leu Ser Ala Leu Leu Thr Glu Asp Leu Arg Asp Asp Arg
785                 790                 795                 800

Val Val Val Met Ser Asn Val Arg Leu Arg Leu Gly Asn Gly Ser Ala
                805                 810                 815

His Glu Glu Thr Ile Gly Lys Leu Ser Lys Val Lys Leu Gly Ser Gln
            820                 825                 830

Leu Ser Val Ser Asp Ile Asp Lys Ala Ser Ser Glu Ala Leu Trp Cys
        835                 840                 845

Ala Leu Thr Arg Glu Pro Asp Phe Asp Pro Lys Asp Gly Leu Pro Ala
    850                 855                 860

Asn Pro Glu Arg His Ile Arg Val Asn Gly Thr His Val Tyr Ala Gly
865                 870                 875                 880

Asp Asn Ile Gly Leu Phe Pro Val Ser Ala Gly Ser Ile Ala Leu Arg
                885                 890                 895

Gly Gly Tyr Ala Glu Leu Gly Ser Ser Phe His His Ala Arg Val Tyr
            900                 905                 910

Lys Ile Thr Ser Gly Lys Lys Pro Ala Phe Ala Met Leu Arg Val Tyr
        915                 920                 925

Thr Ile Asp Leu Leu Pro Tyr Arg Asn Gln Asp Leu Phe Ser Val Glu
    930                 935                 940

Leu Lys Pro Gln Thr Met Ser Met Arg Gln Ala Glu Lys Lys Leu Arg
945                 950                 955                 960

Asp Ala Leu Ala Thr Gly Asn Ala Glu Tyr Leu Gly Trp Leu Val Val
                965                 970                 975

Asp Asp Glu Leu Val Val Asp Thr Ser Lys Ile Ala Thr Asp Gln Val
```

```
            980                 985                 990

Lys Ala Val Glu Ala Glu Leu Gly  Thr Ile Arg Arg Trp  Arg Val Asp
        995                 1000                1005

Gly Phe  Phe Gly Asp Thr Arg  Leu Arg Leu Arg Pro  Leu Gln Met
    1010                1015                1020

Ser Lys  Glu Gly Ile Lys Lys  Glu Ser Ala Pro Glu  Leu Ser Lys
    1025                1030                1035

Ile Ile  Asp Arg Pro Gly Trp  Leu Pro Ala Val Asn  Lys Leu Phe
    1040                1045                1050

Ser Glu  Gly Asn Val Thr Val  Val Arg Arg Asp Ser  Leu Gly Arg
    1055                1060                1065

Val Arg  Leu Glu Ser Thr Ala  His Leu Pro Val Thr  Trp Lys Val
    1070                1075                1080

Gln
```

<210> 395
<211> 1084
<212> PRT
<213> Corynebacterium diphtheriae

<400> 395

```
Met Lys Tyr His Val Gly Ile Asp Val Gly Thr Phe Ser Val Gly Leu
1               5                   10                  15

Ala Ala Ile Glu Val Asp Asp Ala Gly Met Pro Ile Lys Thr Leu Ser
            20                  25                  30

Leu Val Ser His Ile His Asp Ser Gly Leu Asp Pro Asp Lys Ile Lys
        35                  40                  45
```

```
Ser Ala Val Thr Arg Leu Ala Ser Ser Gly Ile Ala Arg Arg Thr Arg
    50                  55                  60

Arg Leu Tyr Arg Arg Lys Arg Arg Arg Leu Gln Gln Leu Asp Lys Phe
65                  70                  75                  80

Ile Gln Arg Gln Gly Trp Pro Val Ile Glu Leu Glu Asp Tyr Ser Asp
                85                  90                  95

Pro Leu Tyr Pro Trp Lys Val Arg Ala Glu Leu Ala Ala Ser Tyr Ile
            100                 105                 110

Ala Asp Glu Lys Glu Arg Gly Glu Lys Leu Ser Val Ala Leu Arg His
        115                 120                 125

Ile Ala Arg His Arg Gly Trp Arg Asn Pro Tyr Ala Lys Val Ser Ser
    130                 135                 140

Leu Tyr Leu Pro Asp Glu Pro Ser Asp Ala Phe Lys Ala Ile Arg Glu
145                 150                 155                 160

Glu Ile Lys Arg Ala Ser Gly Gln Pro Val Pro Glu Thr Ala Thr Val
                165                 170                 175

Gly Gln Met Val Thr Leu Cys Glu Leu Gly Thr Leu Lys Leu Arg Gly
            180                 185                 190

Glu Gly Gly Val Leu Ser Ala Arg Leu Gln Gln Ser Asp His Ala Arg
        195                 200                 205

Glu Ile Gln Glu Ile Cys Arg Met Gln Glu Ile Gly Gln Glu Leu Tyr
    210                 215                 220

Arg Lys Ile Ile Asp Val Val Phe Ala Ala Glu Ser Pro Lys Gly Ser
225                 230                 235                 240

Ala Ser Ser Arg Val Gly Lys Asp Pro Leu Gln Pro Gly Lys Asn Arg
                245                 250                 255
```

```
Ala Leu Lys Ala Ser Asp Ala Phe Gln Arg Tyr Arg Ile Ala Ala Leu
            260                 265                 270

Ile Gly Asn Leu Arg Val Arg Val Asp Gly Glu Lys Arg Ile Leu Ser
        275                 280                 285

Val Glu Glu Lys Asn Leu Val Phe Asp His Leu Val Asn Leu Ala Pro
    290                 295                 300

Lys Lys Glu Pro Glu Trp Val Thr Ile Ala Glu Ile Leu Gly Ile Asp
305                 310                 315                 320

Arg Gly Gln Leu Ile Gly Thr Ala Thr Met Thr Asp Asp Gly Glu Arg
                325                 330                 335

Ala Gly Ala Arg Pro Pro Thr His Asp Thr Asn Arg Ser Ile Val Asn
            340                 345                 350

Ser Arg Ile Ala Pro Leu Val Asp Trp Trp Lys Thr Ala Ser Ala Leu
        355                 360                 365

Glu Gln His Ala Met Val Lys Ala Leu Ser Asn Ala Glu Val Asp Asp
    370                 375                 380

Phe Asp Ser Pro Glu Gly Ala Lys Val Gln Ala Phe Phe Ala Asp Leu
385                 390                 395                 400

Asp Asp Asp Val His Ala Lys Leu Asp Ser Leu His Leu Pro Val Gly
                405                 410                 415

Arg Ala Ala Tyr Ser Glu Asp Thr Leu Val Arg Leu Thr Arg Arg Met
            420                 425                 430

Leu Ala Asp Gly Val Asp Leu Tyr Thr Ala Arg Leu Gln Glu Phe Gly
        435                 440                 445
```

```
Ile Glu Pro Ser Trp Thr Pro Pro Ala Pro Arg Ile Gly Glu Pro Val
    450                 455                 460

Gly Asn Pro Ala Val Asp Arg Val Leu Lys Thr Val Ser Arg Trp Leu
465                 470                 475                 480

Glu Ser Ala Thr Lys Thr Trp Gly Ala Pro Glu Arg Val Ile Ile Glu
                485                 490                 495

His Val Arg Glu Gly Phe Val Thr Glu Lys Arg Ala Arg Glu Met Asp
            500                 505                 510

Gly Asp Met Arg Arg Arg Ala Ala Arg Asn Ala Lys Leu Phe Gln Glu
        515                 520                 525

Met Gln Glu Lys Leu Asn Val Gln Gly Lys Pro Ser Arg Ala Asp Leu
    530                 535                 540

Trp Arg Tyr Gln Ser Val Gln Arg Gln Asn Cys Gln Cys Ala Tyr Cys
545                 550                 555                 560

Gly Ser Pro Ile Thr Phe Ser Asn Ser Glu Met Asp His Ile Val Pro
                565                 570                 575

Arg Ala Gly Gln Gly Ser Thr Asn Thr Arg Glu Asn Leu Val Ala Val
            580                 585                 590

Cys His Arg Cys Asn Gln Ser Lys Gly Asn Thr Pro Phe Ala Ile Trp
        595                 600                 605

Ala Lys Asn Thr Ser Ile Glu Gly Val Ser Val Lys Glu Ala Val Glu
    610                 615                 620

Arg Thr Arg His Trp Val Thr Asp Thr Gly Met Arg Ser Thr Asp Phe
625                 630                 635                 640

Lys Lys Phe Thr Lys Ala Val Val Glu Arg Phe Gln Arg Ala Thr Met
                645                 650                 655
```

```
Asp Glu Glu Ile Asp Ala Arg Ser Met Glu Ser Val Ala Trp Met Ala
            660                 665                 670

Asn Glu Leu Arg Ser Arg Val Ala Gln His Phe Ala Ser His Gly Thr
        675                 680                 685

Thr Val Arg Val Tyr Arg Gly Ser Leu Thr Ala Glu Ala Arg Arg Ala
    690                 695                 700

Ser Gly Ile Ser Gly Lys Leu Glu Phe Leu Asp Gly Val Gly Lys Ser
705                 710                 715                 720

Arg Leu Asp Arg Arg His His Ala Ile Asp Ala Ala Val Ile Ala Phe
                725                 730                 735

Thr Ser Asp Tyr Val Ala Glu Thr Leu Ala Val Arg Ser Asn Leu Lys
            740                 745                 750

Gln Ser Gln Ala His Arg Gln Glu Ala Pro Gln Trp Arg Glu Phe Thr
        755                 760                 765

Gly Lys Asp Ala Glu His Arg Ala Ala Trp Arg Val Trp Cys Gln Lys
    770                 775                 780

Met Glu Lys Leu Ser Ala Leu Leu Thr Glu Asp Leu Arg Asp Asp Arg
785                 790                 795                 800

Val Val Val Met Ser Asn Val Arg Leu Arg Leu Gly Asn Gly Ser Ala
                805                 810                 815

His Glu Glu Thr Ile Gly Lys Leu Ser Lys Val Lys Leu Gly Ser Gln
            820                 825                 830

Leu Ser Val Ser Asp Ile Asp Lys Ala Ser Ser Glu Ala Leu Trp Cys
        835                 840                 845
```

```
Ala Leu Thr Arg Glu Pro Asp Phe Asp Pro Lys Asp Gly Leu Pro Ala
    850                 855                 860

Asn Pro Glu Arg His Ile Arg Val Asn Gly Thr His Val Tyr Ala Gly
865                 870                 875                 880

Asp Asn Ile Gly Leu Phe Pro Val Ser Ala Gly Ser Ile Ala Leu Arg
                885                 890                 895

Gly Gly Tyr Ala Glu Leu Gly Ser Ser Phe His His Ala Arg Val Tyr
            900                 905                 910

Lys Ile Thr Ser Gly Lys Lys Pro Ala Phe Ala Met Leu Arg Val Tyr
        915                 920                 925

Thr Ile Asp Leu Leu Pro Tyr Arg Asn Gln Asp Leu Phe Ser Val Glu
    930                 935                 940

Leu Lys Pro Gln Thr Met Ser Met Arg Gln Ala Glu Lys Lys Leu Arg
945                 950                 955                 960

Asp Ala Leu Ala Thr Gly Asn Ala Glu Tyr Leu Gly Trp Leu Val Val
                965                 970                 975

Asp Asp Glu Leu Val Val Asp Thr Ser Lys Ile Ala Thr Asp Gln Val
            980                 985                 990

Lys Ala Val Glu Ala Glu Leu Gly  Thr Ile Arg Arg Trp  Arg Val Asp
        995                 1000                1005

Gly Phe  Phe Gly Asp Thr Arg  Leu Arg Leu Arg Pro  Leu Gln Met
    1010                1015                1020

Ser Lys  Glu Gly Ile Lys Lys  Glu Ser Ala Pro Glu  Leu Ser Lys
    1025                1030                1035

Ile Ile  Asp Arg Pro Gly Trp  Leu Pro Ala Val Asn  Lys Leu Phe
    1040                1045                1050
```

Ser Glu Gly Asn Val Thr Val Val Arg Arg Asp Ser Leu Gly Arg
    1055   1060   1065

Val Arg Leu Glu Ser Thr Ala His Leu Pro Val Thr Trp Lys Val
    1070   1075   1080

Gln

<210> 396
<211> 1084
<212> PRT
<213> Corynebacterium diphtheriae

<400> 396

Met Lys Tyr His Val Gly Ile Asp Val Gly Thr Phe Ser Val Gly Leu
1   5   10   15

Ala Ala Ile Glu Val Asp Asp Ala Gly Met Pro Ile Lys Thr Leu Ser
            20   25   30

Leu Val Ser His Ile His Asp Ser Gly Leu Asp Pro Asp Lys Met Lys
        35   40   45

Ser Ala Val Thr Arg Leu Ala Ser Ser Gly Ile Ala Arg Arg Thr Arg
    50   55   60

Arg Leu Tyr Arg Arg Lys Arg Arg Arg Leu Gln Gln Leu Asp Lys Phe
65   70   75   80

Ile Gln Arg Gln Gly Trp Pro Val Ile Glu Leu Glu Asp Tyr Ser Asp
                85   90   95

Pro Leu Tyr Pro Trp Lys Val Arg Ala Glu Leu Ala Ala Ser Tyr Ile
            100   105   110

Ala Asp Glu Lys Glu Arg Gly Glu Lys Leu Ser Val Ala Leu Arg His

```
        115                 120                 125

Ile Ala Arg His Arg Gly Trp Arg Asn Pro Tyr Ala Lys Val Ser Ser
    130                 135                 140

Leu Tyr Leu Pro Asp Glu Pro Ser Asp Ala Phe Lys Ser Ile Arg Glu
145                 150                 155                 160

Glu Ile Lys Arg Ala Ser Gly Gln Pro Val Pro Glu Thr Ala Thr Val
                165                 170                 175

Gly Gln Met Val Thr Leu Cys Glu Leu Gly Thr Leu Lys Leu Arg Gly
            180                 185                 190

Glu Gly Gly Val Leu Ser Ala Arg Leu Gln Gln Ser Asp His Ala Arg
        195                 200                 205

Glu Ile Gln Glu Ile Cys Arg Met Gln Glu Ile Gly Gln Glu Leu Tyr
    210                 215                 220

Arg Lys Ile Ile Asp Val Val Phe Ala Ala Glu Ser Pro Lys Gly Ser
225                 230                 235                 240

Ala Ser Ser Arg Val Gly Lys Asp Pro Leu Gln Pro Gly Lys Asn Arg
                245                 250                 255

Ala Leu Lys Ala Ser Asp Ser Phe Gln Arg Tyr Arg Ile Ala Ala Leu
            260                 265                 270

Ile Ser Asn Leu Arg Val Arg Val Asp Gly Glu Lys Arg Ile Leu Ser
        275                 280                 285

Val Glu Glu Lys Asn Leu Val Phe Asp His Leu Val Asn Leu Ala Pro
    290                 295                 300

Lys Lys Glu Pro Glu Trp Val Thr Ile Ala Glu Ile Leu Gly Ile Asp
305                 310                 315                 320
```

```
Arg Gly Gln Leu Ile Gly Thr Ala Thr Met Thr Asp Asp Gly Glu Arg
                325                 330                 335

Ala Gly Ala Arg Pro Pro Thr His Asp Thr Asn Arg Ser Ile Val Asn
            340                 345                 350

Ser Arg Ile Ala Pro Leu Val Asp Trp Trp Lys Thr Ala Ser Ala Leu
        355                 360                 365

Glu Gln His Ala Met Val Lys Ala Leu Ser Asn Ala Glu Val Asp Asp
    370                 375                 380

Phe Asp Ser Pro Glu Gly Ala Lys Val Gln Ala Phe Phe Ala Asp Leu
385                 390                 395                 400

Asp Asp Asp Val His Ala Lys Leu Asp Ser Leu His Leu Pro Val Gly
                405                 410                 415

Arg Ala Ala Tyr Ser Glu Asp Thr Leu Val Arg Leu Thr Arg Arg Met
            420                 425                 430

Leu Ala Asp Gly Val Asp Leu Tyr Thr Ala Arg Leu Gln Glu Phe Gly
        435                 440                 445

Ile Glu Pro Ser Trp Thr Pro Pro Ala Pro Arg Ile Gly Glu Pro Val
    450                 455                 460

Gly Asn Pro Ala Val Asp Arg Val Leu Lys Thr Val Ser Arg Trp Leu
465                 470                 475                 480

Glu Ser Ala Thr Lys Thr Trp Gly Ala Pro Glu Arg Val Ile Ile Glu
                485                 490                 495

His Val Arg Asp Gly Phe Val Thr Glu Lys Arg Ala Arg Glu Met Asp
            500                 505                 510

Gly Asp Met Arg Arg Arg Ala Ala Arg Asn Ala Lys Leu Phe Gln Glu
```

```
        515                 520                 525

Met Gln Glu Lys Leu Asn Val Gln Gly Lys Pro Ser Arg Ala Asp Leu
    530                 535                 540

Trp Arg Tyr Gln Ser Val Gln Arg Gln Asn Cys Gln Cys Ala Tyr Cys
545                 550                 555                 560

Gly Ser Pro Ile Thr Phe Ser Asn Ser Glu Met Asp His Ile Val Pro
                565                 570                 575

Arg Ala Gly Gln Gly Ser Thr Asn Thr Arg Glu Asn Leu Val Ala Val
            580                 585                 590

Cys His Arg Cys Asn Gln Ser Lys Gly Asn Thr Pro Phe Ala Ile Trp
        595                 600                 605

Ala Lys Asn Thr Ser Ile Glu Gly Val Ser Val Lys Glu Ala Val Glu
    610                 615                 620

Arg Thr Arg His Trp Val Thr Asp Thr Gly Met Arg Ser Thr Asp Phe
625                 630                 635                 640

Lys Lys Phe Thr Lys Ala Val Val Glu Arg Phe Gln Arg Ala Thr Met
                645                 650                 655

Asp Glu Glu Ile Asp Ala Arg Ser Met Glu Ser Val Ala Trp Met Ala
            660                 665                 670

Asn Glu Leu Arg Ser Arg Val Ala Gln His Phe Ala Ser His Gly Thr
        675                 680                 685

Thr Val Arg Val Tyr Arg Gly Ser Leu Thr Ala Glu Ala Arg Arg Ala
    690                 695                 700

Ser Gly Ile Ser Gly Lys Leu Glu Phe Leu Asp Gly Val Gly Lys Ser
705                 710                 715                 720
```

```
Arg Leu Asp Arg Arg His His Ala Ile Asp Ala Ala Val Ile Ala Phe
               725                 730                 735

Thr Ser Asp Tyr Val Ala Glu Thr Leu Ala Val Arg Ser Asn Leu Lys
            740                 745                 750

Gln Ser Gln Ala His Arg Gln Glu Ala Pro Gln Trp Arg Glu Phe Thr
        755                 760                 765

Gly Lys Asp Ala Glu His Arg Ala Ala Trp Arg Val Trp Cys Gln Lys
    770                 775                 780

Met Glu Lys Leu Ser Ala Leu Leu Thr Glu Asp Leu Arg Asp Asp Arg
785                 790                 795                 800

Val Val Val Met Ser Asn Val Arg Leu Arg Leu Gly Asn Gly Ser Ala
               805                 810                 815

His Glu Glu Thr Ile Gly Lys Leu Ser Lys Val Lys Leu Gly Ser Gln
            820                 825                 830

Leu Ser Val Ser Asp Ile Asp Lys Ala Ser Ser Glu Ala Leu Trp Cys
        835                 840                 845

Ala Leu Thr Arg Glu Pro Asp Phe Asp Pro Lys Asp Gly Leu Pro Ala
    850                 855                 860

Asn Pro Glu Arg His Ile Arg Val Asn Gly Thr His Val Tyr Ala Gly
865                 870                 875                 880

Asp Asn Ile Gly Leu Phe Pro Val Ser Ala Gly Ser Ile Ala Leu Arg
               885                 890                 895

Gly Gly Tyr Ala Glu Leu Gly Ser Ser Phe His His Ala Arg Val Tyr
            900                 905                 910

Lys Ile Thr Ser Gly Lys Lys Pro Ala Phe Ala Met Leu Arg Val Tyr
```

```
        915                 920                 925

Thr Ile Asp Leu Leu Pro Tyr Arg Asn Gln Asp Leu Phe Ser Val Glu
    930                 935                 940

Leu Lys Pro Gln Thr Met Ser Met Arg Gln Ala Glu Lys Lys Leu Arg
945                 950                 955                 960

Asp Ala Leu Ala Thr Gly Asn Ala Glu Tyr Leu Gly Trp Leu Val Val
                965                 970                 975

Asp Asp Glu Leu Val Val Asp Thr Ser Lys Ile Ala Thr Asp Gln Val
            980                 985                 990

Lys Ala Val Glu Ala Glu Leu Gly  Thr Ile Arg Arg Trp  Arg Val Asp
        995                 1000                1005

Gly Phe  Phe Gly Asp Thr Arg  Leu Arg Leu Arg Pro  Leu Gln Met
    1010                1015                1020

Ser Lys  Glu Gly Ile Lys Lys  Glu Leu Ala Pro Glu  Leu Ser Lys
    1025                1030                1035

Ile Ile  Asp Arg Pro Gly Trp  Leu Pro Ala Val Asn  Lys Leu Phe
    1040                1045                1050

Ser Glu  Gly Asn Val Thr Val  Val Arg Arg Asp Ser  Leu Gly Arg
    1055                1060                1065

Val Arg  Leu Glu Ser Thr Ala  His Leu Pro Val Thr  Trp Lys Val
    1070                1075                1080

Gln
```

<210> 397
<211> 1084
<212> PRT

<213> Corynebacterium diphtheriae

<400> 397

```
Met Lys Tyr His Val Gly Ile Asp Val Gly Thr Phe Ser Val Gly Leu
1               5                  10                  15


Ala Ala Ile Glu Val Asp Asp Ala Gly Met Pro Ile Lys Thr Leu Ser
            20                  25                  30


Leu Val Ser His Ile His Asp Ser Gly Leu Asp Pro Asp Lys Met Lys
        35                  40                  45


Ser Ala Val Thr Arg Leu Ala Ser Ser Gly Ile Ala Arg Arg Thr Arg
    50                  55                  60


Arg Leu Tyr Arg Arg Lys Arg Arg Arg Leu Gln Gln Leu Asp Lys Phe
65                  70                  75                  80


Ile Gln Arg Gln Gly Trp Pro Val Ile Glu Leu Glu Asp Tyr Ser Asp
                85                  90                  95


Pro Leu Tyr Pro Trp Lys Val Arg Ala Glu Leu Ala Ala Ser Tyr Ile
            100                 105                 110


Ala Asp Glu Lys Glu Arg Gly Glu Lys Leu Ser Val Ala Leu Arg His
        115                 120                 125


Ile Ala Arg His Arg Gly Trp Arg Asn Pro Tyr Ala Lys Val Ser Ser
    130                 135                 140


Leu Tyr Leu Pro Asp Glu Pro Ser Asp Ala Phe Lys Ser Ile Arg Glu
145                 150                 155                 160


Glu Ile Lys Arg Ala Ser Gly Gln Pro Val Pro Glu Thr Ala Thr Val
                165                 170                 175


Gly Gln Met Val Thr Leu Cys Glu Leu Gly Thr Leu Lys Leu Arg Gly
            180                 185                 190
```

```
Glu Gly Gly Val Leu Ser Ala Arg Leu Gln Gln Ser Asp His Ala Arg
        195                 200                 205

Glu Ile Gln Glu Ile Cys Arg Met Gln Glu Ile Gly Gln Glu Leu Tyr
    210                 215                 220

Arg Lys Ile Ile Asp Val Val Phe Ala Ala Glu Ser Pro Lys Gly Ser
225                 230                 235                 240

Ala Ser Ser Arg Val Gly Lys Asp Pro Leu Gln Pro Gly Lys Asn Arg
                245                 250                 255

Ala Leu Lys Ala Ser Asp Ala Phe Gln Arg Tyr Arg Ile Ala Ala Leu
            260                 265                 270

Ile Gly Asn Leu Arg Val Arg Val Asp Gly Glu Lys Arg Ile Leu Ser
        275                 280                 285

Val Glu Glu Lys Asn Leu Val Phe Asp His Leu Val Asn Leu Ala Pro
    290                 295                 300

Lys Lys Glu Pro Glu Trp Val Thr Ile Ala Glu Ile Leu Gly Ile Asp
305                 310                 315                 320

Arg Gly Gln Leu Ile Gly Thr Ala Thr Met Thr Asp Asp Gly Glu Arg
                325                 330                 335

Ala Gly Ala Arg Pro Pro Thr His Asp Thr Asn Arg Ser Ile Val Asn
            340                 345                 350

Ser Arg Ile Ala Pro Leu Val Asp Trp Trp Lys Thr Ala Ser Ala Leu
        355                 360                 365

Glu Gln His Ala Met Val Lys Ala Leu Ser Asn Ala Glu Val Asp Asp
    370                 375                 380
```

```
Phe Asp Ser Pro Glu Gly Ala Lys Val Gln Ala Phe Phe Ala Asp Leu
385                 390                 395                 400

Asp Asp Asp Val His Ala Lys Leu Asp Ser Leu His Leu Pro Val Gly
                405                 410                 415

Arg Ala Ala Tyr Ser Glu Asp Thr Leu Val Arg Leu Thr Arg Arg Met
            420                 425                 430

Leu Ala Asp Gly Val Asp Leu Tyr Thr Ala Arg Leu Gln Glu Phe Gly
        435                 440                 445

Ile Glu Pro Ser Trp Thr Pro Pro Ala Pro Arg Ile Gly Glu Pro Val
    450                 455                 460

Gly Asn Pro Ala Val Asp Arg Val Leu Lys Thr Val Ser Arg Trp Leu
465                 470                 475                 480

Glu Ser Ala Thr Lys Thr Trp Gly Ala Pro Glu Arg Val Ile Ile Glu
                485                 490                 495

His Val Arg Glu Gly Phe Val Thr Glu Lys Arg Ala Arg Glu Met Asp
            500                 505                 510

Gly Asp Met Arg Arg Arg Ala Ala Arg Asn Ala Lys Leu Phe Gln Glu
        515                 520                 525

Met Gln Glu Lys Leu Asn Val Gln Gly Lys Pro Ser Arg Ala Asp Leu
    530                 535                 540

Trp Arg Tyr Gln Ser Val Gln Arg Gln Asn Cys Gln Cys Ala Tyr Cys
545                 550                 555                 560

Gly Ser Pro Ile Thr Phe Ser Asn Ser Glu Met Asp His Ile Val Pro
                565                 570                 575

Arg Ala Gly Gln Gly Ser Thr Asn Thr Arg Glu Asn Leu Val Ala Val
            580                 585                 590
```

```
Cys His Arg Cys Asn Gln Ser Lys Gly Asn Thr Pro Phe Ala Ile Trp
        595                 600                 605

Ala Lys Asn Thr Ser Ile Glu Gly Val Ser Val Lys Glu Ala Val Glu
    610                 615                 620

Arg Thr Arg His Trp Val Thr Asp Thr Gly Met Arg Ser Thr Asp Phe
625                 630                 635                 640

Lys Lys Phe Thr Lys Ala Val Val Glu Arg Phe Gln Arg Ala Thr Met
                645                 650                 655

Asp Glu Glu Ile Asp Ala Arg Ser Met Glu Ser Val Ala Trp Met Ala
            660                 665                 670

Asn Glu Leu Arg Ser Arg Val Ala Gln His Phe Ala Ser His Gly Thr
        675                 680                 685

Thr Val Arg Val Tyr Arg Gly Ser Leu Thr Ala Glu Ala Arg Arg Ala
    690                 695                 700

Ser Gly Ile Ser Gly Lys Leu Glu Phe Leu Asp Gly Val Gly Lys Ser
705                 710                 715                 720

Arg Leu Asp Arg Arg His His Ala Ile Asp Ala Ala Val Ile Ala Phe
                725                 730                 735

Thr Ser Asp Tyr Val Ala Glu Thr Leu Ala Val Arg Ser Asn Leu Lys
            740                 745                 750

Gln Ser Gln Ala His Arg Gln Glu Ala Pro Gln Trp Arg Glu Phe Thr
        755                 760                 765

Gly Lys Asp Ala Glu His Arg Ala Ala Trp Arg Val Trp Cys Gln Lys
    770                 775                 780
```

```
Met Glu Lys Leu Ser Ala Leu Leu Thr Glu Asp Leu Arg Asp Asp Arg
785                 790                 795                 800

Val Val Val Met Ser Asn Val Arg Leu Arg Leu Gly Asn Gly Ser Ala
                805                 810                 815

His Glu Glu Thr Ile Gly Lys Leu Ser Lys Val Lys Leu Gly Ser Gln
            820                 825                 830

Leu Ser Val Ser Asp Ile Asp Lys Ala Ser Ser Glu Ala Leu Trp Cys
        835                 840                 845

Ala Leu Thr Arg Glu Pro Asp Phe Asp Pro Lys Asp Gly Leu Pro Ala
    850                 855                 860

Asn Pro Glu Arg His Ile Arg Val Asn Gly Thr His Val Tyr Ala Gly
865                 870                 875                 880

Asp Asn Ile Gly Leu Phe Pro Val Ser Ala Gly Ser Ile Ala Leu Arg
                885                 890                 895

Gly Gly Tyr Ala Glu Leu Gly Ser Ser Phe His His Ala Arg Val Tyr
            900                 905                 910

Lys Ile Thr Ser Gly Lys Lys Pro Ala Phe Ala Met Leu Arg Val Tyr
        915                 920                 925

Thr Ile Asp Leu Leu Pro Tyr Arg Asn Gln Asp Leu Phe Ser Val Glu
    930                 935                 940

Leu Lys Pro Gln Thr Met Ser Met Arg Gln Ala Glu Lys Lys Leu Arg
945                 950                 955                 960

Asp Ala Leu Ala Thr Gly Asn Ala Glu Tyr Leu Gly Trp Leu Val Val
                965                 970                 975

Asp Asp Glu Leu Val Val Asp Thr Ser Lys Ile Ala Thr Asp Gln Val
            980                 985                 990
```

```
Lys Ala Val Glu Ala Glu Leu Gly  Thr Ile Arg Arg Trp  Arg Val Asp
        995                 1000                1005


Gly Phe  Phe Gly Asp Thr Arg  Leu Arg Leu Arg Pro  Leu Gln Met
    1010                1015                1020


Ser Lys  Glu Gly Ile Lys Lys  Glu Ser Ala Pro Glu  Leu Ser Lys
    1025                1030                1035


Ile Ile  Asp Arg Pro Gly Trp  Leu Pro Ala Val Asn  Lys Leu Phe
    1040                1045                1050


Ser Glu  Gly Asn Val Thr Val  Val Arg Arg Asp Ser  Leu Gly Arg
    1055                1060                1065


Val Arg  Leu Glu Ser Thr Ala  His Leu Pro Val Thr  Trp Lys Val
    1070                1075                1080


Gln
```

<210> 398
<211> 1084
<212> PRT
<213> Corynebacterium diphtheriae

<400> 398

```
Met Lys Tyr His Val Gly Ile Asp Val Gly Thr Phe Ser Val Gly Leu
1               5                   10                  15


Ala Ala Ile Glu Val Asp Asp Ala Gly Met Pro Ile Lys Thr Leu Ser
            20                  25                  30


Leu Val Ser His Ile His Asp Ser Arg Leu Asp Pro Asp Lys Ile Lys
        35                  40                  45


Ser Ala Val Thr Arg Leu Ala Ser Ser Gly Ile Ala Arg Arg Thr Arg
```

```
    50                  55                  60

Arg Leu Tyr Arg Arg Lys Arg Arg Arg Leu Gln Gln Leu Asp Lys Phe
65                  70                  75                  80

Ile Gln Arg Gln Gly Trp Pro Val Ile Glu Leu Glu Asp Tyr Ser Asp
                85                  90                  95

Pro Leu Tyr Pro Trp Lys Val Arg Ala Glu Leu Ala Ala Ser Tyr Ile
            100                 105                 110

Ala Asp Glu Lys Glu Arg Gly Glu Lys Leu Ser Val Ala Leu Arg His
        115                 120                 125

Ile Ala Arg His Arg Gly Trp Arg Asn Pro Tyr Ala Lys Val Ser Ser
    130                 135                 140

Leu Tyr Leu Pro Asp Glu Pro Ser Asp Ala Phe Lys Ala Ile Arg Glu
145                 150                 155                 160

Glu Ile Lys Arg Ala Ser Gly Gln Pro Val Pro Glu Thr Ala Thr Val
                165                 170                 175

Gly Gln Met Val Thr Leu Cys Glu Leu Gly Thr Leu Lys Leu Arg Gly
            180                 185                 190

Glu Gly Gly Val Leu Ser Ala Arg Leu Gln Gln Ser Asp His Ala Arg
        195                 200                 205

Glu Ile Gln Glu Ile Cys Arg Met Gln Glu Ile Gly Gln Glu Leu Tyr
    210                 215                 220

Arg Lys Ile Ile Asp Val Val Phe Ala Ala Glu Ser Pro Lys Gly Ser
225                 230                 235                 240

Ala Ser Ser Arg Val Gly Lys Asp Pro Leu Gln Pro Gly Lys Asn Arg
                245                 250                 255
```

```
Ala Leu Lys Ala Ser Asp Ala Phe Gln Arg Tyr Arg Ile Ala Ala Leu
            260                 265                 270

Ile Gly Asn Leu Arg Val Arg Val Asp Gly Glu Lys Arg Ile Leu Ser
        275                 280                 285

Val Glu Glu Lys Asn Leu Val Phe Asp His Leu Val Asn Leu Ala Pro
    290                 295                 300

Lys Lys Glu Pro Glu Trp Val Thr Ile Ala Glu Ile Leu Gly Ile Asp
305                 310                 315                 320

Arg Gly Gln Leu Ile Gly Thr Ala Thr Met Thr Asp Asp Gly Glu Arg
                325                 330                 335

Ala Gly Ala Arg Pro Pro Thr His Asp Thr Asn Arg Ser Ile Val Asn
            340                 345                 350

Ser Arg Ile Ala Pro Leu Val Asp Trp Trp Lys Thr Ala Ser Ala Leu
        355                 360                 365

Glu Gln His Ala Met Val Lys Ala Leu Ser Asn Ala Glu Val Asp Asp
    370                 375                 380

Phe Asp Ser Pro Glu Gly Ala Lys Val Gln Ala Phe Phe Ala Asp Leu
385                 390                 395                 400

Asp Asp Asp Val His Ala Lys Leu Asp Ser Leu His Leu Pro Val Gly
                405                 410                 415

Arg Ala Ala Tyr Ser Glu Asp Thr Leu Val Arg Leu Thr Arg Arg Met
            420                 425                 430

Leu Ala Asp Gly Val Asp Leu Tyr Thr Ala Arg Leu Gln Glu Phe Gly
        435                 440                 445

Ile Glu Pro Ser Trp Thr Pro Pro Ala Pro Arg Ile Gly Glu Pro Val
```

```
    450                 455                 460

Gly Asn Pro Ala Val Asp Arg Val Leu Lys Thr Val Ser Arg Trp Leu
465                 470                 475                 480

Glu Ser Ala Thr Lys Thr Trp Gly Ala Pro Glu Arg Val Ile Ile Glu
                485                 490                 495

His Val Arg Glu Gly Phe Val Thr Glu Lys Arg Ala Arg Glu Met Asp
            500                 505                 510

Gly Asp Met Arg Arg Arg Ala Ala Arg Asn Ala Lys Leu Phe Gln Glu
        515                 520                 525

Met Gln Glu Lys Leu Asn Ile Gln Gly Lys Pro Ser Arg Ala Asp Leu
    530                 535                 540

Trp Arg Tyr Gln Ser Val Gln Arg Gln Asn Cys Gln Cys Ala Tyr Cys
545                 550                 555                 560

Gly Ser Pro Ile Thr Phe Ser Asn Ser Glu Met Asp His Ile Val Pro
                565                 570                 575

Arg Ala Gly Gln Gly Ser Thr Asn Thr Arg Glu Asn Leu Val Ala Val
            580                 585                 590

Cys His Arg Cys Asn Gln Ser Lys Gly Asn Thr Pro Phe Ala Ile Trp
        595                 600                 605

Ala Lys Asn Thr Ser Ile Glu Gly Val Ser Val Lys Glu Ala Val Glu
    610                 615                 620

Arg Thr Arg His Trp Val Thr Asp Thr Gly Met Arg Ser Thr Asp Phe
625                 630                 635                 640

Lys Lys Phe Thr Lys Ala Val Val Glu Arg Phe Gln Arg Val Thr Met
                645                 650                 655
```

```
Asp Glu Glu Ile Asp Ala Arg Ser Met Glu Ser Val Ala Trp Met Ala
            660                 665                 670

Asn Glu Leu Arg Ser Arg Val Ala Gln His Phe Ala Ser Arg Gly Thr
        675                 680                 685

Thr Val Arg Val Tyr Arg Gly Ser Leu Thr Ala Glu Ala Arg Arg Ala
    690                 695                 700

Ser Gly Ile Ser Gly Lys Leu Glu Phe Leu Asp Gly Val Gly Lys Ser
705                 710                 715                 720

Arg Leu Asp Arg Arg His His Ala Ile Asp Ala Ala Val Ile Ala Phe
                725                 730                 735

Thr Ser Asp Tyr Val Ala Glu Thr Leu Ala Val Arg Ser Asn Leu Lys
            740                 745                 750

Gln Ser Gln Ala His Arg Gln Glu Ala Pro Gln Trp Arg Glu Phe Thr
        755                 760                 765

Gly Lys Asp Ala Glu His Arg Ala Ala Trp Arg Val Trp Cys Gln Lys
    770                 775                 780

Met Glu Lys Leu Ser Ala Leu Leu Thr Glu Asp Leu Arg Asp Asp Arg
785                 790                 795                 800

Val Val Val Met Ser Asn Val Arg Leu Arg Leu Gly Asn Gly Ser Ala
                805                 810                 815

His Glu Glu Thr Ile Gly Lys Leu Ser Lys Val Lys Leu Gly Ser Gln
            820                 825                 830

Leu Ser Val Ser Asp Ile Asp Lys Ala Ser Ser Glu Ala Leu Trp Cys
        835                 840                 845

Ala Leu Thr Arg Glu Pro Asp Phe Asp Pro Lys Asp Gly Leu Pro Ala
```

```
    850                 855                 860

Asn Pro Glu Arg His Ile Arg Val Asn Gly Thr His Val Tyr Ala Gly
865                 870                 875                 880

Asp Asn Ile Gly Leu Phe Pro Val Ser Ala Gly Ser Ile Ala Leu Arg
                885                 890                 895

Gly Gly Tyr Ala Glu Leu Gly Ser Ser Phe His His Ala Arg Val Tyr
            900                 905                 910

Lys Ile Thr Ser Gly Lys Lys Pro Ala Phe Ala Met Leu Arg Val Tyr
        915                 920                 925

Thr Ile Asp Leu Leu Pro Tyr Arg Asn Gln Asp Leu Phe Ser Val Glu
    930                 935                 940

Leu Lys Pro Gln Thr Met Ser Met Arg Gln Ala Glu Lys Lys Leu Arg
945                 950                 955                 960

Asp Ala Leu Ala Thr Gly Asn Ala Glu Tyr Leu Gly Trp Leu Val Val
                965                 970                 975

Asp Asp Glu Leu Val Val Asp Thr Ser Lys Ile Ala Thr Asp Gln Val
            980                 985                 990

Lys Ala Val Glu Ala Glu Leu Gly  Thr Ile Arg Arg Trp  Arg Val Asp
        995                 1000                1005

Gly Phe  Phe Gly Asp Thr Arg  Leu Arg Leu Arg Pro  Leu Gln Met
    1010                1015                1020

Ser Lys  Glu Gly Ile Lys Lys  Glu Ser Ala Pro Glu  Leu Ser Lys
    1025                1030                1035

Ile Ile  Asp Arg Pro Gly Trp  Leu Pro Ala Val Asn  Lys Leu Phe
    1040                1045                1050
```

```
Ser Glu  Gly Asn Val Thr Val  Val Arg Arg Asp Ser  Leu Gly Arg
    1055                1060                1065


Val Arg  Leu Glu Ser Thr Ala  His Leu Pro Val Thr  Trp Lys Val
    1070                1075                1080


Gln
```

<210> 399
<211> 1069
<212> PRT
<213> Corynebacterium matruchotii

<400> 399

```
Met Ala Ala Ile Ala Ile Asp Asp Asp Gly Lys Pro Thr Glu Ile Leu
1               5                   10                  15


Ser Ala Ile Ser Leu Ile His Asp Ser Gly Val Asp Pro Asp Ser Ala
            20                  25                  30


Lys Ser Ala Ala Thr Arg Leu Ala Thr Ser Gly Ile Ala Arg Arg Thr
        35                  40                  45


Arg Arg Leu Tyr Arg Arg Lys Arg Lys Arg Leu Ala Lys Leu Asp Lys
    50                  55                  60


Phe Ile Ser Ser Gln Gly Trp Pro Leu Lys Glu Phe Glu Lys Tyr Glu
65                  70                  75                  80


Asp Pro Phe Tyr Pro Trp Arg Val Arg Ala Glu Leu Ala Thr Thr Ala
                85                  90                  95


Ile Thr Asp Gln Gln Glu Leu Gly Glu Lys Leu Ser Ile Ala Leu Arg
            100                 105                 110


His Ile Ala Arg His Arg Gly Trp Arg Asn Pro Tyr Ser Lys Val Thr
        115                 120                 125
```

```
Ala Leu Tyr Thr Val Thr Glu Pro Ser Asp Ala Phe Leu Ala Met Gln
    130                 135                 140

Glu Glu Cys Ala Lys Gln Leu Gly Arg Thr Ile Pro Glu Thr Ile Thr
145                 150                 155                 160

Val Gly Gln Leu Val Thr Gly Met Asn Leu Gly Lys Thr Arg Leu Arg
                165                 170                 175

Gly Glu Asn Ser Leu Leu Ala Ala Arg Pro Arg Gln Ser Asp Asn Ala
            180                 185                 190

Asn Glu Ile His Thr Ile Ala Lys Val Gln Gly Leu Ser Asn Glu Leu
        195                 200                 205

Val Arg Gln Ile Ile Asp His Val Phe Ala Ala Glu Ser Pro Lys Gly
    210                 215                 220

Ser Ala Ala Glu Gln Val Gly Lys Asp Pro Leu Gln Pro Thr Lys Lys
225                 230                 235                 240

Arg Ala Leu Lys Ala Ser Asp Ala Phe Gln Gln Tyr Arg Ile Ala Ala
                245                 250                 255

Leu Ile Gly Asn Leu Arg Ile Arg Gly Gly Lys Gly Asn Arg Arg Leu
            260                 265                 270

Thr Thr Glu Glu Thr Arg Leu Val Phe Asp Tyr Leu Arg Ser Leu Pro
        275                 280                 285

Ala Lys Gln Glu Pro Thr Trp Gln Leu Val Ala Glu Gln Leu Lys Ile
    290                 295                 300

Asp Arg Gly Asn Leu Val Gly Thr Ala Ile Met Thr Asp Asp Gly Glu
305                 310                 315                 320
```

```
Arg Ala Gly Ala Lys Pro Pro Val His Asp Thr Asn Arg Ile Met Glu
                325                 330                 335

Asn Thr Lys Ile Lys Pro Leu Ala Thr Trp Trp Lys Ser Ala Asp Ala
            340                 345                 350

Asp Ala Arg Ala Ala Met Val Lys Ala Leu Ser Asn Ala Glu Val Asp
        355                 360                 365

Asp Phe Asp Ser Gln Ala Gly Ala Gln Val Gln Glu Phe Phe Phe Gly
    370                 375                 380

Ile Ser Asp Glu Asp Gln Glu Lys Leu Asp Gly Leu His Leu Pro Ile
385                 390                 395                 400

Gly Arg Ala Ala Tyr Ser Glu Asp Thr Leu Asp Arg Leu Thr Lys Arg
                405                 410                 415

Met Ile Gly Glu Gly Met Asp Leu Tyr Glu Ala Arg Gln Ala Glu Phe
            420                 425                 430

Lys Ile Ser Asn Asp Trp Ala Pro Pro Ala Pro Glu Ile Gly Glu Arg
        435                 440                 445

Val Gly Asn Pro Ala Val Asp Arg Val Leu Lys Ala Thr Ala Arg Trp
    450                 455                 460

Leu Asn Ala Ala Glu Arg Gln Trp Gly Ala Pro Lys Ser Val Asn Ile
465                 470                 475                 480

Glu His Val Arg Ala Ala Phe Met Ser Glu Ser Ser Ala Arg Glu Leu
                485                 490                 495

Asp Arg Asp Asn Gln Gln Arg Ala Lys Arg Asn Val Lys Val Val Ala
            500                 505                 510

Glu Met Gln Glu Lys Leu Gly Ile Glu Gly Arg Pro Ser Arg Ala Asp
        515                 520                 525
```

```
Val Trp Arg Phe Gln Ser Ile Gln Arg Gln Asn Gly Lys Cys Ala Tyr
    530                 535                 540

Cys Gly Ala Glu Ile Ser Phe Lys Asn Ser Glu Met Asp His Ile Ile
545                 550                 555                 560

Pro Gln Val Gly Glu Gly Ser Thr Asn Thr Arg Asp Asn Leu Val Ala
                565                 570                 575

Val Cys Arg Glu Cys Asn Ser Ser Lys Ser Asn Ile Ala Phe Ala Val
            580                 585                 590

Trp Ala Glu Asn Thr Ser Arg Pro Gly Val Ser Val Gln Lys Ala Ile
        595                 600                 605

Glu Arg Thr His His Trp Val Thr Asp Ser Gly Leu Arg Lys Pro Glu
    610                 615                 620

Phe Asp Lys Phe Arg Lys Gln Val Cys Asp Arg Leu Arg Arg Lys Ala
625                 630                 635                 640

Thr Asp Glu Pro Ile Asp Ala Arg Ser Leu Glu Ser Val Ala Trp Met
                645                 650                 655

Ala Asn Glu Leu Arg Ser Arg Ile Ala Gln Lys Phe Lys Asp Gly Asp
            660                 665                 670

Thr Lys Val Arg Val Tyr Lys Gly Ala Leu Thr Ala Glu Ala Arg Arg
        675                 680                 685

Ala Ser Gly Ile Ser Gly Lys Leu Glu Phe Val Asp Gly Lys Gly Lys
    690                 695                 700

Ser Arg Leu Asp Arg Arg His His Ala Val Asp Ala Ala Val Val Ala
705                 710                 715                 720
```

```
Phe Thr Ser Asn Tyr Val Ala Glu Thr Leu Ala Leu Arg Ser Asn Met
                725                 730                 735

Lys Phe Asp Gln Glu Leu Arg Arg Lys Ala Pro Gln Trp Arg Glu Phe
            740                 745                 750

Thr Gly Ser Asp His Val His Gln Val Glu Trp Thr Lys Trp Lys Tyr
        755                 760                 765

Arg Met Gln Ala Leu Ala Glu Leu Leu Asn Asn Ala Leu Val Gln Asp
    770                 775                 780

Arg Ile Val Val Met His Asn Leu Arg Leu Arg Leu Gly Asn Gly Ala
785                 790                 795                 800

Ala His Glu Asp Thr Ile Gly Lys Leu Thr Arg Leu Lys Val Gly Asp
                805                 810                 815

Ala Ile Ser Thr Thr Asp Ile Asp Arg Ala Ser Ser Glu Ala Leu Trp
            820                 825                 830

Cys Ala Leu Thr Arg Asp Pro Asp Tyr Asp Pro Lys Thr Gly Leu Pro
        835                 840                 845

Glu Asn Pro Asn Arg Thr Ile Arg Ile His Gly Thr His Leu Thr Ala
    850                 855                 860

Ser Asp Glu Ile Thr Val Phe Pro Val Ala Ala Ala Ser Ile Pro Ile
865                 870                 875                 880

Arg Asp Gly Phe Ala Lys Leu Gly Ser Asn Tyr His His Val Arg Leu
                885                 890                 895

Phe Arg Val Pro Ser Gly Lys Lys Tyr Lys Tyr Cys Leu Met Gln Val
            900                 905                 910

Tyr Thr Val Asp Leu Leu Lys Phe Arg Lys Glu Asp Leu Phe Thr Val
        915                 920                 925
```

```
Glu Leu Lys Pro Gln Thr Ile Ser Val Arg Thr Cys Glu Ala Leu Leu
    930                 935                 940

Arg Lys Ala Leu Ala Asn Gly Thr Ala Glu Tyr Leu Gly Trp Leu Val
945                 950                 955                 960

Ser Asp Asp Glu Leu Leu Ile Asp Thr Ser Ser Phe Asp Thr Pro Gly
                965                 970                 975

Ile Val Lys Leu Arg Glu Glu Tyr Gly Pro Val Asn Arg Trp Arg Leu
            980                 985                 990

Ala Gly Leu Thr Ser Val Thr Arg  Leu Asn Leu Arg Pro  Leu Tyr Leu
        995                 1000                1005

Ser Lys  Glu Gly Leu Lys Pro  Asn Val Asn Pro Glu  Ile Lys Lys
    1010                1015                1020

Ile Ile  Asp Asn Arg Ser Trp  Ile Ile Thr Val Asn  Lys Leu Phe
    1025                1030                1035

Ser Ser  Gly His Val Lys Ile  Ile Arg Arg Asp Ala  Leu Gly Arg
    1040                1045                1050

Pro Arg  Leu His Ser Ala Ala  His Leu Pro Ile Cys  Trp Glu Val
    1055                1060                1065

Lys
```

<210> 400
<211> 210
<212> PRT
<213> Diplosphaera colitermitum

<400> 400

```
Met Ser Asp Ile Leu Asp Lys Pro Ile Val Leu Ser Leu Asn Arg Ala
```

```
1               5                   10                  15

Trp Gln Val Ile Gly His Arg Thr Val Lys Gln Ala Leu Val Ala Leu
            20                  25                  30

Asn Gly Gly Asn Ala Asp Leu Pro Pro Ala Leu Gly Leu Asp Ile Ala
        35                  40                  45

Tyr Pro Lys Phe Asp Asp Gly Ala Trp Asn Phe Asp Arg Pro Leu Phe
    50                  55                  60

Leu Asn Pro Leu Pro Trp Ser Glu Trp Ile Glu Leu Pro Val Arg Asp
65                  70                  75                  80

Phe Asp Phe Ala Ile Thr Thr Pro Arg Leu Arg Ile Arg Val Pro Thr
                85                  90                  95

Val Ile Val Ala Thr Gln Phe Ala Lys Met Pro Val Arg Ile Pro Arg
            100                 105                 110

Leu Thr Arg Glu Ala Ile Phe Glu Arg Asp Gly Gly Val Cys Gln Tyr
        115                 120                 125

Thr Gly Glu His Val Gly Lys His Gly Gly Asn Leu Asp His Val Val
    130                 135                 140

Pro Arg Asp Arg Gly Gly Arg Asp Ser Phe Glu Asn Leu Val Trp Ala
145                 150                 155                 160

Lys Arg Glu Ile Asn Ser Leu Lys Ala Asn Arg Leu Pro His Glu Ala
                165                 170                 175

Gly Leu Arg Leu Leu Arg Arg Pro Lys Ala Pro Ala Pro Leu Pro Ala
            180                 185                 190

Ser Met Thr Ile Arg Glu Ala Arg His Pro Asp Trp Arg His Phe Leu
        195                 200                 205
```

Thr Pro
    210

<210> 401
<211> 1332
<212> PRT
<213> Dolosigranulum pigrum

<400> 401

Met Gln Lys Asn Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ala Val Met Lys Asp Asp Tyr Thr Leu Ile Arg Lys Arg Met
            20   25   30

Lys Val Leu Gly Asn Thr Asp Ile Lys Lys Ile Lys Lys Asn Phe Trp
        35   40   45

Gly Val Arg Leu Phe Asp Glu Gly Glu Thr Ala Lys Glu Thr Arg Leu
    50   55   60

Lys Arg Gly Thr Arg Arg Arg Tyr Gln Arg Arg Arg Asn Arg Leu Ile
65   70   75   80

Tyr Leu Gln Asp Ile Phe Gln Gln Pro Met Leu Ala Ile Asp Glu Asn
                85   90   95

Phe Phe His Arg Leu Asp Asp Ser Phe Phe Val Pro Asp Asp Lys Ser
            100   105   110

Tyr Asp Arg His Pro Ile Phe Gly Ser Leu Glu Glu Glu Val Ala Tyr
        115   120   125

His Asn Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130   135   140

Asn Pro Glu Lys Ala Asp Leu Arg Leu Val Tyr Thr Ala Leu Ala His
145   150   155   160

```
Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Thr
                165                 170                 175

Glu Asn Thr Ser Ile Ser Glu Thr Phe Glu Gln Phe Leu Asp Thr Tyr
            180                 185                 190

Ser Asp Ile Phe Lys Glu Gln Leu Val Gly Asp Ile Ser Lys Val Glu
        195                 200                 205

Glu Ile Leu Ser Ser Lys Gln Ser Arg Ser Arg Lys His Glu Gln Ile
    210                 215                 220

Met Ala Leu Phe Pro Asn Glu Asn Lys Leu Gly Asn Phe Gly Arg Phe
225                 230                 235                 240

Met Met Leu Ile Val Gly Asn Thr Ser Asn Phe Lys Pro Val Phe Asp
                245                 250                 255

Leu Asp Asp Glu Tyr Lys Leu Lys Leu Ser Asp Glu Thr Tyr Glu Glu
            260                 265                 270

Asp Leu Asp Thr Leu Leu Gly Met Thr Asp Asp Val Phe Leu Asp Val
        275                 280                 285

Phe Met Ala Ala Lys Asn Val Tyr Asp Ala Val Glu Met Ser Ala Ile
    290                 295                 300

Ile Ser Thr Asp Thr Gly Asn Ser Lys Ala Val Leu Ser Asn Gln Met
305                 310                 315                 320

Ile Asn Phe Tyr Asp Glu His Lys Val Asp Leu Ala Gln Leu Lys Gln
                325                 330                 335

Phe Phe Lys Thr His Leu Pro Asp Lys Tyr Tyr Glu Cys Phe Ser Asp
            340                 345                 350
```

```
Pro Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn Gln
        355                 360                 365

Glu Asp Phe Tyr Lys Tyr Ile Glu Lys Val Met Lys Thr Ile Lys Ser
    370                 375                 380

Asp Lys Lys Asp Tyr Phe Leu Asp Lys Ile Asp Arg Glu Val Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Ser Phe Tyr Asn Ser Val Ile Pro His Gln Ile His
                405                 410                 415

Leu Gln Glu Met Gln Ala Ile Leu Asp Arg Gln Ser Gln Tyr Tyr Pro
            420                 425                 430

Phe Leu Ala Glu Asn Arg Asp Lys Ile Glu Ser Leu Val Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Thr Val Ser Asp Gln Ser Glu Phe
    450                 455                 460

Ala Trp Met Glu Arg Gln Ser Asp Glu Pro Ile Arg Pro Trp Asn Phe
465                 470                 475                 480

Asp Glu Ile Val Asn Lys Glu Arg Ser Ala Glu Lys Phe Ile Glu Arg
                485                 490                 495

Met Thr Asn Met Asp Thr Tyr Leu Leu Glu Glu Lys Val Leu Pro Lys
            500                 505                 510

Arg Ser Leu Leu Tyr Gln Thr Phe Glu Val Tyr Asn Glu Leu Thr Lys
        515                 520                 525

Val Arg Tyr Thr Asn Glu Gln Gly Lys Thr Glu Lys Leu Asn Arg Gln
    530                 535                 540

Gln Lys Ala Glu Ile Ile Glu Thr Leu Phe Lys Gln Lys Asn Arg Val
545                 550                 555                 560
```

```
Arg Glu Lys Asp Ile Ala Asn Tyr Leu Glu Gln Tyr Gly Tyr Val Asp
                565                 570                 575

Gly Thr Asp Ile Lys Gly Val Glu Asp Lys Phe Asn Ala Ser Leu Ser
            580                 585                 590

Thr Tyr Asn Asp Leu Ala Lys Ile Asp Gly Ala Lys Ala Tyr Leu Asp
        595                 600                 605

Asp Pro Glu Tyr Ala Asp Val Trp Glu Asp Ile Ile Lys Ile Leu Thr
    610                 615                 620

Ile Phe Glu Asp Lys Ala Met Arg Lys Lys Gln Leu Gln Thr Tyr Ser
625                 630                 635                 640

Asp Thr Leu Ser Pro Glu Ile Leu Lys Lys Leu Glu Arg Lys His Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Phe Ser Lys Lys Leu Ile Asn Gly Leu Arg Asp
            660                 665                 670

Glu Gly Ser Asn Lys Thr Ile Leu Asp Tyr Leu Lys Ser Asp Glu Gly
        675                 680                 685

Ser Ser Gly Pro Thr Asn Arg Asn Phe Met Gln Leu Ile Arg Asp Asn
    690                 695                 700

Thr Leu Ser Phe Lys Lys Lys Ile Glu Asp Ala Gln Thr Ile Glu Asp
705                 710                 715                 720

Thr Thr His Ile Tyr Asp Thr Val Ala Glu Leu Pro Gly Ser Pro Ala
                725                 730                 735

Ile Lys Lys Gly Ile Arg Gln Ala Leu Lys Ile Val Glu Glu Ile Ile
            740                 745                 750
```

```
Asp Ile Ile Gly Tyr Glu Pro Glu Asn Ile Val Val Glu Met Ala Arg
        755                 760                 765

Glu Ser Gln Thr Thr Lys Lys Gly Lys Asp Leu Ser Lys Glu Arg Leu
    770                 775                 780

Glu Lys Leu Thr Glu Ala Ile Lys Glu Phe Asp Gly Pro Ser Asp Val
785                 790                 795                 800

Lys Val Lys Asp Leu Lys Asn Glu Asn Leu Arg Asn Asp Arg Leu Tyr
                805                 810                 815

Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Asn Glu Pro Leu
            820                 825                 830

Asp Ile Asn Asn Leu Ser Lys Tyr Asp Ile Asp His Ile Ile Pro Gln
        835                 840                 845

Ser Phe Thr Thr Asp Asn Ser Ile Asp Asn Lys Val Leu Val Ser Arg
    850                 855                 860

Thr Lys Asn Gln Gly Asn Lys Ser Asp Asp Val Pro Ser Ile Asn Ile
865                 870                 875                 880

Val His Lys Met Lys Pro Phe Trp Arg Gln Leu His Lys Ala Gly Leu
                885                 890                 895

Ile Ser Asp Arg Lys Phe Lys Asn Leu Thr Lys Ala Glu His Gly Gly
            900                 905                 910

Leu Thr Glu Ala Asp Arg Ala His Phe Leu Asn Arg Gln Leu Val Glu
        915                 920                 925

Thr Arg Gln Ile Thr Lys His Val Ala Asn Leu Leu Asp Ser Gln Tyr
    930                 935                 940

Asn Thr Ala Glu Glu Gln Arg Ile Asn Ile Val Leu Leu Lys Ser Ser
945                 950                 955                 960
```

```
Met Thr Ser Arg Phe Arg Lys Glu Phe Lys Leu Tyr Lys Val Arg Glu
               965                 970                 975


Ile Asn Asp Tyr His His Gly His Asp Ala Tyr Leu Asn Ala Val Val
            980                 985                 990


Ala Thr Thr Ile Met Lys Val Tyr  Pro Asn Leu Lys Pro  Gln Phe Val
        995                 1000                1005


Tyr Gly  Gln Tyr Lys Lys Thr  Ser Met Phe Lys Glu  Glu Lys Ala
    1010                1015                1020


Thr Ala  Arg Lys His Phe Tyr  Ser Asn Ile Thr Lys  Phe Phe Lys
    1025                1030                1035


Lys Glu  Lys Val Val Asn Glu  Glu Thr Gly Glu Ile  Leu Trp Asp
    1040                1045                1050


Thr Glu  Arg His Leu Ser Thr  Ile Lys Arg Val Leu  Ser Trp Lys
    1055                1060                1065


Gln Met  Asn Ile Val Lys Lys  Val Glu Lys Gln Lys  Gly Gln Leu
    1070                1075                1080


Trp Lys  Glu Thr Ile Tyr Pro  Lys Gly Asp Ser Ser  Lys Leu Ile
    1085                1090                1095


Pro Val  Lys Glu Gly Met Asp  Pro Gln Lys Tyr Gly  Gly Leu Ser
    1100                1105                1110


Gln Val  Ser Glu Ala Phe Ala  Val Val Ile Thr His  Glu Lys Gly
    1115                1120                1125


Lys Lys  Lys Gln Leu Lys Ser  Asp Leu Ile Ser Ile  Pro Ile Val
    1130                1135                1140
```

```
Asp Gln  Lys Ala Tyr Glu Gln  His Pro Thr Ala Tyr  Leu Glu Glu
    1145                1150                1155

Ala Gly  Tyr Asn Asn Pro Thr  Val Leu His Glu Leu  Phe Lys Tyr
    1160                1165                1170

Gln Leu  Phe Glu Leu Glu Asp  Gly Ser Arg Arg Met  Ile Ala Ser
    1175                1180                1185

Ala Lys  Glu Phe Gln Lys Gly  Asn Gln Met Val Leu  Pro Leu Glu
    1190                1195                1200

Leu Val  Glu Leu Leu Tyr His  Ala Asn Arg Tyr Asp  Lys Val Lys
    1205                1210                1215

Phe Pro  Asp Ser Ile Glu Tyr  Val His Asp Asn Leu  Ala Lys Phe
    1220                1225                1230

Asp Asp  Leu Leu Glu Tyr Val  Ile Asp Phe Ser Asn  Lys Tyr Ile
    1235                1240                1245

Asn Ala  Asp Lys Asn Val Gln  Lys Ile Gln Lys Ile  Tyr Lys Glu
    1250                1255                1260

His Gly  Thr Glu Asp Val Glu  Leu Thr Val Glu Ser  Phe Val Asn
    1265                1270                1275

Leu Met  Thr Phe Thr Ala Met  Gly Ala Pro Ala Thr  Phe Lys Phe
    1280                1285                1290

Tyr Gly  Glu Ser Ile Thr Arg  Ser Arg Tyr Thr Ser  Ile Thr Glu
    1295                1300                1305

Phe Arg  Gly Ser Thr Leu Ile  Phe Gln Ser Ile Thr  Gly Leu Tyr
    1310                1315                1320

Glu Thr  Arg Tyr Lys Leu Glu  Asp Asn
    1325                1330
```

<210> 402
<211> 921
<212> PRT
<213> Enterococcus faecalis

<400> 402

```
Met Ile Pro His Gln Ile His Leu Ala Glu Leu Gln Ala Ile Ile His
1               5                   10                  15


Arg Gln Ala Ala Tyr Tyr Pro Phe Leu Lys Glu Asn Gln Glu Lys Ile
            20                  25                  30


Glu Gln Leu Val Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ser
        35                  40                  45


Lys Gly Asp Ala Ser Thr Phe Ala Trp Leu Lys Arg Gln Ser Glu Glu
    50                  55                  60


Pro Ile Arg Pro Trp Asn Leu Gln Glu Thr Val Asp Leu Asp Gln Ser
65                  70                  75                  80


Ala Thr Ala Phe Ile Glu Arg Met Thr Asn Phe Asp Thr Tyr Leu Pro
                85                  90                  95


Ser Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Lys Phe Met
            100                 105                 110


Val Phe Asn Glu Leu Thr Lys Ile Ser Tyr Thr Asp Asp Arg Gly Ile
        115                 120                 125


Lys Ala Asn Phe Ser Gly Lys Glu Lys Glu Lys Ile Phe Asp Tyr Leu
    130                 135                 140


Phe Lys Thr Arg Arg Lys Val Lys Lys Lys Asp Ile Ile Gln Phe Tyr
145                 150                 155                 160


Arg Asn Glu Tyr Asn Thr Glu Ile Val Thr Leu Ser Gly Leu Glu Glu
```

```
                165                 170                 175

Asp Gln Phe Asn Ala Ser Phe Ser Thr Tyr Gln Asp Leu Leu Lys Cys
            180                 185                 190

Gly Leu Thr Arg Ala Glu Leu Asp His Pro Asp Asn Ala Glu Lys Leu
        195                 200                 205

Glu Asp Ile Ile Lys Ile Leu Thr Ile Phe Glu Asp Arg Gln Arg Ile
    210                 215                 220

Arg Thr Gln Leu Ser Thr Phe Lys Gly Gln Phe Ser Ala Glu Val Leu
225                 230                 235                 240

Lys Lys Leu Glu Arg Lys His Tyr Thr Gly Trp Gly Arg Leu Ser Lys
                245                 250                 255

Lys Leu Ile Asn Gly Ile Tyr Asp Lys Glu Ser Gly Lys Thr Ile Leu
            260                 265                 270

Gly Tyr Leu Ile Lys Asp Asp Gly Val Ser Lys His Tyr Asn Arg Asn
        275                 280                 285

Phe Met Gln Leu Ile Asn Asp Ser Gln Leu Ser Phe Lys Asn Ala Ile
    290                 295                 300

Gln Lys Ala Gln Ser Ser Glu His Glu Glu Thr Leu Ser Glu Thr Val
305                 310                 315                 320

Asn Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Tyr Gln Ser
                325                 330                 335

Leu Lys Ile Val Asp Glu Leu Val Ala Ile Met Gly Tyr Ala Pro Lys
            340                 345                 350

Arg Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Ser Thr Gly
        355                 360                 365
```

```
Lys Arg Arg Ser Ile Gln Arg Leu Lys Ile Val Glu Lys Ala Met Ala
    370                 375                 380

Glu Ile Gly Ser Asn Leu Leu Lys Glu Gln Pro Thr Thr Asn Glu Gln
385                 390                 395                 400

Leu Arg Asp Thr Arg Leu Phe Leu Tyr Tyr Met Gln Asn Gly Lys Asp
                405                 410                 415

Met Tyr Thr Gly Asp Glu Leu Ser Leu His Arg Leu Ser His Tyr Asp
            420                 425                 430

Ile Asp His Ile Ile Pro Gln Ser Phe Met Lys Asp Asp Ser Leu Asp
        435                 440                 445

Asn Leu Val Leu Val Gly Ser Thr Glu Asn Arg Gly Lys Ser Asp Asp
    450                 455                 460

Val Pro Ser Lys Glu Val Val Lys Asp Met Lys Ala Tyr Trp Glu Lys
465                 470                 475                 480

Leu Tyr Ala Ala Gly Leu Ile Ser Gln Arg Lys Phe Gln Arg Leu Thr
                485                 490                 495

Lys Gly Glu Gln Gly Gly Leu Thr Leu Glu Asp Lys Ala His Phe Ile
            500                 505                 510

Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala Gly
        515                 520                 525

Ile Leu Asp Gln Arg Tyr Asn Ala Asn Ser Lys Glu Lys Lys Val Gln
    530                 535                 540

Ile Ile Thr Leu Lys Ala Ser Leu Thr Ser Gln Phe Arg Ser Ile Phe
545                 550                 555                 560

Gly Leu Tyr Lys Val Arg Glu Val Asn Asp Tyr His His Gly Gln Asp
```

```
                565                 570                 575

Ala Tyr Leu Asn Cys Val Val Ala Thr Thr Leu Leu Lys Val Tyr Pro
            580                 585                 590

Asn Leu Ala Pro Glu Phe Val Tyr Gly Glu Tyr Pro Lys Phe Gln Thr
        595                 600                 605

Phe Lys Glu Asn Lys Ala Thr Ala Lys Ala Ile Ile Tyr Thr Asn Leu
    610                 615                 620

Leu Arg Phe Phe Thr Glu Asp Glu Pro Arg Phe Thr Lys Asp Gly Glu
625                 630                 635                 640

Ile Leu Trp Ser Asn Ser Tyr Leu Lys Thr Ile Lys Lys Glu Leu Asn
                645                 650                 655

Tyr His Gln Met Asn Ile Val Lys Lys Val Glu Val Gln Lys Gly Gly
            660                 665                 670

Phe Ser Lys Glu Ser Ile Lys Pro Lys Gly Pro Ser Asn Lys Leu Ile
        675                 680                 685

Pro Val Lys Asn Gly Leu Asp Pro Gln Lys Tyr Gly Gly Phe Asp Ser
    690                 695                 700

Pro Ile Val Ala Tyr Thr Val Leu Phe Thr His Glu Lys Gly Lys Lys
705                 710                 715                 720

Pro Leu Ile Lys Gln Glu Ile Leu Gly Ile Thr Ile Met Glu Lys Thr
                725                 730                 735

Arg Phe Glu Gln Asn Arg Ile Leu Phe Leu Glu Glu Lys Gly Phe Leu
            740                 745                 750

Arg Pro Arg Val Leu Met Lys Leu Pro Lys Tyr Thr Leu Tyr Glu Phe
        755                 760                 765
```

```
Pro Glu Gly Arg Arg Arg Leu Leu Ala Ser Ala Lys Glu Ala Gln Lys
    770                 775                 780

Gly Asn Gln Met Val Leu Pro Glu His Leu Leu Thr Leu Leu Tyr His
785                 790                 795                 800

Ala Lys Gln Cys Leu Leu Pro Asn Gln Ser Glu Ser Leu Thr Tyr Val
                805                 810                 815

Glu Gln His Gln Pro Glu Phe Gln Glu Ile Leu Glu Arg Val Val Asp
            820                 825                 830

Phe Ala Glu Val His Thr Leu Ala Lys Ser Lys Val Gln Gln Ile Val
        835                 840                 845

Lys Leu Phe Glu Ala Asn Gln Thr Ala Asp Val Lys Glu Ile Ala Ala
    850                 855                 860

Ser Phe Ile Gln Leu Met Gln Phe Asn Ala Met Gly Ala Pro Ser Thr
865                 870                 875                 880

Phe Lys Phe Phe Gln Lys Asp Ile Glu Arg Ala Arg Tyr Thr Ser Ile
                885                 890                 895

Lys Glu Ile Phe Asp Ala Thr Ile Ile Tyr Gln Ser Thr Thr Gly Leu
            900                 905                 910

Tyr Glu Thr Arg Arg Lys Val Val Asp
        915                 920


<210>  403
<211>  1337
<212>  PRT
<213>  Enterococcus faecalis

<400>  403

Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15
```

```
Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
            20                  25                  30

Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Ala Leu Asp Glu Asn
                85                  90                  95

Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
            100                 105                 110

Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175

Glu Asn Ile Ser Val Lys Glu Gln Phe Gln Gln Phe Met Ile Ile Tyr
            180                 185                 190

Asn Gln Thr Phe Val Asn Gly Glu Ser Arg Leu Val Ser Ala Pro Leu
        195                 200                 205
```

```
Pro Glu Ser Val Leu Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg
    210                 215                 220

Thr Lys Lys Ser Glu Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala
225                 230                 235                 240

Asn Gly Leu Phe Gly Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala
                245                 250                 255

Asp Phe Lys Lys Val Phe Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr
            260                 265                 270

Ala Ser Glu Ser Tyr Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val
        275                 280                 285

Gly Asp Glu Tyr Ser Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp
    290                 295                 300

Ala Val Glu Leu Ser Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser His
305                 310                 315                 320

Ala Lys Leu Ser Ser Ser Met Ile Val Arg Phe Thr Glu His Gln Glu
                325                 330                 335

Asp Leu Lys Lys Phe Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu
            340                 345                 350

Tyr Asp Asn Leu Phe Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr
        355                 360                 365

Ile Ala His Ala Gly Lys Val Ser Gln Leu Lys Phe Tyr Gln Tyr Val
    370                 375                 380

Lys Lys Ile Ile Gln Asp Ile Ala Gly Ala Glu Tyr Phe Leu Glu Lys
385                 390                 395                 400

Ile Ala Gln Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly
                405                 410                 415
```

```
Val Ile Pro His Gln Ile His Leu Ala Glu Leu Gln Ala Ile Ile His
            420                 425                 430

Arg Gln Ala Ala Tyr Tyr Pro Phe Leu Lys Glu Asn Gln Glu Lys Ile
        435                 440                 445

Glu Gln Leu Val Thr Phe Arg Ile Pro Tyr Tyr Ile Gly Pro Leu Ser
    450                 455                 460

Lys Gly Asp Ala Ser Thr Phe Ala Trp Leu Lys Arg Gln Ser Glu Glu
465                 470                 475                 480

Pro Ile Arg Pro Trp Asn Leu Gln Glu Thr Val Asp Leu Asp Gln Ser
                485                 490                 495

Ala Thr Ala Phe Ile Glu Arg Met Thr Asn Phe Asp Thr Tyr Leu Ser
            500                 505                 510

Ser Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Lys Phe Met
        515                 520                 525

Val Phe Asn Glu Leu Thr Lys Ile Ser Tyr Thr Asp Asp Arg Gly Ile
    530                 535                 540

Lys Ala Asn Phe Ser Gly Lys Glu Lys Glu Lys Ile Phe Asp Tyr Leu
545                 550                 555                 560

Phe Lys Thr Arg Arg Lys Val Lys Lys Lys Asp Ile Ile Gln Phe Tyr
                565                 570                 575

Arg Asn Glu Tyr Asn Thr Glu Ile Val Thr Leu Ser Gly Leu Glu Glu
            580                 585                 590

Asp Gln Phe Asn Ala Ser Phe Ser Thr Tyr Gln Asp Leu Leu Lys Cys
        595                 600                 605
```

```
Gly Leu Thr Arg Ala Glu Leu Asp His Pro Asp Asn Ala Glu Lys Leu
    610                 615                 620

Glu Asp Ile Ile Lys Ile Leu Thr Ile Phe Glu Asp Arg Gln Arg Ile
625                 630                 635                 640

Arg Thr Gln Leu Ser Thr Phe Lys Gly Gln Phe Ser Ala Glu Val Leu
                645                 650                 655

Lys Lys Leu Glu Arg Lys His Tyr Thr Gly Trp Gly Arg Leu Ser Lys
            660                 665                 670

Lys Leu Ile Asn Gly Ile Tyr Asp Lys Glu Ser Gly Lys Thr Ile Leu
        675                 680                 685

Gly Tyr Leu Ile Lys Asp Asp Gly Val Ser Lys His Tyr Asn Arg Asn
    690                 695                 700

Phe Met Gln Leu Ile Asn Asp Ser Gln Leu Ser Phe Lys Asn Ala Ile
705                 710                 715                 720

Gln Lys Ala Gln Ser Ser Glu His Glu Glu Thr Leu Ser Glu Thr Val
                725                 730                 735

Asn Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Tyr Gln Ser
            740                 745                 750

Leu Lys Ile Val Asp Glu Leu Val Ala Ile Met Gly Tyr Ala Pro Lys
        755                 760                 765

Arg Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Ser Thr Gly
    770                 775                 780

Lys Arg Arg Ser Ile Gln Arg Leu Lys Ile Val Glu Lys Ala Met Ala
785                 790                 795                 800

Glu Ile Gly Ser Asn Leu Leu Lys Glu Gln Pro Thr Thr Asn Glu Gln
                805                 810                 815
```

```
Leu Arg Asp Thr Arg Leu Phe Leu Tyr Tyr Met Gln Asn Gly Lys Asp
            820                 825                 830

Met Tyr Thr Gly Asp Glu Leu Ser Leu His Arg Leu Ser His Tyr Asp
        835                 840                 845

Ile Asp His Ile Ile Pro Gln Ser Phe Met Lys Asp Asp Ser Leu Asp
    850                 855                 860

Asn Leu Val Leu Val Gly Ser Thr Glu Asn Arg Gly Lys Ser Asp Asp
865                 870                 875                 880

Val Pro Ser Lys Glu Val Val Lys Asp Met Lys Ala Tyr Trp Glu Lys
                885                 890                 895

Leu Tyr Ala Ala Gly Leu Ile Ser Gln Arg Lys Phe Gln Arg Leu Thr
            900                 905                 910

Lys Gly Glu Gln Gly Gly Leu Thr Leu Glu Asp Lys Ala His Phe Ile
        915                 920                 925

Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala Gly
    930                 935                 940

Ile Leu Asp Gln Arg Tyr Asn Ala Asn Ser Lys Glu Lys Lys Val Gln
945                 950                 955                 960

Ile Ile Thr Leu Lys Ala Ser Leu Thr Ser Gln Phe Arg Ser Ile Phe
                965                 970                 975

Gly Leu Tyr Lys Val Arg Glu Val Asn Asp Tyr His His Gly Gln Asp
            980                 985                 990

Ala Tyr Leu Asn Cys Val Val Ala  Thr Thr Leu Leu Lys  Val Tyr Pro
        995                 1000                1005
```

```
Asn Leu  Ala Pro Glu Phe Val  Tyr Gly Glu Tyr Pro  Lys Phe Gln
    1010                1015                1020

Ala Phe  Lys Glu Asn Lys Ala  Thr Ala Lys Ala Ile  Ile Tyr Thr
    1025                1030                1035

Asn Leu  Leu Arg Phe Phe Thr  Glu Asp Glu Pro Arg  Phe Thr Lys
    1040                1045                1050

Asp Gly  Glu Ile Leu Trp Ser  Asn Ser Tyr Leu Lys  Thr Ile Lys
    1055                1060                1065

Lys Glu  Leu Asn Tyr His Gln  Met Asn Ile Val Lys  Lys Val Glu
    1070                1075                1080

Val Gln  Lys Gly Gly Phe Ser  Lys Glu Ser Ile Lys  Pro Lys Gly
    1085                1090                1095

Pro Ser  Asn Lys Leu Ile Pro  Val Lys Asn Gly Leu  Asp Pro Gln
    1100                1105                1110

Lys Tyr  Gly Gly Phe Asp Ser  Pro Val Val Ala Tyr  Thr Val Leu
    1115                1120                1125

Phe Thr  His Glu Lys Gly Lys  Lys Pro Leu Ile Lys  Gln Glu Ile
    1130                1135                1140

Leu Gly  Ile Thr Ile Met Glu  Lys Thr Arg Phe Glu  Gln Asn Pro
    1145                1150                1155

Ile Leu  Phe Leu Glu Glu Lys  Gly Phe Leu Arg Pro  Arg Val Leu
    1160                1165                1170

Met Lys  Leu Pro Lys Tyr Thr  Leu Tyr Glu Phe Pro  Glu Gly Arg
    1175                1180                1185

Arg Arg  Leu Leu Ala Ser Ala  Lys Glu Ala Gln Lys  Gly Asn Gln
    1190                1195                1200
```

```
Met Val  Leu Pro Glu His Leu  Leu Thr Leu Leu Tyr  His Ala Lys
    1205                1210                1215


Gln Cys  Leu Leu Pro Asn Gln  Ser Glu Ser Leu Ala  Tyr Val Glu
    1220                1225                1230


Gln His  Gln Pro Glu Phe Gln  Glu Ile Leu Glu Arg  Val Val Asp
    1235                1240                1245


Phe Ala  Glu Val His Thr Leu  Ala Lys Ser Lys Val  Gln Gln Ile
    1250                1255                1260


Val Lys  Leu Phe Glu Ala Asn  Gln Thr Ala Asp Val  Lys Glu Ile
    1265                1270                1275


Ala Ala  Ser Phe Ile Gln Leu  Met Gln Phe Asn Ala  Met Gly Ala
    1280                1285                1290


Pro Ser  Thr Phe Lys Phe Phe  Gln Lys Asp Ile Glu  Arg Ala Arg
    1295                1300                1305


Tyr Thr  Ser Ile Lys Glu Ile  Phe Asp Ala Thr Ile  Ile Tyr Gln
    1310                1315                1320


Ser Thr  Thr Gly Leu Tyr Glu  Thr Arg Arg Lys Val  Val Asp
    1325                1330                1335


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<213>  Enterococcus faecalis

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Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
```

```
            20                  25                  30

Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Ala Leu Asp Glu Asn
                85                  90                  95

Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
            100                 105                 110

Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175

Glu Asn Ile Ser Val Lys Glu Gln Phe Gln Gln Phe Met Ile Ile Tyr
            180                 185                 190

Asn Gln Thr Phe Val Asn Gly Glu Ser Arg Leu Val Ser Ala Pro Leu
        195                 200                 205

Pro Glu Ser Val Leu Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg
    210                 215                 220
```

```
Thr Lys Lys Ser Glu Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala
225                 230                 235                 240

Asn Gly Leu Phe Gly Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala
                245                 250                 255

Asp Phe Lys Lys Val Phe Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr
            260                 265                 270

Ala Ser Glu Ser Tyr Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val
        275                 280                 285

Gly Asp Glu Tyr Ser Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp
    290                 295                 300

Ala Val Glu Leu Ser Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser His
305                 310                 315                 320

Ala Lys Leu Ser Ser Ser Met Ile Val Arg Phe Thr Glu His Gln Glu
                325                 330                 335

Asp Leu Lys Asn Phe Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu
            340                 345                 350

Tyr Asp Asn Leu Phe Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr
        355                 360                 365

Ile Thr His Ala Gly Lys Val Ser Gln Leu Lys Phe Tyr Gln Tyr Val
    370                 375                 380

Lys Lys Ile Ile Gln Asp Ile Ala Gly Ala Glu Tyr Phe Leu Glu Lys
385                 390                 395                 400

Ile Ala Gln Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly
                405                 410                 415

Val Ile Pro His Gln Ile His Leu Ala Glu Leu Gln Ala Ile Ile His
```

```
            420                 425                 430

Arg Gln Ala Ala Tyr Tyr Pro Phe Leu Lys Glu Asn Gln Glu Lys Ile
        435                 440                 445

Glu Gln Leu Val Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ser
    450                 455                 460

Lys Gly Asp Ala Asn Thr Phe Ala Trp Leu Lys Arg Gln Ser Glu Glu
465                 470                 475                 480

Pro Ile Arg Pro Trp Asn Leu Gln Glu Thr Val Asp Leu Asp Gln Ser
                485                 490                 495

Ala Thr Ala Phe Ile Glu Arg Met Thr Asn Phe Asp Thr Tyr Leu Pro
            500                 505                 510

Ser Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Lys Phe Met
        515                 520                 525

Val Phe Asn Glu Leu Thr Lys Ile Ser Tyr Thr Asp Asp Arg Gly Ile
    530                 535                 540

Lys Ala Asn Phe Ser Gly Lys Glu Lys Glu Lys Ile Phe Asp Tyr Leu
545                 550                 555                 560

Phe Lys Thr Arg Arg Lys Val Lys Lys Lys Asp Ile Ile Gln Phe Tyr
                565                 570                 575

Arg Asn Glu Tyr Asn Thr Glu Ile Val Thr Leu Ser Gly Leu Glu Glu
            580                 585                 590

Asp Gln Phe Asn Ala Ser Phe Ser Thr Tyr Gln Asp Leu Leu Lys Cys
        595                 600                 605

Gly Leu Thr Arg Ala Glu Leu Asp His Pro Asp Asn Ala Glu Lys Leu
    610                 615                 620
```

```
Glu Asp Ile Ile Lys Ile Leu Thr Ile Phe Glu Asp Arg Gln Arg Ile
625                 630                 635                 640

Arg Thr Gln Leu Ser Thr Phe Lys Gly Gln Phe Ser Ala Glu Val Leu
                645                 650                 655

Lys Lys Leu Glu Arg Lys His Tyr Thr Gly Trp Gly Arg Leu Ser Lys
            660                 665                 670

Lys Leu Ile Asn Gly Ile Tyr Asp Lys Glu Ser Gly Lys Thr Ile Leu
        675                 680                 685

Asp Tyr Leu Ile Lys Asp Asp Gly Val Ser Lys His Tyr Asn Arg Asn
    690                 695                 700

Phe Met Gln Leu Ile Asn Asp Ser Gln Leu Ser Phe Lys Asn Ala Ile
705                 710                 715                 720

Gln Lys Ala Gln Ser Ser Glu His Glu Glu Thr Leu Ser Glu Thr Val
                725                 730                 735

Asn Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Tyr Gln Ser
            740                 745                 750

Leu Lys Ile Val Asp Glu Leu Val Ala Ile Met Gly Tyr Ala Pro Lys
        755                 760                 765

Arg Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Ser Thr Gly
    770                 775                 780

Lys Arg Arg Ser Ile Gln Arg Leu Lys Ile Val Glu Lys Ala Met Ala
785                 790                 795                 800

Glu Ile Gly Ser Asn Leu Leu Lys Glu Gln Pro Thr Thr Asn Glu Gln
                805                 810                 815

Leu Arg Asp Thr Arg Leu Phe Leu Tyr Tyr Met Gln Asn Gly Lys Asp
```

```
            820                 825                 830

Met Tyr Thr Gly Asp Glu Leu Ser Leu His Arg Leu Ser His Tyr Asp
        835                 840                 845

Ile Asp His Ile Ile Pro Gln Ser Phe Met Lys Asp Asp Ser Leu Asp
    850                 855                 860

Asn Leu Val Leu Val Gly Ser Thr Glu Asn Arg Gly Lys Ser Asp Asp
865                 870                 875                 880

Val Pro Ser Lys Glu Val Val Lys Asp Met Lys Ala Tyr Trp Glu Lys
                885                 890                 895

Leu Tyr Ala Ala Gly Leu Ile Ser Gln Arg Lys Phe Gln Arg Leu Thr
            900                 905                 910

Lys Gly Glu Gln Gly Gly Leu Thr Leu Glu Asp Lys Ala His Phe Ile
        915                 920                 925

Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala Gly
    930                 935                 940

Ile Leu Asp Gln Arg Tyr Asn Ala Lys Ser Lys Glu Lys Lys Val Gln
945                 950                 955                 960

Ile Ile Thr Leu Lys Ala Ser Leu Thr Ser Gln Phe Arg Ser Ile Phe
                965                 970                 975

Gly Leu Tyr Lys Val Arg Glu Val Asn Asp Tyr His His Gly Gln Asp
            980                 985                 990

Ala Tyr Leu Asn Cys Val Val Ala  Thr Thr Leu Leu Lys  Val Tyr Pro
        995                 1000                1005

Asn Leu  Ala Pro Glu Phe Val  Tyr Gly Glu Tyr Pro  Lys Phe Gln
    1010                1015                1020
```

```
Thr Phe  Lys Glu Asn Lys Ala  Thr Ala Lys Ala Ile  Ile Tyr Thr
    1025                1030                1035

Asn Leu  Leu Arg Phe Phe Thr  Glu Asp Glu Pro Arg  Phe Thr Lys
    1040                1045                1050

Asp Gly  Glu Ile Leu Trp Ser  Asn Ser Tyr Leu Lys  Thr Ile Lys
    1055                1060                1065

Lys Glu  Leu Asn Tyr His Gln  Met Asn Ile Val Lys  Lys Val Glu
    1070                1075                1080

Val Gln  Lys Gly Gly Phe Ser  Lys Glu Ser Ile Lys  Pro Lys Gly
    1085                1090                1095

Pro Ser  Asn Lys Leu Ile Pro  Val Lys Asn Gly Leu  Asp Pro Gln
    1100                1105                1110

Lys Tyr  Gly Gly Phe Asp Ser  Pro Ile Val Ala Tyr  Thr Val Leu
    1115                1120                1125

Phe Thr  His Glu Lys Gly Lys  Lys Pro Leu Ile Lys  Gln Glu Ile
    1130                1135                1140

Leu Gly  Ile Thr Ile Met Glu  Lys Thr Arg Phe Glu  Gln Asn Pro
    1145                1150                1155

Ile Leu  Phe Leu Glu Glu Lys  Gly Phe Leu Arg Pro  Arg Val Leu
    1160                1165                1170

Met Lys  Leu Pro Lys Tyr Thr  Leu Tyr Gln Phe Pro  Glu Gly Arg
    1175                1180                1185

Arg Arg  Leu Leu Ala Ser Ala  Lys Glu Ala Gln Lys  Gly Asn Gln
    1190                1195                1200

Met Val  Leu Pro Glu His Leu  Leu Thr Leu Leu Tyr  His Ala Lys
```

```
    1205                1210                1215

Gln Cys  Leu Leu Pro Asn Gln  Ser Glu Ser Leu Ala  Tyr Val Glu
    1220                1225                1230

Gln His  Gln Pro Glu Phe Gln  Glu Ile Leu Glu Arg  Val Val Asp
    1235                1240                1245

Phe Ala  Glu Val His Thr Leu  Ala Lys Ser Lys Val  Gln Gln Ile
    1250                1255                1260

Val Lys  Leu Phe Glu Ala Asn  Gln Thr Ala Asp Val  Lys Glu Ile
    1265                1270                1275

Ala Ala  Ser Phe Ile Gln Leu  Met Gln Phe Asn Ala  Met Gly Ala
    1280                1285                1290

Pro Ser  Thr Phe Lys Phe Phe  Gln Lys Asp Ile Glu  Arg Ala Arg
    1295                1300                1305

Tyr Thr  Ser Ile Lys Glu Ile  Phe Asp Ala Thr Ile  Ile Tyr Gln
    1310                1315                1320

Ser Thr  Thr Gly Leu Tyr Glu  Thr Arg Arg Lys Val  Val Asp
    1325                1330                1335


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<400>  405

Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
            20                  25                  30
```

```
Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Ala Leu Asp Glu Asn
                85                  90                  95

Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
            100                 105                 110

Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175

Glu Asn Ile Ser Val Lys Glu Gln Phe Gln Gln Phe Met Ile Ile Tyr
            180                 185                 190

Asn Gln Thr Phe Val Asn Gly Glu Ser Arg Leu Val Ser Thr Pro Leu
        195                 200                 205

Pro Glu Ser Val Leu Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg
    210                 215                 220

Thr Lys Lys Ser Glu Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala
225                 230                 235                 240
```

```
Asn Gly Leu Phe Gly Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala
                245                 250                 255

Asp Phe Lys Lys Val Phe Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr
            260                 265                 270

Ala Ser Glu Ser Tyr Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val
        275                 280                 285

Gly Asp Glu Tyr Ser Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp
    290                 295                 300

Ala Val Glu Leu Ser Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser His
305                 310                 315                 320

Ala Lys Leu Ser Ser Ser Met Ile Val Arg Phe Thr Glu His Gln Glu
                325                 330                 335

Asp Leu Lys Asn Phe Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu
            340                 345                 350

Tyr Asp Asn Leu Phe Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr
        355                 360                 365

Ile Thr His Ala Gly Lys Val Ser Gln Leu Lys Phe Tyr Gln Tyr Val
    370                 375                 380

Lys Lys Ile Ile Gln Asp Ile Ala Gly Ala Glu Tyr Phe Leu Glu Lys
385                 390                 395                 400

Ile Ala Gln Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly
                405                 410                 415

Val Ile Pro His Gln Ile His Leu Ala Glu Leu Gln Ala Ile Ile His
            420                 425                 430
```

```
Arg Gln Ala Ala Tyr Tyr Pro Phe Leu Lys Glu Asn Gln Glu Lys Ile
        435                 440                 445

Glu Gln Leu Val Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ser
    450                 455                 460

Lys Gly Asp Ala Ser Thr Phe Ala Trp Leu Lys Arg Gln Ser Glu Glu
465                 470                 475                 480

Pro Ile Arg Pro Trp Asn Leu Gln Glu Thr Val Asp Leu Asp Gln Ser
                485                 490                 495

Ala Thr Ala Phe Ile Glu Arg Met Thr Asn Phe Asp Thr Tyr Leu Pro
            500                 505                 510

Ser Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Lys Phe Met
        515                 520                 525

Val Phe Asn Glu Leu Thr Lys Ile Ser Tyr Thr Asp Asp Arg Gly Ile
    530                 535                 540

Lys Ala Asn Phe Ser Gly Lys Glu Lys Glu Lys Ile Phe Asp Tyr Leu
545                 550                 555                 560

Phe Lys Thr Arg Arg Lys Val Lys Lys Lys Asp Ile Ile Gln Phe Tyr
                565                 570                 575

Arg Asn Glu Tyr Asn Thr Glu Ile Val Thr Leu Ser Gly Leu Glu Glu
            580                 585                 590

Asp Gln Phe Asn Ala Ser Phe Ser Thr Tyr Gln Asp Leu Leu Lys Cys
        595                 600                 605

Gly Leu Thr Arg Ala Glu Leu Asp His Pro Asp Asn Ala Glu Lys Leu
    610                 615                 620

Glu Asp Ile Ile Lys Ile Leu Thr Ile Phe Glu Asp Arg Gln Arg Ile
625                 630                 635                 640
```

```
Arg Thr Gln Leu Ser Thr Phe Lys Gly Gln Phe Ser Ala Glu Val Leu
                645                 650                 655

Lys Lys Leu Glu Arg Lys His Tyr Thr Gly Trp Gly Arg Leu Ser Lys
            660                 665                 670

Lys Leu Ile Asn Gly Ile Tyr Asp Lys Glu Ser Gly Lys Thr Ile Leu
        675                 680                 685

Asp Tyr Leu Val Lys Asp Asp Gly Val Ser Lys His Tyr Asn Arg Asn
    690                 695                 700

Phe Met Gln Leu Ile Asn Asp Ser Gln Leu Ser Phe Lys Asn Ala Ile
705                 710                 715                 720

Gln Lys Ala Gln Ser Ser Glu His Glu Glu Thr Leu Ser Glu Thr Val
                725                 730                 735

Asn Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Tyr Gln Ser
            740                 745                 750

Leu Lys Ile Val Asp Glu Leu Val Ala Ile Met Gly Tyr Ala Pro Lys
        755                 760                 765

Arg Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Ser Thr Gly
    770                 775                 780

Lys Arg Arg Ser Ile Gln Arg Leu Lys Ile Val Glu Lys Ala Met Ala
785                 790                 795                 800

Glu Ile Gly Ser Asn Leu Leu Lys Glu Gln Pro Thr Thr Asn Glu Gln
                805                 810                 815

Leu Arg Asp Thr Arg Leu Phe Leu Tyr Tyr Met Gln Asn Gly Lys Asp
            820                 825                 830
```

```
Met Tyr Thr Gly Asp Glu Leu Ser Leu His Arg Leu Ser His Tyr Asp
        835                 840                 845

Ile Asp His Ile Ile Pro Gln Ser Phe Met Lys Asp Asp Ser Leu Asp
    850                 855                 860

Asn Leu Val Leu Val Gly Ser Thr Glu Asn Arg Gly Lys Ser Asp Asp
865                 870                 875                 880

Val Pro Ser Lys Glu Val Val Lys Asp Met Lys Ala Tyr Trp Glu Lys
                885                 890                 895

Leu Tyr Ala Ala Gly Leu Ile Ser Gln Arg Lys Phe Gln Arg Leu Thr
            900                 905                 910

Lys Gly Glu Gln Gly Gly Leu Thr Leu Glu Asp Lys Ala His Phe Ile
        915                 920                 925

Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala Gly
    930                 935                 940

Ile Leu Asp Gln Arg Tyr Asn Ala Lys Ser Lys Glu Lys Lys Val Gln
945                 950                 955                 960

Ile Ile Thr Leu Lys Ala Ser Leu Thr Ser Gln Phe Arg Ser Ile Phe
                965                 970                 975

Gly Leu Tyr Lys Val Arg Glu Val Asn Asp Tyr His His Gly Gln Asp
            980                 985                 990

Ala Tyr Leu Asn Cys Val Val Ala  Thr Thr Leu Leu Lys  Val Tyr Pro
        995                 1000                1005

Asn Leu  Ala Pro Glu Phe Val  Tyr Gly Glu Tyr Pro  Lys Phe Gln
    1010                1015                1020

Thr Phe  Lys Glu Asn Lys Ala  Thr Ala Lys Ala Ile  Ile Tyr Thr
    1025                1030                1035
```

```
Asn Leu  Leu Arg Phe Phe Thr  Glu Asp Glu Pro Arg  Phe Thr Lys
    1040                1045                1050

Asp Gly  Glu Ile Leu Trp Ser  Asn Ser Tyr Leu Lys  Thr Ile Lys
    1055                1060                1065

Lys Glu  Leu Asn Tyr His Gln  Met Asn Ile Val Lys  Lys Val Glu
    1070                1075                1080

Val Gln  Lys Gly Gly Phe Ser  Lys Glu Ser Ile Lys  Pro Lys Gly
    1085                1090                1095

Pro Ser  Asn Lys Leu Ile Pro  Val Lys Asn Gly Leu  Asp Pro Gln
    1100                1105                1110

Lys Tyr  Gly Gly Phe Asp Ser  Pro Ile Val Ala Tyr  Thr Val Leu
    1115                1120                1125

Phe Thr  His Glu Lys Gly Lys  Lys Pro Leu Ile Lys  Gln Glu Ile
    1130                1135                1140

Leu Gly  Ile Thr Ile Met Glu  Lys Thr Arg Phe Glu  Gln Asn Pro
    1145                1150                1155

Ile Leu  Phe Leu Glu Glu Lys  Gly Phe Leu Arg Pro  Arg Val Leu
    1160                1165                1170

Met Lys  Leu Pro Lys Tyr Thr  Leu Tyr Glu Phe Pro  Glu Gly Arg
    1175                1180                1185

Arg Arg  Leu Leu Ala Ser Ala  Lys Glu Ala Gln Lys  Gly Asn Gln
    1190                1195                1200

Met Val  Leu Pro Glu His Leu  Leu Thr Leu Leu Tyr  His Ala Lys
    1205                1210                1215
```

```
Gln Cys  Leu Leu Pro Asn Gln  Ser Glu Ser Leu Ala  Tyr Val Glu
    1220                1225                1230


Gln His  Gln Pro Glu Phe Gln  Glu Ile Leu Glu Arg  Val Val Asp
    1235                1240                1245


Phe Ala  Glu Val His Thr Leu  Ala Lys Ser Lys Val  Gln Gln Ile
    1250                1255                1260


Val Lys  Leu Phe Glu Ala Asn  Gln Thr Ala Asp Val  Lys Glu Ile
    1265                1270                1275


Ala Ala  Ser Phe Ile Gln Leu  Met Gln Phe Asn Ala  Met Gly Ala
    1280                1285                1290


Pro Ser  Thr Phe Lys Phe Phe  Gln Lys Asp Ile Glu  Arg Ala Arg
    1295                1300                1305


Tyr Thr  Ser Ile Lys Glu Ile  Phe Asp Ala Thr Ile  Ile Tyr Gln
    1310                1315                1320


Ser Thr  Thr Gly Leu Tyr Glu  Thr Arg Arg Lys Val  Val Asp
    1325                1330                1335


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<212>  PRT
<213>  Enterococcus faecalis

<400>  406

Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
            20                  25                  30


Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45
```

```
Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Asp Leu Asp Glu Asn
                85                  90                  95

Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
            100                 105                 110

Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175

Glu Asn Ile Ser Val Lys Glu Gln Phe Gln Gln Phe Met Ile Ile Tyr
            180                 185                 190

Asn Gln Thr Phe Val Asn Gly Glu Ser Arg Leu Val Ser Ala Pro Leu
        195                 200                 205

Pro Glu Ser Val Leu Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg
    210                 215                 220

Thr Lys Lys Ser Glu Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala
225                 230                 235                 240

Asn Gly Leu Phe Gly Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala
```

```
                245                 250                 255

Asp Phe Lys Lys Val Phe Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr
            260                 265                 270

Ala Ser Glu Ser Tyr Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val
        275                 280                 285

Gly Asp Glu Tyr Ser Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp
    290                 295                 300

Ala Val Glu Leu Ser Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser His
305                 310                 315                 320

Ala Lys Leu Ser Ser Ser Met Ile Val Arg Phe Thr Glu His Gln Glu
                325                 330                 335

Asp Leu Lys Lys Phe Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu
            340                 345                 350

Tyr Asp Asn Leu Phe Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr
        355                 360                 365

Ile Ala His Ala Gly Lys Val Ser Gln Leu Lys Phe Tyr Gln Tyr Val
    370                 375                 380

Lys Lys Ile Ile Gln Asp Ile Ala Gly Ala Glu Tyr Phe Leu Glu Lys
385                 390                 395                 400

Ile Ala Gln Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly
                405                 410                 415

Val Ile Pro His Gln Ile His Leu Ala Glu Leu Gln Ala Ile Ile His
            420                 425                 430

Arg Gln Ala Ala Tyr Tyr Pro Phe Leu Lys Glu Asn Gln Glu Lys Ile
        435                 440                 445
```

```
Glu Gln Leu Val Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ser
    450                 455                 460

Lys Gly Asp Ala Ser Thr Phe Ala Trp Leu Lys Arg Gln Ser Glu Glu
465                 470                 475                 480

Pro Ile Arg Pro Trp Asn Leu Gln Glu Thr Val Asp Leu Asp Gln Ser
                485                 490                 495

Ala Thr Ala Phe Ile Glu Arg Met Thr Asn Phe Asp Thr Tyr Leu Pro
            500                 505                 510

Ser Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Lys Phe Met
        515                 520                 525

Val Phe Asn Glu Leu Thr Lys Ile Ser Tyr Thr Asp Asp Arg Gly Ile
    530                 535                 540

Lys Ala Asn Phe Ser Gly Lys Glu Lys Glu Lys Ile Phe Asp Tyr Leu
545                 550                 555                 560

Phe Lys Thr Arg Arg Lys Val Lys Lys Lys Asp Ile Ile Gln Phe Tyr
                565                 570                 575

Arg Asn Glu Tyr Asn Thr Glu Ile Val Thr Leu Ser Gly Leu Glu Glu
            580                 585                 590

Asp Gln Phe Asn Ala Ser Phe Ser Thr Tyr Gln Asp Leu Leu Lys Cys
        595                 600                 605

Gly Leu Thr Arg Ala Glu Leu Asp His Pro Asp Asn Ala Glu Lys Leu
    610                 615                 620

Glu Asp Ile Ile Lys Ile Leu Thr Ile Phe Glu Asp Arg Gln Arg Ile
625                 630                 635                 640

Arg Thr Gln Leu Ser Thr Phe Lys Gly Gln Phe Ser Ala Glu Val Leu
```

```
                645                 650                 655

Lys Lys Leu Glu Arg Lys His Tyr Thr Gly Trp Gly Arg Leu Ser Lys
            660                 665                 670

Lys Leu Ile Asn Gly Ile Tyr Asp Lys Glu Ser Gly Lys Thr Ile Leu
        675                 680                 685

Gly Tyr Leu Ile Lys Asp Asp Gly Val Ser Lys His Tyr Asn Arg Asn
    690                 695                 700

Phe Met Gln Leu Ile Asn Asp Ser Gln Leu Ser Phe Lys Asn Ala Ile
705                 710                 715                 720

Gln Lys Ala Gln Ser Ser Glu His Glu Glu Thr Leu Ser Glu Thr Val
                725                 730                 735

Asn Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Tyr Gln Ser
            740                 745                 750

Leu Lys Ile Val Asp Glu Leu Val Ala Ile Met Gly Tyr Ala Pro Lys
        755                 760                 765

Arg Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Ser Thr Gly
    770                 775                 780

Lys Arg Arg Ser Ile Gln Arg Leu Lys Ile Val Glu Lys Ala Met Ala
785                 790                 795                 800

Glu Ile Gly Ser Asn Leu Leu Lys Glu Gln Pro Thr Thr Asn Glu Gln
                805                 810                 815

Leu Arg Asp Thr Arg Leu Phe Leu Tyr Tyr Met Gln Asn Gly Lys Asp
            820                 825                 830

Met Tyr Thr Gly Asp Glu Leu Ser Leu His Arg Leu Ser His Tyr Asp
        835                 840                 845
```

```
Ile Asp His Ile Ile Pro Gln Ser Phe Met Lys Asp Asp Ser Leu Asp
    850                 855                 860

Asn Leu Val Leu Val Gly Ser Thr Glu Asn Arg Gly Lys Ser Asp Asp
865                 870                 875                 880

Val Pro Ser Lys Glu Val Val Lys Asp Met Lys Ala Tyr Trp Glu Lys
                885                 890                 895

Leu Tyr Ala Ala Gly Leu Ile Ser Gln Arg Lys Phe Gln Arg Leu Thr
            900                 905                 910

Lys Gly Glu Gln Gly Gly Leu Thr Leu Glu Asp Lys Ala His Phe Ile
        915                 920                 925

Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala Gly
    930                 935                 940

Ile Leu Asp Gln Arg Tyr Asn Ala Asn Ser Lys Glu Lys Lys Val Gln
945                 950                 955                 960

Ile Ile Thr Leu Lys Ala Ser Leu Thr Ser Gln Phe Arg Ser Ile Phe
                965                 970                 975

Gly Leu Tyr Lys Val Arg Glu Val Asn Asp Tyr His His Gly Gln Asp
            980                 985                 990

Ala Tyr Leu Asn Cys Val Val Ala  Thr Thr Leu Leu Lys  Val Tyr Pro
        995                 1000                1005

Asn Leu  Ala Pro Glu Phe Val  Tyr Gly Glu Tyr Pro  Lys Phe Gln
    1010                1015                1020

Thr Phe  Lys Glu Asn Lys Ala  Thr Ala Lys Ala Ile  Ile Tyr Thr
    1025                1030                1035

Asn Leu  Leu Arg Phe Phe Thr  Glu Asp Glu Pro Arg  Phe Thr Lys
```

```
    1040                1045                1050

Asp Gly  Glu Ile Leu Trp Ser  Asn Ser Tyr Leu Lys  Thr Ile Lys
    1055                1060                1065

Lys Glu  Leu Asn Tyr His Gln  Met Asn Ile Val Lys  Lys Val Glu
    1070                1075                1080

Val Gln  Lys Gly Gly Phe Ser  Lys Glu Ser Ile Lys  Pro Lys Gly
    1085                1090                1095

Pro Ser  Asn Lys Leu Ile Pro  Val Lys Asn Gly Leu  Asp Pro Gln
    1100                1105                1110

Lys Tyr  Gly Gly Phe Asp Ser  Pro Ile Val Ala Tyr  Thr Val Leu
    1115                1120                1125

Phe Thr  His Glu Lys Gly Lys  Lys Pro Leu Ile Lys  Gln Glu Ile
    1130                1135                1140

Leu Gly  Ile Thr Ile Met Glu  Lys Thr Arg Phe Glu  Gln Asn Pro
    1145                1150                1155

Ile Leu  Phe Leu Glu Glu Lys  Gly Phe Leu Arg Pro  Arg Val Leu
    1160                1165                1170

Met Lys  Leu Pro Lys Tyr Thr  Leu Tyr Glu Phe Pro  Glu Gly Arg
    1175                1180                1185

Arg Arg  Leu Leu Ala Ser Ala  Lys Glu Ala Gln Lys  Gly Asn Gln
    1190                1195                1200

Met Val  Leu Pro Glu His Leu  Leu Thr Leu Leu Tyr  His Ala Lys
    1205                1210                1215

Gln Cys  Leu Leu Pro Asn Gln  Ser Glu Ser Leu Ala  Tyr Val Glu
    1220                1225                1230
```

```
Gln His  Gln Pro Glu Phe Gln  Glu Ile Leu Glu Arg  Val Val Asp
    1235                1240                1245


Phe Ala  Glu Val His Thr Leu  Ala Lys Ser Lys Val  Gln Gln Ile
    1250                1255                1260


Val Lys  Leu Phe Glu Ala Asn  Gln Thr Ala Asp Val  Lys Glu Ile
    1265                1270                1275


Ala Ala  Ser Phe Ile Gln Leu  Met Gln Phe Asn Ala  Met Gly Ala
    1280                1285                1290


Pro Ser  Thr Phe Lys Phe Phe  Gln Lys Asp Ile Glu  Arg Ala Arg
    1295                1300                1305


Tyr Thr  Ser Ile Lys Glu Ile  Phe Asp Ala Thr Ile  Ile Tyr Gln
    1310                1315                1320


Ser Thr  Thr Gly Leu Tyr Glu  Thr Arg Arg Lys Val  Val Asp
    1325                1330                1335


<210>  407
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<212>  PRT
<213>  Enterococcus faecalis

<400>  407

Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
            20                  25                  30


Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60
```

```
Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Asp Leu Asp Glu Asn
                85                  90                  95

Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
            100                 105                 110

Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175

Glu Asn Ile Ser Val Lys Glu Gln Phe Gln Gln Phe Met Ile Ile Tyr
            180                 185                 190

Asn Gln Thr Phe Val Asn Gly Glu Ser Arg Leu Val Ser Ala Pro Leu
        195                 200                 205

Pro Glu Ser Val Leu Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg
    210                 215                 220

Thr Lys Lys Ser Glu Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala
225                 230                 235                 240

Asn Gly Leu Phe Gly Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala
                245                 250                 255
```

```
Asp Phe Lys Lys Val Phe Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr
            260                 265                 270

Ala Ser Glu Ser Tyr Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val
        275                 280                 285

Gly Asp Glu Tyr Ser Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp
    290                 295                 300

Ala Val Glu Leu Ser Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser His
305                 310                 315                 320

Ala Lys Leu Ser Ser Ser Met Ile Val Arg Phe Thr Glu His Gln Glu
                325                 330                 335

Asp Leu Lys Lys Phe Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu
            340                 345                 350

Tyr Asp Asn Leu Phe Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr
        355                 360                 365

Ile Ala His Ala Gly Lys Val Ser Gln Leu Lys Phe Tyr Gln Tyr Val
    370                 375                 380

Lys Lys Ile Ile Gln Asp Ile Ala Gly Ala Glu Tyr Phe Leu Glu Lys
385                 390                 395                 400

Ile Ala Gln Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly
                405                 410                 415

Val Ile Pro His Gln Ile His Leu Ala Glu Leu Gln Ala Ile Ile His
            420                 425                 430

Arg Gln Ala Ala Tyr Tyr Pro Phe Leu Lys Glu Asn Gln Glu Lys Ile
        435                 440                 445

Glu Gln Leu Val Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ser
    450                 455                 460
```

```
Lys Gly Asp Ala Ser Thr Phe Ala Trp Leu Lys Arg Gln Ser Glu Glu
465                 470                 475                 480

Pro Ile Arg Pro Trp Asn Leu Gln Glu Thr Val Asp Leu Asp Gln Ser
                485                 490                 495

Ala Thr Ala Phe Ile Glu Arg Met Thr Asn Phe Asp Thr Tyr Leu Pro
            500                 505                 510

Ser Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Lys Phe Met
        515                 520                 525

Val Phe Asn Glu Leu Thr Lys Ile Ser Tyr Thr Asp Asp Arg Gly Ile
    530                 535                 540

Lys Ala Asn Phe Ser Gly Lys Glu Lys Glu Lys Ile Phe Asp Tyr Leu
545                 550                 555                 560

Phe Lys Thr Arg Arg Lys Val Lys Lys Lys Asp Ile Ile Gln Phe Tyr
                565                 570                 575

Arg Asn Glu Tyr Asn Thr Glu Ile Val Thr Leu Ser Gly Leu Glu Glu
            580                 585                 590

Asp Gln Phe Asn Ala Ser Phe Ser Thr Tyr Gln Asp Leu Leu Lys Cys
        595                 600                 605

Gly Leu Thr Arg Ala Glu Leu Asp His Pro Asp Asn Ala Glu Lys Leu
    610                 615                 620

Glu Asp Ile Ile Lys Ile Leu Thr Ile Phe Glu Asp Arg Gln Arg Ile
625                 630                 635                 640

Arg Thr Gln Leu Ser Thr Phe Lys Gly Gln Phe Ser Ala Glu Val Leu
                645                 650                 655
```

```
Lys Lys Leu Glu Arg Lys His Tyr Thr Gly Trp Gly Arg Leu Ser Lys
            660                 665                 670

Lys Leu Ile Asn Gly Ile Tyr Asp Lys Glu Ser Gly Lys Thr Ile Leu
        675                 680                 685

Gly Tyr Leu Ile Lys Asp Asp Gly Val Ser Lys His Tyr Asn Arg Asn
    690                 695                 700

Phe Met Gln Leu Ile Asn Asp Ser Gln Leu Ser Phe Lys Asn Ala Ile
705                 710                 715                 720

Gln Lys Ala Gln Ser Ser Glu His Glu Glu Thr Leu Ser Glu Thr Val
                725                 730                 735

Asn Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Tyr Gln Ser
            740                 745                 750

Leu Lys Ile Val Asp Glu Leu Val Ala Ile Met Gly Tyr Ala Pro Lys
        755                 760                 765

Arg Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Ser Thr Gly
    770                 775                 780

Lys Arg Arg Ser Ile Gln Arg Leu Lys Ile Val Glu Lys Ala Met Ala
785                 790                 795                 800

Glu Ile Gly Ser Asn Leu Leu Lys Glu Gln Pro Thr Thr Asn Glu Gln
                805                 810                 815

Leu Arg Asp Thr Arg Leu Phe Leu Tyr Tyr Met Gln Asn Gly Lys Asp
            820                 825                 830

Met Tyr Thr Gly Asp Glu Leu Ser Leu His Arg Leu Ser His Tyr Asp
        835                 840                 845

Ile Asp His Ile Ile Pro Gln Ser Phe Met Lys Asp Asp Ser Leu Asp
    850                 855                 860
```

```
Asn Leu Val Leu Val Gly Ser Thr Glu Asn Arg Gly Lys Ser Asp Asp
865                 870                 875                 880

Val Pro Ser Lys Glu Val Val Lys Asp Met Lys Ala Tyr Trp Glu Lys
                885                 890                 895

Leu Tyr Ala Ala Gly Leu Ile Ser Gln Arg Lys Phe Gln Arg Leu Thr
            900                 905                 910

Lys Gly Glu Gln Gly Gly Leu Thr Leu Glu Asp Lys Ala His Phe Ile
        915                 920                 925

Gln Arg Gln Leu Val Glu Thr Arg
    930                 935
```

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<212> PRT
<213> Enterococcus faecalis

<400> 408

```
Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
            20                  25                  30

Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Asp Leu Asp Glu Asn
```

```
                85                  90                  95

Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
            100                 105                 110

Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175

Glu Asn Ile Ser Val Lys Glu Gln Phe Gln Gln Phe Met Ile Ile Tyr
            180                 185                 190

Asn Gln Thr Phe Val Asn Gly Glu Ser Arg Leu Val Ser Ala Pro Leu
        195                 200                 205

Pro Glu Ser Val Leu Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg
    210                 215                 220

Thr Lys Lys Ser Glu Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala
225                 230                 235                 240

Asn Gly Leu Phe Gly Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala
                245                 250                 255

Asp Phe Lys Lys Val Phe Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr
            260                 265                 270

Ala Ser Glu Ser Tyr Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val
        275                 280                 285
```

```
Gly Asp Glu Tyr Ser Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp
    290                 295                 300

Ala Val Glu Leu Ser Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser His
305                 310                 315                 320

Ala Lys Leu Ser Ser Ser Met Ile Val Arg Phe Thr Glu His Gln Glu
                325                 330                 335

Asp Leu Lys Lys Phe Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu
            340                 345                 350

Tyr Asp Asn Leu Phe Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr
        355                 360                 365

Ile Ala His Ala Gly Lys Val Ser Gln Leu Lys Phe Tyr Gln Tyr Val
    370                 375                 380

Lys Lys Ile Ile Gln Asp Ile Ala Gly Ala Glu Tyr Phe Leu Glu Lys
385                 390                 395                 400

Ile Ala Gln Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly
                405                 410                 415

Val Ile Pro His Gln Ile His Leu Ala Glu Leu Gln Ala Ile Ile His
            420                 425                 430

Arg Gln Ala Ala Tyr Tyr Pro Phe Leu Lys Glu Asn Gln Glu Lys Ile
        435                 440                 445

Glu Gln Leu Val Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ser
    450                 455                 460

Lys Gly Asp Ala Ser Thr Phe Ala Trp Leu Lys Arg Gln Ser Glu Glu
465                 470                 475                 480

Pro Ile Arg Pro Trp Asn Leu Gln Glu Thr Val Asp Leu Asp Gln Ser
```

```
                485                 490                 495

Ala Thr Ala Phe Ile Glu Arg Met Thr Asn Phe Asp Thr Tyr Leu Pro
            500                 505                 510

Ser Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Lys Phe Met
        515                 520                 525

Val Phe Asn Glu Leu Thr Lys Ile Ser Tyr Thr Asp Asp Arg Gly Ile
    530                 535                 540

Lys Ala Asn Phe Ser Gly Lys Glu Lys Glu Lys Ile Phe Asp Tyr Leu
545                 550                 555                 560

Phe Lys Thr Arg Arg Lys Val Lys Lys Lys Asp Ile Ile Gln Phe Tyr
                565                 570                 575

Arg Asn Glu Tyr Asn Thr Glu Ile Val Thr Leu Ser Gly Leu Glu Glu
            580                 585                 590

Asp Gln Phe Asn Ala Ser Phe Ser Thr Tyr Gln Asp Leu Leu Lys Cys
        595                 600                 605

Gly Leu Thr Arg Ala Glu Leu Asp His Pro Asp Asn Ala Glu Lys Leu
    610                 615                 620

Glu Asp Ile Ile Lys Ile Leu Thr Ile Phe Glu Asp Arg Gln Arg Ile
625                 630                 635                 640

Arg Thr Gln Leu Ser Thr Phe Lys Gly Gln Phe Ser Ala Glu Val Leu
                645                 650                 655

Lys Lys Leu Glu Arg Lys His Tyr Thr Gly Trp Gly Arg Leu Ser Lys
            660                 665                 670

Lys Leu Ile Asn Gly Ile Tyr Asp Lys Glu Ser Gly Lys Thr Ile Leu
        675                 680                 685
```

```
Asp Tyr Leu Val Lys Asp Asp Gly Val Ser Lys His Tyr Asn Arg Asn
    690                 695                 700

Phe Met Gln Leu Ile Asn Asp Ser Gln Leu Ser Phe Lys Asn Ala Ile
705                 710                 715                 720

Gln Lys Ala Gln Ser Ser Glu His Glu Glu Thr Leu Ser Glu Thr Val
                725                 730                 735

Asn Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Tyr Gln Ser
            740                 745                 750

Leu Lys Ile Val Asp Glu Leu Val Ala Ile Met Gly Tyr Ala Pro Lys
        755                 760                 765

Arg Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Ser Thr Gly
    770                 775                 780

Lys Arg Arg Ser Ile Gln Arg Leu Lys Ile Val Glu Lys Ala Met Ala
785                 790                 795                 800

Glu Ile Gly Ser Asn Leu Leu Lys Glu Gln Pro Thr Thr Asn Glu Gln
                805                 810                 815

Leu Arg Asp Thr Arg Leu Phe Leu Tyr Tyr Met Gln Asn Gly Lys Asp
            820                 825                 830

Met Tyr Thr Gly Asp Glu Leu Ser Leu His Arg Leu Ser His Tyr Asp
        835                 840                 845

Ile Asp His Ile Ile Pro Gln Ser Phe Met Lys Asp Asp Ser Leu Asp
    850                 855                 860

Asn Leu Val Leu Val Gly Ser Thr Glu Asn Arg Gly Lys Ser Asp Asp
865                 870                 875                 880

Val Pro Ser Lys Glu Val Val Lys Asp Met Lys Ala Tyr Trp Glu Lys
```

```
               885                 890                 895

Leu Tyr Ala Ala Gly Leu Ile Ser Gln Arg Lys Phe Gln Arg Leu Thr
            900                 905                 910

Lys Gly Glu Gln Gly Gly Leu Thr Leu Glu Asp Lys Ala His Phe Ile
        915                 920                 925

Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala Gly
    930                 935                 940

Ile Leu Asn Gln Arg Tyr Asn Ala Asn Ser Lys Glu Lys Lys Val Gln
945                 950                 955                 960

Ile Ile Thr Leu Lys Ala Ser Leu Thr Ser Gln Phe Arg Ser Ile Phe
               965                 970                 975

Gly Leu Tyr Lys Val Arg Glu Val Asn Asp Tyr His His Gly Gln Asp
            980                 985                 990

Ala Tyr Leu Asn Cys Val Val Ala  Thr Thr Leu Leu Lys  Val Tyr Pro
        995                 1000                1005

Asn Leu  Ala Pro Glu Phe Val  Tyr Gly Glu Tyr Pro  Lys Phe Gln
    1010                1015                1020

Thr Phe  Lys Glu Asn Lys Ala  Thr Ala Lys Ala Ile  Ile Tyr Thr
    1025                1030                1035

Asn Leu  Leu Arg Phe Phe Thr  Glu Asp Glu Pro Arg  Phe Thr Lys
    1040                1045                1050

Asp Gly  Glu Ile Leu Trp Ser  Asn Ser Tyr Leu Lys  Thr Ile Lys
    1055                1060                1065

Lys Glu  Leu Asn Tyr His Gln  Met Asn Ile Val Lys  Lys Val Glu
    1070                1075                1080
```

```
Val Gln  Lys Gly Gly Phe Ser  Lys Glu Ser Ile Lys  Pro Lys Gly
    1085                1090                1095

Pro Ser  Asn Lys Leu Ile Pro  Val Lys Asn Gly Leu  Asp Pro Gln
    1100                1105                1110

Lys Tyr  Gly Gly Phe Asp Ser  Pro Val Val Ala Tyr  Thr Val Leu
    1115                1120                1125

Phe Thr  His Glu Lys Gly Lys  Lys Pro Leu Ile Lys  Gln Glu Ile
    1130                1135                1140

Leu Gly  Ile Thr Ile Met Glu  Lys Thr Arg Phe Glu  Gln Asn Pro
    1145                1150                1155

Ile Leu  Phe Leu Glu Glu Lys  Gly Phe Leu Arg Pro  Arg Val Leu
    1160                1165                1170

Met Lys  Leu Pro Lys Tyr Thr  Leu Tyr Glu Phe Pro  Glu Gly Arg
    1175                1180                1185

Arg Arg  Leu Leu Ala Ser Ala  Lys Glu Ala Gln Lys  Gly Asn Gln
    1190                1195                1200

Met Val  Leu Pro Glu His Leu  Leu Thr Leu Leu Tyr  His Ala Lys
    1205                1210                1215

Gln Cys  Leu Leu Pro Asn Gln  Ser Glu Ser Leu Ala  Tyr Val Glu
    1220                1225                1230

Gln His  Gln Pro Glu Phe Gln  Glu Ile Leu Glu Arg  Val Val Asp
    1235                1240                1245

Phe Ala  Glu Val His Thr Leu  Ala Lys Ser Lys Val  Gln Gln Ile
    1250                1255                1260

Val Lys  Leu Phe Glu Ala Asn  Gln Thr Ala Asp Val  Lys Glu Ile
```

```
    1265                1270                1275

Ala Ala  Ser Phe Ile Gln Leu  Met Gln Phe Asn Ala  Met Gly Ala
    1280                1285                1290

Pro Ser  Thr Phe Lys Phe Phe  Gln Lys Asp Ile Glu  Arg Ala Arg
    1295                1300                1305

Tyr Thr  Ser Ile Lys Glu Ile  Phe Asp Ala Thr Ile  Ile Tyr Gln
    1310                1315                1320

Ser Thr  Thr Gly Leu Tyr Glu  Thr Arg Arg Lys Val  Val Asp
    1325                1330                1335
```

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<212> PRT
<213> Enterococcus faecalis

<400> 409

```
Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
            20                  25                  30

Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Asp Leu Asp Glu Asn
                85                  90                  95
```

```
Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
            100                 105                 110

Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175

Glu Asn Ile Ser Val Lys Glu Gln Phe Gln Gln Phe Met Ile Ile Tyr
            180                 185                 190

Asn Gln Thr Phe Val Asn Gly Glu Ser Arg Leu Val Ser Ala Pro Leu
        195                 200                 205

Pro Glu Ser Val Leu Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg
    210                 215                 220

Thr Lys Lys Ser Glu Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala
225                 230                 235                 240

Asn Gly Leu Phe Gly Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala
                245                 250                 255

Asp Phe Lys Lys Val Phe Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr
            260                 265                 270

Ala Ser Glu Ser Tyr Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val
        275                 280                 285

Gly Asp Glu Tyr Ser Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp
    290                 295                 300
```

```
Ala Val Glu Leu Ser Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser His
305                 310                 315                 320

Ala Lys Leu Ser Ser Ser Met Ile Val Arg Phe Thr Glu His Gln Glu
                325                 330                 335

Asp Leu Lys Lys Phe Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu
            340                 345                 350

Tyr Asp Asn Leu Phe Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr
        355                 360                 365

Ile Ala His Ala Gly Lys Val Ser Gln Leu Lys Phe Tyr Gln Tyr Val
    370                 375                 380

Lys Lys Ile Ile Gln Asp Ile Ala Gly Ala Glu Tyr Phe Leu Glu Lys
385                 390                 395                 400

Ile Ala Gln Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly
                405                 410                 415

Val Ile Pro His Gln Ile His Leu Ala Glu Leu Gln Ala Ile Ile His
            420                 425                 430

Arg Gln Ala Ala Tyr Tyr Pro Phe Leu Lys Glu Asn Gln Glu Lys Ile
        435                 440                 445

Glu Gln Leu Val Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ser
    450                 455                 460

Lys Gly Asp Ala Ser Thr Phe Ala Trp Leu Lys Arg Gln Ser Glu Glu
465                 470                 475                 480

Pro Ile Arg Pro Trp Asn Leu Gln Glu Thr Val Asp Leu Asp Gln Ser
                485                 490                 495
```

```
Ala Thr Ala Phe Ile Glu Arg Met Thr Asn Phe Asp Thr Tyr Leu Pro
            500                 505                 510

Ser Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Lys Phe Met
        515                 520                 525

Val Phe Asn Glu Leu Thr Lys Ile Ser Tyr Thr Asp Asp Arg Gly Ile
    530                 535                 540

Lys Ala Asn Phe Ser Gly Lys Glu Lys Glu Lys Ile Phe Asp Tyr Leu
545                 550                 555                 560

Phe Lys Thr Arg Arg Lys Val Lys Lys Lys Asp Ile Ile Gln Phe Tyr
                565                 570                 575

Arg Asn Glu Tyr Asn Thr Glu Ile Val Thr Leu Ser Gly Leu Glu Glu
            580                 585                 590

Asp Gln Phe Asn Ala Ser Phe Ser Thr Tyr Gln Asp Leu Leu Lys Cys
        595                 600                 605

Gly Leu Thr Arg Ala Glu Leu Asp His Pro Asp Asn Ala Glu Lys Leu
    610                 615                 620

Glu Asp Ile Ile Lys Ile Leu Thr Ile Phe Glu Asp Arg Gln Arg Ile
625                 630                 635                 640

Arg Thr Gln Leu Ser Thr Phe Lys Gly Gln Phe Ser Ala Glu Val Leu
                645                 650                 655

Lys Lys Leu Glu Arg Lys His Tyr Thr Gly Trp Gly Arg Leu Ser Lys
            660                 665                 670

Lys Leu Ile Asn Gly Ile Tyr Asp Lys Glu Ser Gly Lys Thr Ile Leu
        675                 680                 685

Gly Tyr Leu Ile Lys Asp Asp Gly Val Ser Lys His Tyr Asn Arg Asn
    690                 695                 700
```

```
Phe Met Gln Leu Ile Asn Asp Ser Gln Leu Ser Phe Lys Asn Ala Ile
705                 710                 715                 720

Gln Lys Ala Gln Ser Ser Glu His Glu Glu Thr Leu Ser Glu Thr Val
                725                 730                 735

Asn Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Tyr Gln Ser
            740                 745                 750

Leu Lys Ile Val Asp Glu Leu Val Ala Ile Met Gly Tyr Ala Pro Lys
        755                 760                 765

Arg Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Ser Thr Gly
    770                 775                 780

Lys Arg Arg Ser Ile Gln Arg Leu Lys Ile Val Glu Lys Ala Met Ala
785                 790                 795                 800

Glu Ile Gly Ser Asn Leu Leu Lys Glu Gln Pro Thr Thr Asn Glu Gln
                805                 810                 815

Leu Arg Asp Thr Arg Leu Phe Leu Tyr Tyr Met Gln Asn Gly Lys Asp
            820                 825                 830

Met Tyr Thr Gly Asp Glu Leu Ser Leu His Arg Leu Ser His Tyr Asp
        835                 840                 845

Ile Asp His Ile Ile Pro Gln Ser Phe Met Lys Asp Asp Ser Leu Asp
    850                 855                 860

Asn Leu Val Leu Val Gly Ser Thr Glu Asn Leu Gly Lys Ser Asp Asp
865                 870                 875                 880

Val Pro Ser Lys Glu Val Val Lys Asp Met Lys Ala Tyr Trp Glu Lys
                885                 890                 895
```

```
Leu Tyr Ala Ala Gly Leu Ile Ser Gln Arg Lys Phe Gln Arg Leu Thr
            900                 905                 910

Lys Gly Glu Gln Gly Gly Leu Thr Leu Glu Asp Lys Ala His Phe Ile
        915                 920                 925

Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala Gly
    930                 935                 940

Ile Leu Asp Gln Arg Tyr Asn Ala Asn Ser Lys Glu Lys Lys Val Gln
945                 950                 955                 960

Ile Ile Thr Leu Lys Ala Ser Leu Thr Ser Gln Phe Arg Ser Ile Phe
                965                 970                 975

Gly Leu Tyr Lys Val Arg Glu Val Asn Asp Tyr His His Gly Gln Asp
            980                 985                 990

Ala Tyr Leu Asn Cys Val Val Ala  Thr Thr Leu Leu Lys  Val Tyr Pro
        995                 1000                1005

Asn Leu  Ala Pro Glu Phe Val  Tyr Gly Glu Tyr Pro  Lys Phe Gln
    1010                1015                1020

Thr Phe  Lys Glu Asn Lys Ala  Thr Ala Lys Ala Ile  Ile Tyr Thr
    1025                1030                1035

Asn Leu  Leu Arg Phe Phe Thr  Glu Asp Glu Pro Arg  Phe Thr Lys
    1040                1045                1050

Asp Gly  Glu Ile Leu Trp Ser  Asn Ser Tyr Leu Lys  Thr Ile Lys
    1055                1060                1065

Lys Glu  Leu Asn Tyr His Gln  Met Asn Ile Val Lys  Lys Val Glu
    1070                1075                1080

Val Gln  Lys Gly Gly Phe Ser  Lys Glu Ser Ile Lys  Pro Lys Gly
    1085                1090                1095
```

```
Pro Ser  Asn Lys Leu Ile Pro  Val Lys Asn Gly Leu  Asp Pro Gln
    1100                1105                1110

Lys Tyr  Gly Gly Phe Asp Ser  Pro Ile Val Ala Tyr  Thr Val Leu
    1115                1120                1125

Phe Thr  His Glu Lys Gly Lys  Lys Pro Leu Ile Lys  Gln Glu Ile
    1130                1135                1140

Leu Gly  Ile Thr Ile Met Glu  Lys Thr Arg Phe Glu  Gln Asn Pro
    1145                1150                1155

Ile Leu  Phe Leu Glu Glu Lys  Gly Phe Leu Arg Pro  Arg Val Leu
    1160                1165                1170

Met Lys  Leu Pro Lys Tyr Thr  Leu Tyr Glu Phe Pro  Glu Gly Arg
    1175                1180                1185

Arg Arg  Leu Leu Ala Ser Ala  Lys Glu Ala Gln Lys  Gly Asn Gln
    1190                1195                1200

Met Val  Leu Pro Glu His Leu  Leu Thr Leu Leu Tyr  His Ala Lys
    1205                1210                1215

Gln Cys  Leu Leu Pro Asn Gln  Ser Glu Ser Leu Ala  Tyr Val Glu
    1220                1225                1230

Gln His  Gln Pro Glu Phe Gln  Glu Ile Leu Glu Arg  Val Val Asp
    1235                1240                1245

Phe Ala  Glu Val His Thr Leu  Ala Lys Ser Lys Val  Gln Gln Ile
    1250                1255                1260

Val Lys  Leu Phe Glu Ala Asn  Gln Thr Ala Asp Val  Lys Glu Ile
    1265                1270                1275
```

```
Ala Ala  Ser Phe Ile Gln Leu  Met Gln Phe Asn Ala  Met Gly Ala
    1280                1285                1290


Pro Ser  Thr Phe Lys Phe Phe  Gln Lys Asp Ile Glu  Arg Ala Arg
    1295                1300                1305


Tyr Thr  Ser Ile Lys Glu Ile  Phe Asp Ala Thr Ile  Ile Tyr Gln
    1310                1315                1320


Ser Thr  Thr Gly Leu Tyr Glu  Thr Arg Arg Lys Val  Val Asp
    1325                1330                1335
```

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<211> 1337
<212> PRT
<213> Enterococcus faecalis

<400> 410

```
Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
            20                  25                  30


Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80


Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Asp Leu Asp Glu Asn
                85                  90                  95


Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
            100                 105                 110
```

```
Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175

Glu Asn Thr Ser Val Lys Glu Gln Phe Gln Gln Phe Met Val Ile Tyr
            180                 185                 190

Asn Gln Thr Phe Val Asn Gly Glu Ser Arg Leu Val Ser Ala Pro Leu
        195                 200                 205

Pro Glu Ser Val Leu Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg
    210                 215                 220

Thr Lys Lys Ser Glu Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala
225                 230                 235                 240

Asn Gly Leu Phe Gly Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala
                245                 250                 255

Asp Phe Lys Lys Val Phe Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr
            260                 265                 270

Ala Ser Glu Ser Tyr Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val
        275                 280                 285

Gly Asp Glu Tyr Ser Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp
    290                 295                 300

Ala Val Glu Leu Ser Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser His
```

```
305                 310                 315                 320

Ala Lys Leu Ser Ser Ser Met Ile Val Arg Phe Thr Glu His Gln Glu
                325                 330                 335

Asp Leu Lys Lys Phe Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu
            340                 345                 350

Tyr Asp Asn Leu Phe Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr
        355                 360                 365

Ile Ala His Ala Gly Lys Val Ser Gln Leu Lys Phe Tyr Gln Tyr Val
    370                 375                 380

Lys Lys Ile Ile Gln Asp Ile Ala Gly Ala Glu Tyr Phe Leu Glu Lys
385                 390                 395                 400

Ile Ala Gln Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly
                405                 410                 415

Val Ile Pro His Gln Ile His Leu Ala Glu Leu Gln Ala Ile Ile His
            420                 425                 430

Arg Gln Ala Ala Tyr Tyr Pro Phe Leu Lys Glu Asn Gln Glu Lys Ile
        435                 440                 445

Glu Gln Leu Val Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ser
    450                 455                 460

Lys Gly Asp Ala Ser Thr Phe Ala Trp Leu Lys Arg Gln Ser Glu Glu
465                 470                 475                 480

Pro Ile Arg Pro Trp Asn Leu Gln Glu Thr Val Asp Leu Asp Gln Ser
                485                 490                 495

Ala Thr Ala Phe Ile Glu Arg Met Thr Asn Phe Asp Thr Tyr Leu Pro
            500                 505                 510
```

```
Ser Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Lys Phe Met
        515                 520                 525

Val Phe Asn Glu Leu Thr Lys Ile Ser Tyr Thr Asp Asp Arg Gly Ile
    530                 535                 540

Lys Ala Asn Phe Ser Gly Lys Glu Lys Glu Lys Ile Phe Asp Tyr Leu
545                 550                 555                 560

Phe Lys Thr Arg Arg Lys Val Lys Lys Lys Asp Ile Ile Gln Phe Tyr
                565                 570                 575

Arg Asn Glu Tyr Asn Thr Glu Ile Val Thr Leu Ser Gly Leu Glu Glu
            580                 585                 590

Asp Gln Phe Asn Ala Ser Phe Ser Thr Tyr Gln Asp Leu Leu Lys Cys
        595                 600                 605

Gly Leu Thr Arg Ala Glu Leu Asp His Pro Asp Asn Ala Glu Lys Leu
    610                 615                 620

Glu Asp Ile Ile Lys Ile Leu Thr Ile Phe Glu Asp Arg Gln Arg Ile
625                 630                 635                 640

Arg Thr Gln Leu Ser Thr Phe Lys Gly Gln Phe Ser Ala Glu Val Leu
                645                 650                 655

Lys Lys Leu Glu Arg Lys His Tyr Thr Gly Trp Gly Arg Leu Ser Lys
            660                 665                 670

Lys Leu Ile Asn Gly Ile Tyr Asp Lys Glu Ser Gly Lys Thr Ile Leu
        675                 680                 685

Asp Tyr Leu Val Lys Asp Asp Gly Val Ser Lys His Tyr Asn Arg Asn
    690                 695                 700

Phe Met Gln Leu Ile Asn Asp Ser Gln Leu Ser Phe Lys Asn Ala Ile
```

```
705                 710                 715                 720

Gln Lys Ala Gln Ser Ser Glu His Glu Glu Thr Leu Ser Glu Thr Val
                725                 730                 735

Asn Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Tyr Gln Ser
            740                 745                 750

Leu Lys Ile Val Asp Glu Leu Val Ala Ile Met Gly Tyr Ala Pro Lys
        755                 760                 765

Arg Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Ser Thr Gly
    770                 775                 780

Lys Arg Arg Ser Ile Gln Arg Leu Lys Ile Val Glu Lys Ala Met Ala
785                 790                 795                 800

Glu Ile Gly Ser Asn Leu Leu Lys Glu Gln Pro Thr Thr Asn Glu Gln
                805                 810                 815

Leu Arg Asp Thr Arg Leu Phe Leu Tyr Tyr Met Gln Asn Gly Lys Asp
            820                 825                 830

Met Tyr Thr Gly Asp Glu Leu Ser Leu His Arg Leu Ser His Tyr Asp
        835                 840                 845

Ile Asp His Ile Ile Pro Gln Ser Phe Met Lys Asp Asp Ser Leu Asp
    850                 855                 860

Asn Leu Val Leu Val Gly Ser Thr Glu Asn Arg Gly Lys Ser Asp Asp
865                 870                 875                 880

Val Pro Ser Lys Lys Val Val Lys Lys Met Lys Ala Tyr Trp Glu Lys
                885                 890                 895

Leu Tyr Ala Ala Gly Leu Ile Ser Gln Arg Lys Phe Gln Arg Leu Thr
            900                 905                 910
```

```
Lys Gly Glu Gln Gly Gly Leu Thr Leu Glu Asp Lys Ala His Phe Ile
        915                 920                 925


Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala Gly
    930                 935                 940


Ile Leu Asp Gln Arg Tyr Asn Ala Lys Ser Lys Glu Lys Lys Val Gln
945                 950                 955                 960


Ile Ile Thr Leu Lys Ala Ser Leu Thr Ser Gln Phe Arg Ser Ile Phe
                965                 970                 975


Gly Leu Tyr Lys Val Arg Glu Val Asn Asp Tyr His His Gly Gln Asp
            980                 985                 990


Ala Tyr Leu Asn Cys Val Val Ala  Thr Thr Leu Leu Lys  Val Tyr Pro
        995                 1000                1005


Asn Leu  Ala Pro Glu Phe Val  Tyr Gly Glu Tyr Pro  Lys Phe Gln
    1010                1015                1020


Ala Phe  Lys Glu Asn Lys Ala  Thr Ala Lys Thr Ile  Ile Tyr Thr
    1025                1030                1035


Asn Leu  Met Arg Phe Phe Thr  Glu Asp Glu Pro Arg  Phe Thr Lys
    1040                1045                1050


Asp Ser  Glu Ile Leu Trp Ser  Asn Ser Tyr Leu Lys  Thr Ile Lys
    1055                1060                1065


Lys Glu  Leu Asn Tyr His Gln  Met Asn Ile Val Lys  Lys Val Glu
    1070                1075                1080


Val Gln  Lys Gly Gly Phe Ser  Lys Glu Ser Ile Lys  Pro Lys Gly
    1085                1090                1095


Pro Ser  Asn Lys Leu Ile Pro  Val Lys Asn Gly Leu  Asp Pro Gln
```

```
    1100                1105                1110

Lys Tyr  Gly Gly Phe Asp Ser  Pro Val Val Ala Tyr  Thr Val Leu
    1115                1120                1125

Phe Thr  His Glu Lys Gly Lys  Lys Pro Leu Ile Lys  Gln Glu Ile
    1130                1135                1140

Leu Gly  Ile Thr Ile Met Glu  Lys Thr Arg Phe Glu  Gln Asn Pro
    1145                1150                1155

Ile Leu  Phe Leu Glu Glu Lys  Gly Phe Leu Arg Pro  Arg Val Leu
    1160                1165                1170

Met Lys  Leu Pro Lys Tyr Thr  Leu Tyr Glu Phe Pro  Glu Gly Arg
    1175                1180                1185

Arg Arg  Leu Leu Ala Ser Ala  Lys Glu Ala Gln Lys  Gly Asn Gln
    1190                1195                1200

Met Val  Leu Pro Glu His Leu  Leu Thr Leu Leu Tyr  His Ala Lys
    1205                1210                1215

Gln Cys  Leu Leu Pro Asn Gln  Ser Glu Ser Leu Ala  Tyr Val Glu
    1220                1225                1230

Gln His  Gln Pro Glu Phe Gln  Glu Ile Leu Glu Arg  Val Val Asp
    1235                1240                1245

Phe Ala  Glu Val His Thr Leu  Ala Lys Ser Lys Val  Gln Gln Ile
    1250                1255                1260

Val Lys  Leu Phe Glu Ala Asn  Gln Thr Ala Asp Val  Lys Glu Ile
    1265                1270                1275

Ala Ala  Ser Phe Ile Gln Leu  Met Gln Phe Asn Ala  Met Gly Ala
    1280                1285                1290
```

```
Pro Ser  Thr Phe Lys Phe Phe  Gln Lys Asp Ile Glu  Arg Ala Arg
    1295                1300                1305


Tyr Thr  Ser Ile Lys Glu Ile  Phe Asp Ala Thr Ile  Ile Tyr Gln
    1310                1315                1320


Ser Thr  Thr Gly Leu Tyr Glu  Thr Arg Arg Lys Val  Val Asp
    1325                1330                1335


<210>  411
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<212>  PRT
<213>  Enterococcus faecalis

<400>  411

Met Tyr Ser Ile Gly Leu Asp Leu Gly Ile Ser Ser Val Gly Trp Ser
1               5                   10                  15


Val Ile Asp Glu Arg Thr Gly Asn Val Ile Asp Leu Gly Val Arg Leu
            20                  25                  30


Phe Ser Ala Lys Asn Ser Glu Lys Asn Leu Glu Arg Arg Thr Asn Arg
        35                  40                  45


Gly Gly Arg Arg Leu Ile Arg Arg Lys Thr Asn Arg Leu Lys Asp Ala
    50                  55                  60


Lys Lys Ile Leu Ala Ala Val Gly Phe Tyr Glu Asp Lys Ser Leu Lys
65                  70                  75                  80


Asn Ser Cys Pro Tyr Gln Leu Arg Val Lys Gly Leu Thr Glu Pro Leu
                85                  90                  95


Ser Lys Gly Glu Ile Tyr Lys Val Thr Leu His Ile Leu Lys Lys Arg
            100                 105                 110


Gly Ile Ser Tyr Leu Asp Glu Asp Asp Thr Glu Ala Ala Lys Glu Ser
        115                 120                 125
```

```
Gln Asp Tyr Lys Glu Gln Val Arg Glu Asn Ala Gln Leu Leu Thr Lys
    130                 135                 140

Tyr Thr Pro Gly Gln Ile Gln Leu Gln Arg Leu Lys Glu Asn Asn Arg
145                 150                 155                 160

Val Lys Thr Gly Ile Asn Ala Gln Gly Asn Tyr Gln Leu Asn Val Phe
                165                 170                 175

Lys Val Ser Ala Tyr Ala Asn Glu Leu Ala Thr Ile Leu Lys Thr Gln
            180                 185                 190

Gln Ala Phe Tyr Pro Asn Glu Leu Thr Asp Asp Trp Ile Ala Leu Phe
        195                 200                 205

Val Gln Pro Gly Ile Ala Glu Glu Ala Gly Leu Ile Tyr Arg Lys Arg
    210                 215                 220

Pro Tyr Tyr His Gly Pro Gly Asn Glu Ala Asn Asn Ser Pro Tyr Gly
225                 230                 235                 240

Arg Trp Ser Asp Phe Lys Lys Thr Gly Gln Pro Ala Thr Asn Ile Phe
                245                 250                 255

Asp Lys Leu Ile Gly Lys Asp Phe Gln Gly Glu Leu Arg Ala Ser Gly
            260                 265                 270

Leu Ser Leu Ser Ala Gln Gln Tyr Asn Leu Leu Asn Asp Leu Thr Asn
        275                 280                 285

Leu Lys Ile Asp Gly Glu Ile Pro Leu Ser Pro Glu Gln Lys Glu Tyr
    290                 295                 300

Ile Leu Ala Glu Leu Met Thr Lys Glu Phe Thr Arg Phe Gly Val Asn
305                 310                 315                 320
```

```
Asp Val Val Lys Leu Leu Gly Val Lys Lys Glu Arg Leu Ser Gly Trp
                325                 330                 335

Arg Leu Asp Lys Lys Gly Lys Pro Glu Ile His Thr Leu Lys Gly Tyr
            340                 345                 350

Arg Asn Trp Arg Lys Ile Phe Ala Glu Ser Gly Ile Asp Leu Ala Met
        355                 360                 365

Leu Pro Thr Glu Thr Ile Asp Cys Leu Ala Lys Ile Leu Thr Leu Asn
    370                 375                 380

Thr Glu Arg Glu Gly Ile Glu Asn Thr Leu Ala Phe Glu Leu Pro Glu
385                 390                 395                 400

Leu Ala Glu Ser Val Lys Leu Leu Val Leu Asp Arg Tyr Lys Glu Leu
                405                 410                 415

Ser Gln Ser Val Ser Thr Gln Ala Trp His Arg Phe Ser Leu Lys Thr
            420                 425                 430

Leu His Leu Leu Ile Pro Glu Leu Met Asn Ala Thr Ser Glu Gln Asn
        435                 440                 445

Thr Leu Leu Glu Gln Phe Gln Leu Lys Ser Asp Val Arg Lys Arg Tyr
    450                 455                 460

Ser Glu Tyr Lys Lys Leu Pro Thr Lys Asp Val Leu Thr Glu Ile Tyr
465                 470                 475                 480

Asn Pro Thr Val Asn Lys Thr Val Ser Gln Ala Phe Lys Val Ile Asp
                485                 490                 495

Ala Leu Leu Val Lys Tyr Gly Lys Glu Gln Ile Arg Tyr Ile Thr Ile
            500                 505                 510

Glu Met Pro Arg Asp Asp Asn Glu Glu Asp Glu Lys Lys Arg Ile Lys
        515                 520                 525
```

```
Glu Leu His Ala Lys Asn Ser Gln Arg Lys Asn Asp Ser Gln Ser Tyr
    530                 535                 540

Phe Met Gln Lys Ser Gly Trp Ser Gln Glu Lys Phe Gln Thr Thr Ile
545                 550                 555                 560

Gln Lys Asn Arg Arg Phe Leu Ala Lys Leu Leu Tyr Tyr Tyr Glu Gln
                565                 570                 575

Asp Gly Ile Cys Ala Tyr Thr Gly Leu Ser Ile Ser Pro Glu Leu Leu
            580                 585                 590

Val Ser Asp Ser Thr Glu Ile Asp His Ile Ile Pro Ile Ser Ile Ser
        595                 600                 605

Leu Asp Asp Ser Ile Asn Asn Lys Val Leu Val Leu Ser Lys Ala Asn
    610                 615                 620

Gln Val Lys Gly Gln Gln Thr Pro Tyr Asp Ala Trp Met Asp Gly Ser
625                 630                 635                 640

Phe Lys Lys Ile Asn Gly Lys Phe Ser Asn Trp Asp Asp Tyr Gln Lys
                645                 650                 655

Trp Val Glu Ser Arg His Phe Ser His Lys Lys Glu Asn Asn Leu Leu
            660                 665                 670

Glu Thr Arg Asn Ile Phe Asp Ser Glu Gln Val Glu Lys Phe Leu Ala
        675                 680                 685

Arg Asn Leu Asn Asp Thr Arg Tyr Ala Ser Arg Leu Val Leu Asn Thr
    690                 695                 700

Leu Gln Ser Phe Phe Ala Asn Gln Glu Thr Lys Val Arg Val Val Asn
705                 710                 715                 720
```

```
Gly Ser Phe Thr His Thr Leu Arg Lys Lys Trp Gly Ala Asp Leu Asp
                725                 730                 735

Lys Thr Arg Glu Thr His His His His Ala Val Asp Ala Thr Leu Cys
            740                 745                 750

Ala Val Thr Pro Phe Val Lys Val Ser Arg Tyr His Tyr Ala Val Lys
        755                 760                 765

Glu Glu Thr Gly Glu Lys Val Met Arg Glu Ile Asp Phe Glu Thr Gly
    770                 775                 780

Glu Ile Val Asp Glu Met Ser Tyr Arg Glu Phe Lys Lys Ser Lys Lys
785                 790                 795                 800

Tyr Glu Arg Lys Thr Tyr Gln Val Lys Trp Pro Asn Phe Arg Glu Gln
                805                 810                 815

Leu Lys Pro Val Asn Leu His Pro Arg Ile Lys Phe Ser His Gln Val
            820                 825                 830

Asp Arg Lys Ala Asn Arg Lys Leu Ser Asp Ala Thr Ile Tyr Ser Val
        835                 840                 845

Arg Glu Lys Thr Glu Val Lys Thr Leu Lys Ser Gly Lys Gln Lys Ile
    850                 855                 860

Thr Thr Asp Glu Tyr Thr Ile Gly Lys Ile Lys Asp Ile Tyr Thr Val
865                 870                 875                 880

Asp Gly Trp Glu Ala Phe Lys Lys Lys Gln Asp Lys Leu Leu Met Lys
                885                 890                 895

Asp Leu Asp Glu Lys Thr Tyr Glu Arg Leu Leu Ser Ile Ala Glu Thr
            900                 905                 910

Thr Pro Asp Phe Gln Glu Val Glu Glu Lys Asn Gly Lys Val Lys Arg
        915                 920                 925
```

```
Val Lys Arg Ser Pro Phe Ala Val Tyr Cys Glu Glu Asn Asp Ile Pro
    930                 935                 940

Ala Ile Arg Lys Tyr Ala Lys Lys Asn Asn Gly Pro Leu Ile Arg Ser
945                 950                 955                 960

Leu Lys Tyr Tyr Asp Gly Lys Leu Asn Lys His Ile Asn Ile Thr Lys
                965                 970                 975

Asp Ser Gln Gly Arg Pro Val Glu Lys Thr Lys Asn Gly Arg Lys Val
            980                 985                 990

Thr Leu Gln Ser Leu Lys Pro Tyr  Arg Tyr Asp Ile Tyr  Gln Asp Leu
        995                 1000                1005

Glu Thr  Lys Ala Tyr Tyr Thr  Val Gln Leu Tyr Tyr  Ser Asp Leu
    1010                1015                1020

Arg Phe  Val Glu Gly Lys Tyr  Gly Ile Thr Glu Lys  Glu Tyr Met
    1025                1030                1035

Lys Lys  Val Ala Glu Gln Thr  Lys Gly Gln Val Val  Arg Phe Cys
    1040                1045                1050

Phe Ser  Leu Gln Lys Asn Asp  Gly Leu Glu Ile Glu  Trp Lys Asp
    1055                1060                1065

Ser Gln  Arg Tyr Asp Val Arg  Phe Tyr Asn Phe Gln  Ser Ala Asn
    1070                1075                1080

Ser Ile  Asn Phe Lys Gly Leu  Glu Gln Glu Met Met  Pro Ala Glu
    1085                1090                1095

Asn Gln  Phe Lys Gln Lys Pro  Tyr Asn Asn Gly Ala  Ile Asn Leu
    1100                1105                1110
```

```
Asn Ile  Ala Lys Tyr Gly Lys  Glu Gly Lys Lys Leu  Arg Lys Phe
    1115                 1120                 1125


Asn Thr  Asp Ile Leu Gly Lys  Lys His Tyr Leu Tyr  Tyr Glu Lys
    1130                 1135                 1140


Glu Pro  Lys Asn Ile Ile Lys
    1145                 1150
```

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<211> 1150
<212> PRT
<213> Enterococcus faecalis

<400> 412

```
Met Tyr Ser Ile Gly Leu Asp Leu Gly Ile Ser Ser Val Gly Trp Ser
1               5                   10                  15


Val Ile Asp Glu Arg Thr Gly Asn Val Ile Asp Leu Gly Val Arg Leu
            20                  25                  30


Phe Ser Ala Lys Asn Ser Glu Lys Asn Leu Glu Arg Arg Thr Asn Arg
        35                  40                  45


Gly Gly Arg Arg Leu Ile Arg Arg Lys Thr Asn Arg Leu Lys Asp Ala
    50                  55                  60


Lys Lys Ile Leu Ala Ala Val Gly Phe Tyr Glu Asp Lys Ser Leu Lys
65                  70                  75                  80


Asn Ser Cys Pro Tyr Gln Leu Arg Val Lys Gly Leu Thr Glu Pro Leu
                85                  90                  95


Ser Lys Gly Glu Ile Tyr Lys Val Thr Leu His Ile Leu Lys Lys Arg
            100                 105                 110


Gly Ile Ser Tyr Leu Asp Glu Asp Asp Thr Glu Ala Ala Lys Glu Ser
        115                 120                 125
```

```
Gln Asp Tyr Lys Glu Gln Val Arg Lys Asn Ala Gln Leu Leu Thr Lys
    130                 135                 140

Tyr Thr Pro Gly Gln Ile Gln Leu Gln Arg Leu Lys Glu Asn Asn Arg
145                 150                 155                 160

Val Lys Thr Gly Ile Asn Ala Gln Gly Asn Tyr Gln Leu Asn Val Phe
                165                 170                 175

Lys Val Ser Ala Tyr Ala Asn Glu Leu Ala Thr Ile Leu Lys Thr Gln
            180                 185                 190

Gln Ala Phe Tyr Pro Asn Glu Leu Thr Asp Asp Trp Ile Ala Leu Phe
        195                 200                 205

Val Gln Pro Gly Ile Ala Glu Glu Ala Gly Leu Ile Tyr Arg Lys Arg
    210                 215                 220

Pro Tyr Tyr His Gly Pro Gly Asn Glu Ala Asn Asn Ser Pro Tyr Gly
225                 230                 235                 240

Arg Trp Ser Asp Phe Lys Lys Thr Gly Gln Pro Ala Thr Asn Ile Phe
                245                 250                 255

Asp Arg Leu Ile Gly Lys Asp Phe Gln Gly Glu Leu Arg Ala Ser Gly
            260                 265                 270

Leu Ser Leu Ser Ala Gln Gln Tyr Asn Leu Leu Asn Asp Leu Thr Asn
        275                 280                 285

Leu Lys Ile Asp Gly Glu Ile Pro Leu Ser Pro Glu Gln Lys Glu Tyr
    290                 295                 300

Ile Leu Ala Glu Leu Met Thr Lys Glu Phe Thr Arg Phe Gly Val Asn
305                 310                 315                 320

Asp Val Ala Lys Leu Leu Gly Val Lys Lys Glu Arg Leu Ser Gly Trp
```

```
                325                 330                 335

Arg Leu Asp Lys Lys Gly Lys Pro Glu Ile His Thr Leu Lys Gly Tyr
            340                 345                 350

Arg Asn Trp Arg Lys Ile Phe Ala Glu Ser Gly Ile Asp Leu Ala Thr
        355                 360                 365

Leu Pro Thr Glu Thr Ile Asp Cys Leu Ala Lys Val Leu Thr Leu Asn
    370                 375                 380

Thr Glu His Glu Gly Ile Glu Asn Thr Leu Ala Phe Glu Leu Pro Glu
385                 390                 395                 400

Leu Ala Glu Ser Val Lys Leu Leu Val Leu Asp Arg Tyr Lys Glu Leu
                405                 410                 415

Ser Gln Ser Val Ser Thr Gln Ala Trp His Arg Phe Ser Leu Lys Thr
            420                 425                 430

Leu His Leu Leu Ile Pro Glu Leu Met Asn Ala Thr Ser Glu Gln Asn
        435                 440                 445

Thr Leu Leu Glu Gln Phe Gln Leu Lys Ser Asp Val Arg Lys Arg Tyr
    450                 455                 460

Ser Glu Tyr Lys Lys Leu Pro Thr Lys Asp Val Leu Thr Glu Ile Tyr
465                 470                 475                 480

Asn Pro Thr Val Asn Lys Thr Val Ser Gln Ala Phe Lys Val Ile Asp
                485                 490                 495

Ala Leu Leu Val Lys Tyr Gly Lys Glu Gln Ile Arg Tyr Ile Thr Ile
            500                 505                 510

Glu Met Pro Arg Asp Asp Asn Glu Glu Asp Glu Lys Lys Arg Ile Lys
        515                 520                 525
```

```
Glu Leu His Ala Lys Asn Ser Gln Arg Lys Asn Asp Ser Gln Ser Tyr
    530                 535                 540

Phe Met Gln Lys Ser Gly Trp Ser Gln Glu Lys Phe Gln Thr Thr Ile
545                 550                 555                 560

Gln Lys Asn Arg Arg Phe Leu Ala Lys Leu Leu Tyr Tyr Tyr Glu Gln
                565                 570                 575

Asp Gly Ile Cys Ala Tyr Thr Gly Leu Ser Ile Ser Pro Glu Leu Leu
            580                 585                 590

Val Ser Asp Ser Thr Glu Ile Asp His Ile Ile Pro Ile Ser Ile Ser
        595                 600                 605

Leu Asp Asp Ser Ile Asn Asn Lys Val Leu Val Leu Ser Lys Ala Asn
    610                 615                 620

Gln Val Lys Gly Gln Gln Thr Pro Tyr Asp Ala Trp Met Asp Gly Ser
625                 630                 635                 640

Phe Lys Lys Ile Asn Gly Lys Phe Ser Asn Trp Asp Asp Tyr Gln Lys
                645                 650                 655

Trp Val Glu Ser Arg His Phe Ser His Lys Lys Glu Asn Asn Leu Leu
            660                 665                 670

Glu Thr Arg Asn Ile Phe Asp Ser Glu Gln Val Glu Lys Phe Leu Ala
        675                 680                 685

Arg Asn Leu Asn Asp Thr Arg Tyr Ala Ser Arg Leu Val Leu Asn Thr
    690                 695                 700

Leu Gln Ser Phe Phe Ala Asn His Glu Thr Lys Val Arg Val Val Asn
705                 710                 715                 720

Gly Ser Phe Thr His Thr Leu Arg Lys Lys Trp Gly Ala Asp Leu Asp
```

```
                725                 730                 735

Lys Thr Arg Glu Thr His His His His Ala Val Asp Ala Thr Leu Cys
            740                 745                 750

Ala Val Thr Pro Phe Val Lys Val Ser Arg Tyr His Tyr Ala Val Lys
        755                 760                 765

Glu Glu Thr Gly Glu Lys Val Met Arg Glu Ile Asp Phe Glu Thr Gly
    770                 775                 780

Glu Ile Val Asp Glu Met Ser Tyr Gln Glu Phe Lys Lys Ser Lys Lys
785                 790                 795                 800

Tyr Glu Arg Lys Thr Tyr Gln Val Lys Trp Pro Asn Phe Arg Glu Gln
                805                 810                 815

Leu Lys Pro Val Asn Leu His Pro Arg Ile Lys Phe Ser His Gln Val
            820                 825                 830

Asp Arg Lys Ala Asn Arg Lys Leu Ser Asp Ala Thr Ile Tyr Ser Val
        835                 840                 845

Arg Glu Lys Thr Glu Val Lys Thr Leu Lys Ser Gly Lys Gln Lys Ile
    850                 855                 860

Thr Thr Asp Glu Tyr Thr Ile Gly Lys Ile Lys Asp Ile Tyr Thr Val
865                 870                 875                 880

Asp Gly Trp Glu Ala Phe Lys Lys Lys Gln Asp Lys Leu Leu Met Lys
                885                 890                 895

Asp Leu Asp Glu Lys Thr Tyr Glu Arg Leu Leu Ser Ile Ala Glu Thr
            900                 905                 910

Thr Pro Asp Phe Gln Glu Val Glu Glu Lys Asn Gly Lys Val Lys Arg
        915                 920                 925
```

```
Val Lys Arg Ser Pro Phe Ala Val Tyr Cys Glu Glu Asn Asp Ile Pro
    930                 935                 940

Ala Ile Gln Lys Tyr Ala Lys Lys Asn Asn Gly Pro Leu Ile Arg Ser
945                 950                 955                 960

Leu Lys Tyr Tyr Asp Gly Lys Leu Asn Lys His Ile Asn Ile Thr Lys
                965                 970                 975

Asp Ser Gln Gly Arg Pro Val Glu Lys Thr Lys Asn Gly Arg Lys Val
            980                 985                 990

Thr Leu Gln Ser Leu Lys Pro Tyr  Arg Tyr Asp Ile Tyr  Gln Asp Leu
        995                 1000                1005

Glu Thr  Lys Ala Tyr Tyr Thr  Val Gln Leu Tyr Tyr  Ser Asp Leu
    1010                1015                1020

Arg Phe  Val Glu Gly Lys Tyr  Gly Ile Thr Glu Lys  Glu Tyr Met
    1025                1030                1035

Lys Lys  Val Ala Glu Gln Thr  Lys Gly Gln Val Val  Arg Phe Cys
    1040                1045                1050

Phe Ser  Leu Gln Lys Asn Asp  Gly Leu Glu Ile Glu  Trp Lys Asp
    1055                1060                1065

Ser Gln  Arg Tyr Asp Val Arg  Phe Tyr Asn Phe Gln  Ser Ala Asn
    1070                1075                1080

Ser Ile  Asn Phe Lys Gly Leu  Glu Gln Glu Met Met  Pro Ala Glu
    1085                1090                1095

Asn Gln  Phe Lys Gln Lys Pro  Tyr Asn Asn Gly Ala  Ile Asn Leu
    1100                1105                1110

Asn Ile  Ala Lys Tyr Gly Lys  Glu Gly Lys Lys Leu  Arg Lys Phe
```

```
    1115                1120                1125


Asn Thr  Asp Ile Leu Gly Lys  Lys His Tyr Leu Tyr  Tyr Glu Lys
    1130                1135                1140


Glu Pro  Lys Asn Ile Ile Lys
    1145                1150


<210>  413
<211>  1150
<212>  PRT
<213>  Enterococcus faecalis

<400>  413

Met Tyr Ser Ile Gly Leu Asp Leu Gly Ile Ser Ser Val Gly Trp Ser
1               5                   10                  15


Val Ile Asp Glu Arg Thr Gly Asn Val Ile Asp Leu Gly Val Arg Leu
            20                  25                  30


Phe Ser Ala Lys Asn Ser Glu Lys Asn Leu Glu Arg Arg Thr Asn Arg
        35                  40                  45


Gly Gly Arg Arg Leu Ile Arg Arg Lys Thr Asn Arg Leu Lys Asp Ala
    50                  55                  60


Lys Lys Ile Leu Ala Ala Val Gly Phe Tyr Glu Asp Lys Ser Leu Lys
65                  70                  75                  80


Asn Ser Cys Pro Tyr Gln Leu Arg Val Lys Gly Leu Thr Glu Pro Leu
                85                  90                  95


Ser Lys Gly Glu Ile Tyr Lys Val Thr Leu His Ile Leu Lys Lys Arg
            100                 105                 110


Gly Ile Ser Tyr Leu Asp Glu Asp Asp Thr Glu Ala Ala Lys Glu Ser
        115                 120                 125
```

```
Gln Asp Tyr Lys Glu Gln Val Arg Lys Asn Ala Gln Leu Leu Thr Lys
    130                 135                 140

Tyr Thr Pro Gly Gln Ile Gln Leu Gln Arg Leu Lys Glu Asn Asn Arg
145                 150                 155                 160

Val Lys Thr Gly Ile Asn Val Gln Gly Asn Tyr Gln Leu Asn Val Phe
                165                 170                 175

Lys Val Ser Ala Tyr Ala Asn Glu Leu Ala Thr Ile Leu Lys Thr Gln
            180                 185                 190

Gln Ala Phe Tyr Pro Asn Glu Leu Thr Asp Asp Trp Ile Ala Leu Phe
        195                 200                 205

Val Gln Pro Gly Ile Ala Glu Glu Ala Gly Leu Ile Tyr Arg Lys Arg
    210                 215                 220

Pro Tyr Tyr His Gly Pro Gly Asn Glu Ala Asn Asn Ser Pro Tyr Gly
225                 230                 235                 240

Arg Trp Ser Asp Phe Gln Lys Thr Gly Glu Pro Ala Thr Asn Ile Phe
                245                 250                 255

Asp Lys Leu Ile Gly Lys Asp Phe Gln Gly Glu Leu Arg Ala Ser Gly
            260                 265                 270

Leu Ser Leu Ser Ala Gln Gln Tyr Asn Leu Leu Asn Asp Leu Thr Asn
        275                 280                 285

Leu Lys Ile Asp Gly Glu Val Pro Leu Ser Ser Glu Gln Lys Glu Tyr
    290                 295                 300

Ile Leu Thr Glu Leu Met Thr Lys Glu Phe Thr Arg Phe Gly Val Asn
305                 310                 315                 320

Asp Val Val Lys Leu Leu Gly Val Lys Lys Glu Arg Leu Ser Gly Trp
                325                 330                 335
```

```
Arg Leu Asp Lys Lys Gly Lys Pro Glu Ile His Thr Leu Lys Gly Tyr
            340                 345                 350

Arg Asn Trp Arg Lys Ile Phe Ala Glu Ala Gly Ile Asp Leu Ala Thr
        355                 360                 365

Leu Pro Thr Glu Thr Ile Asp Cys Leu Ala Lys Val Leu Thr Leu Asn
    370                 375                 380

Thr Glu Arg Glu Gly Ile Glu Asn Thr Leu Ala Phe Glu Leu Pro Glu
385                 390                 395                 400

Leu Ser Glu Ser Val Lys Leu Leu Val Leu Asp Arg Tyr Lys Glu Leu
                405                 410                 415

Ser Gln Ser Ile Ser Thr Gln Ser Trp His Arg Phe Ser Leu Lys Thr
            420                 425                 430

Leu His Leu Leu Ile Pro Glu Leu Met Asn Ala Thr Ser Glu Gln Asn
        435                 440                 445

Thr Leu Leu Glu Gln Phe Gln Leu Lys Ser Asp Val Arg Lys Arg Tyr
    450                 455                 460

Ser Glu Tyr Lys Lys Leu Pro Thr Lys Asp Val Leu Ala Glu Ile Tyr
465                 470                 475                 480

Asn Pro Thr Val Asn Lys Thr Val Ser Gln Ala Phe Lys Val Ile Asp
                485                 490                 495

Ala Leu Leu Val Lys Tyr Gly Lys Glu Gln Ile Arg Tyr Ile Thr Ile
            500                 505                 510

Glu Met Pro Arg Asp Asp Asn Glu Glu Asp Glu Lys Lys Arg Ile Lys
        515                 520                 525
```

```
Glu Leu His Ala Lys Asn Ser Gln Arg Lys Asn Asp Ser Gln Ser Tyr
    530                 535                 540

Phe Met Gln Lys Ser Gly Trp Ser Gln Glu Lys Phe Gln Thr Thr Ile
545                 550                 555                 560

Gln Lys Asn Arg Arg Phe Leu Ala Lys Leu Leu Tyr Tyr Tyr Glu Gln
                565                 570                 575

Asp Gly Ile Cys Ala Tyr Thr Gly Leu Pro Ile Ser Pro Glu Leu Leu
            580                 585                 590

Val Ser Asp Ser Thr Glu Ile Asp His Ile Ile Pro Ile Ser Ile Ser
        595                 600                 605

Leu Asp Asp Ser Ile Asn Asn Lys Val Leu Val Leu Ser Lys Ala Asn
    610                 615                 620

Gln Val Lys Gly Gln Gln Thr Pro Tyr Asp Ala Trp Met Asp Gly Ser
625                 630                 635                 640

Phe Lys Lys Ile Asn Gly Lys Phe Ser Asn Trp Asp Asp Tyr Gln Lys
                645                 650                 655

Trp Val Glu Ser Arg His Phe Ser His Lys Lys Glu Asn Asn Leu Leu
            660                 665                 670

Glu Thr Arg Asn Ile Phe Asp Ser Glu Gln Val Glu Lys Phe Leu Ala
        675                 680                 685

Arg Asn Leu Asn Asp Thr Arg Tyr Ala Ser Arg Leu Val Leu Asn Thr
    690                 695                 700

Leu Gln Ser Phe Phe Thr Asn Gln Glu Thr Lys Val Arg Val Val Asn
705                 710                 715                 720

Gly Ser Phe Thr His Thr Leu Arg Lys Lys Trp Gly Ala Asp Leu Asp
                725                 730                 735
```

```
Lys Thr Arg Glu Thr His His His His Ala Val Asp Ala Thr Leu Cys
            740                 745                 750

Ala Val Thr Pro Phe Val Lys Val Ser Arg Tyr His Tyr Ala Val Lys
        755                 760                 765

Glu Glu Thr Gly Glu Lys Val Met Arg Glu Ile Asp Phe Glu Thr Gly
    770                 775                 780

Glu Ile Val Asn Glu Met Ser Tyr Arg Glu Phe Lys Lys Ser Lys Lys
785                 790                 795                 800

Tyr Glu Arg Lys Thr Tyr Gln Val Lys Trp Pro Asn Phe Arg Glu Gln
                805                 810                 815

Leu Lys Pro Val Asn Leu His Pro Arg Ile Lys Phe Ser His Gln Val
            820                 825                 830

Asp Arg Lys Ala Asn Arg Lys Leu Ser Asp Ala Thr Ile Tyr Ser Val
        835                 840                 845

Arg Glu Lys Thr Glu Val Lys Thr Leu Lys Ser Gly Lys Gln Lys Ile
    850                 855                 860

Thr Thr Asp Glu Tyr Thr Ile Gly Lys Ile Lys Asp Ile Tyr Thr Leu
865                 870                 875                 880

Asp Gly Trp Glu Ala Phe Lys Lys Lys Gln Asp Lys Leu Leu Met Lys
                885                 890                 895

Asp Leu Asp Glu Lys Thr Tyr Glu Arg Leu Leu Ser Ile Ala Glu Thr
            900                 905                 910

Thr Pro Asp Phe Gln Glu Val Glu Glu Lys Asn Gly Lys Val Lys Arg
        915                 920                 925
```

```
Val Lys Arg Ser Pro Phe Ala Val Tyr Cys Glu Glu Asn Asp Ile Pro
    930                 935                 940

Ala Ile Gln Lys Tyr Ala Lys Lys Asn Asn Gly Pro Leu Ile Arg Ser
945                 950                 955                 960

Leu Lys Tyr Tyr Asp Gly Lys Leu Asn Lys His Ile Asn Ile Thr Lys
                965                 970                 975

Asp Ser Gln Gly Arg Pro Val Glu Lys Thr Lys Asn Gly Arg Lys Val
            980                 985                 990

Thr Leu Gln Ser Leu Lys Pro Tyr  Arg Tyr Asp Ile Tyr  Gln Asp Leu
        995                 1000                1005

Glu Thr  Lys Ala Tyr Tyr Thr  Val Gln Leu Tyr Tyr  Ser Asp Leu
    1010                1015                1020

Arg Phe  Val Glu Gly Lys Tyr  Gly Ile Thr Glu Lys  Glu Tyr Met
    1025                1030                1035

Lys Lys  Val Ala Glu Gln Thr  Lys Gly Gln Val Val  Arg Phe Cys
    1040                1045                1050

Phe Ser  Leu Gln Lys Asn Asp  Gly Leu Glu Ile Glu  Trp Lys Asp
    1055                1060                1065

Ser Gln  Arg Tyr Asp Val Arg  Phe Tyr Asn Phe Gln  Ser Ala Asn
    1070                1075                1080

Ser Ile  Asn Phe Lys Gly Leu  Glu Gln Glu Ile Met  Pro Ala Glu
    1085                1090                1095

Asn Gln  Phe Lys Gln Lys Pro  Tyr Asn Asn Gly Ala  Ile Asn Leu
    1100                1105                1110

Asn Ile  Ala Lys Tyr Gly Lys  Glu Gly Lys Lys Leu  Arg Lys Phe
    1115                1120                1125
```

```
Asn Thr  Asp Ile Leu Gly Lys  Lys His Tyr Leu Phe  Tyr Glu Lys
    1130                1135                1140


Glu Pro  Lys Asn Ile Ile Lys
    1145                1150
```

<210> 414
<211> 1150
<212> PRT
<213> Enterococcus faecalis

<400> 414

```
Met Tyr Ser Ile Gly Leu Asp Leu Gly Ile Ser Ser Val Gly Trp Ser
1               5                   10                  15


Val Ile Asp Glu Arg Thr Gly Asn Val Ile Asp Leu Gly Val Arg Leu
            20                  25                  30


Phe Ser Ala Lys Asn Ser Glu Lys Asn Leu Glu Arg Arg Thr Asn Arg
        35                  40                  45


Gly Gly Arg Arg Leu Ile Arg Arg Lys Thr Asn Arg Leu Lys Asp Ala
    50                  55                  60


Lys Lys Ile Leu Ala Ala Val Gly Phe Tyr Glu Asp Lys Ser Leu Lys
65                  70                  75                  80


Asn Ser Cys Pro Tyr Gln Leu Arg Val Lys Gly Leu Thr Glu Pro Leu
                85                  90                  95


Ser Arg Gly Glu Ile Tyr Lys Val Thr Leu His Ile Leu Lys Lys Arg
            100                 105                 110


Gly Ile Ser Tyr Leu Asp Glu Val Asp Thr Glu Ala Ala Lys Glu Ser
        115                 120                 125


Gln Asp Tyr Lys Glu Gln Val Arg Lys Asn Ala Gln Leu Leu Thr Lys
```

```
    130                 135                 140

Tyr Thr Pro Gly Gln Ile Gln Leu Gln Arg Leu Lys Glu Asn Asn Arg
145                 150                 155                 160

Val Lys Thr Gly Ile Asn Ala Gln Gly Asn Tyr Gln Leu Asn Val Phe
                165                 170                 175

Lys Val Ser Ala Tyr Ala Asn Glu Leu Ala Thr Ile Leu Lys Thr Gln
            180                 185                 190

Gln Ala Phe Tyr Pro Asn Glu Leu Thr Asp Asp Trp Ile Ala Leu Phe
        195                 200                 205

Val Gln Pro Gly Ile Ala Glu Glu Ala Gly Leu Ile Tyr Arg Lys Arg
    210                 215                 220

Pro Tyr Tyr His Gly Pro Gly Asn Glu Ala Asn Asn Ser Pro Tyr Gly
225                 230                 235                 240

Arg Trp Ser Asp Phe Gln Lys Thr Gly Glu Pro Ala Thr Asn Ile Phe
                245                 250                 255

Asp Lys Leu Ile Gly Lys Asp Phe Gln Gly Glu Leu Arg Ala Ser Gly
            260                 265                 270

Leu Ser Leu Ser Ala Gln Gln Tyr Asn Leu Leu Asn Asp Leu Thr Asn
        275                 280                 285

Leu Lys Ile Asp Gly Glu Val Pro Leu Ser Ser Glu Gln Lys Glu Tyr
    290                 295                 300

Ile Leu Thr Glu Leu Met Thr Lys Glu Phe Thr Arg Phe Gly Val Asn
305                 310                 315                 320

Asp Val Val Lys Leu Leu Gly Val Lys Lys Glu Arg Leu Ser Gly Trp
                325                 330                 335
```

```
Arg Leu Asp Lys Lys Gly Lys Pro Glu Ile His Thr Leu Lys Gly Tyr
            340                 345                 350

Arg Asn Trp Arg Lys Ile Phe Ala Glu Ala Gly Ile Asp Leu Ala Thr
        355                 360                 365

Leu Pro Thr Glu Thr Ile Asp Cys Leu Ala Lys Val Leu Thr Leu Asn
    370                 375                 380

Thr Glu Arg Glu Gly Ile Glu Asn Thr Leu Ala Phe Glu Leu Pro Glu
385                 390                 395                 400

Leu Ser Glu Ser Val Lys Leu Leu Val Leu Asp Arg Tyr Lys Glu Leu
                405                 410                 415

Ser Gln Ser Ile Ser Thr Gln Ser Trp His Arg Phe Ser Leu Lys Thr
            420                 425                 430

Leu His Leu Leu Ile Pro Glu Leu Met Asn Ala Thr Ser Glu Gln Asn
        435                 440                 445

Thr Leu Leu Glu Gln Phe Gln Leu Lys Ser Asp Val Arg Lys Arg Tyr
    450                 455                 460

Ser Glu Tyr Lys Lys Leu Pro Thr Lys Asp Val Leu Ala Glu Ile Tyr
465                 470                 475                 480

Asn Pro Thr Val Asn Lys Thr Val Ser Gln Ala Phe Lys Val Ile Asp
                485                 490                 495

Ala Leu Leu Val Lys Tyr Gly Lys Glu Gln Ile Arg Tyr Ile Thr Ile
            500                 505                 510

Glu Met Pro Arg Asp Asp Asn Glu Glu Asp Glu Lys Lys Arg Ile Lys
        515                 520                 525

Glu Leu His Ala Lys Asn Ser Gln Arg Lys Asn Asp Ser Gln Ser Tyr
```

```
    530                 535                 540

Phe Met Gln Lys Ser Gly Trp Ser Gln Glu Lys Phe Gln Thr Thr Ile
545                 550                 555                 560

Gln Lys Asn Arg Arg Phe Leu Ala Lys Leu Leu Tyr Tyr Tyr Glu Gln
                565                 570                 575

Asp Gly Ile Cys Ala Tyr Thr Gly Leu Pro Ile Ser Pro Glu Leu Leu
            580                 585                 590

Val Ser Asp Ser Thr Glu Ile Asp His Ile Ile Pro Ile Ser Ile Ser
        595                 600                 605

Leu Asp Asp Ser Ile Asn Asn Lys Val Leu Val Leu Ser Lys Ala Asn
    610                 615                 620

Gln Val Lys Gly Gln Gln Thr Pro Tyr Asp Ala Trp Met Asp Gly Ser
625                 630                 635                 640

Phe Lys Lys Ile Asn Gly Lys Phe Ser Asn Trp Asp Asp Tyr Gln Lys
                645                 650                 655

Trp Val Glu Ser Arg His Phe Ser His Lys Lys Glu Asn Asn Leu Leu
            660                 665                 670

Glu Thr Arg Asn Ile Phe Asp Ser Glu Gln Val Glu Lys Phe Leu Ala
        675                 680                 685

Arg Asn Leu Asn Asp Thr Arg Tyr Ala Ser Arg Leu Val Leu Asn Thr
    690                 695                 700

Leu Gln Ser Phe Phe Thr Asn Gln Glu Thr Lys Val Arg Val Val Asn
705                 710                 715                 720

Gly Ser Phe Thr His Thr Leu Arg Lys Lys Trp Gly Ala Asp Leu Asp
                725                 730                 735
```

```
Lys Thr Arg Glu Thr His His His His Ala Val Asp Ala Thr Leu Cys
            740                 745                 750

Ala Val Thr Ser Phe Val Lys Val Ser Arg Tyr His Tyr Ala Val Lys
        755                 760                 765

Glu Glu Thr Gly Glu Lys Val Met Arg Glu Ile Asp Phe Glu Thr Gly
    770                 775                 780

Glu Ile Val Asn Glu Met Ser Tyr Trp Glu Phe Lys Lys Ser Lys Lys
785                 790                 795                 800

Tyr Glu Arg Lys Thr Tyr Gln Val Lys Trp Pro Asn Phe Arg Glu Gln
                805                 810                 815

Leu Lys Pro Val Asn Leu His Pro Arg Ile Lys Phe Ser His Gln Val
            820                 825                 830

Asp Arg Lys Ala Asn Arg Lys Leu Ser Asp Ala Thr Ile Tyr Ser Val
        835                 840                 845

Arg Glu Lys Thr Glu Val Lys Thr Leu Lys Ser Gly Lys Gln Lys Ile
    850                 855                 860

Thr Thr Asp Glu Tyr Thr Ile Gly Lys Ile Lys Asp Ile Tyr Thr Leu
865                 870                 875                 880

Asp Gly Trp Glu Ala Phe Lys Lys Lys Gln Asp Lys Leu Leu Met Lys
                885                 890                 895

Asp Leu Asp Glu Lys Thr Tyr Glu Arg Leu Leu Ser Ile Ala Glu Thr
            900                 905                 910

Thr Pro Asp Phe Gln Glu Val Glu Glu Lys Asn Gly Lys Val Lys Arg
        915                 920                 925

Val Lys Arg Ser Pro Phe Ala Val Tyr Cys Glu Glu Asn Asp Ile Pro
```

```
    930                 935                 940

Ala Ile Gln Lys Tyr Ala Lys Lys Asn Asn Gly Pro Leu Ile Arg Ser
945                 950                 955                 960

Leu Lys Tyr Tyr Asp Gly Lys Leu Asn Lys His Ile Asn Ile Thr Lys
                965                 970                 975

Asp Ser Gln Gly Arg Pro Val Glu Lys Thr Lys Asn Gly Arg Lys Val
            980                 985                 990

Thr Leu Gln Ser Leu Lys Pro Tyr  Arg Tyr Asp Ile Tyr  Gln Asp Leu
        995                 1000                1005

Glu Thr  Lys Ala Tyr Tyr Thr  Val Gln Leu Tyr Tyr  Ser Asp Leu
    1010                1015                1020

Arg Phe  Val Glu Gly Lys Tyr  Gly Ile Thr Glu Lys  Glu Tyr Met
    1025                1030                1035

Lys Lys  Val Ala Glu Gln Thr  Lys Gly Gln Val Val  Arg Phe Cys
    1040                1045                1050

Phe Ser  Leu Gln Lys Asn Asp  Gly Leu Glu Ile Glu  Trp Lys Asp
    1055                1060                1065

Ser Gln  Arg Tyr Asp Val Arg  Phe Tyr Asn Phe Gln  Ser Ala Asn
    1070                1075                1080

Ser Ile  Asn Phe Lys Gly Leu  Glu Gln Glu Met Met  Pro Ala Glu
    1085                1090                1095

Asn Gln  Phe Lys Gln Lys Pro  Tyr Asn Asn Gly Ala  Ile Asn Leu
    1100                1105                1110

Asn Ile  Ala Lys Tyr Gly Lys  Glu Gly Lys Lys Leu  Arg Lys Phe
    1115                1120                1125
```

```
Asn Thr  Asp Ile Leu Gly Lys  Lys His Tyr Leu Phe  Tyr Glu Lys
    1130                1135                1140


Glu Pro  Lys Asn Ile Ile Lys
    1145                1150
```

<210> 415
<211> 1150
<212> PRT
<213> Enterococcus faecalis

<400> 415

```
Met Tyr Ser Ile Gly Leu Asp Leu Gly Val Ser Ser Val Gly Trp Ser
1               5                   10                  15


Val Ile Asp Glu Arg Thr Gly Asn Val Ile Asp Leu Gly Val Arg Leu
            20                  25                  30


Phe Ser Ala Lys Asn Ser Glu Lys Asn Leu Glu Arg Arg Thr Asn Arg
        35                  40                  45


Gly Gly Arg Arg Leu Ile Arg Arg Lys Thr Asn Arg Leu Lys Asp Ala
    50                  55                  60


Lys Lys Ile Leu Ala Ala Val Gly Phe Tyr Glu Asp Lys Ser Leu Lys
65                  70                  75                  80


Asn Ser Cys Pro Tyr Gln Leu Arg Val Lys Gly Leu Thr Glu Pro Leu
                85                  90                  95


Ser Lys Gly Glu Ile Tyr Lys Val Thr Leu His Ile Leu Lys Lys Arg
            100                 105                 110


Gly Ile Ser Tyr Leu Asp Glu Asp Asp Thr Glu Ala Ala Lys Glu Ser
        115                 120                 125


Gln Asp Tyr Lys Glu Gln Val Arg Glu Asn Ala Gln Leu Leu Thr Lys
    130                 135                 140
```

```
Tyr Thr Pro Gly Gln Ile Gln Leu Gln Arg Leu Lys Glu Asn Asn Arg
145                 150                 155                 160

Val Lys Thr Gly Ile Asn Ala Gln Gly Asn Tyr Gln Leu Asn Val Phe
                165                 170                 175

Lys Val Ser Ala Tyr Ala Asn Glu Leu Ala Thr Ile Leu Lys Thr Gln
            180                 185                 190

Gln Ala Phe Tyr Pro Asn Glu Leu Thr Asp Asp Trp Ile Ala Leu Phe
        195                 200                 205

Val Gln Pro Gly Ile Ala Glu Glu Ala Gly Leu Ile Tyr Arg Lys Arg
    210                 215                 220

Pro Tyr Tyr His Gly Pro Gly Asn Glu Ala Asn Asn Ser Pro Tyr Gly
225                 230                 235                 240

Arg Trp Ser Asp Phe Lys Lys Thr Gly Gln Pro Ala Thr Asn Ile Phe
                245                 250                 255

Asp Lys Leu Ile Gly Lys Asp Phe Gln Gly Glu Leu Arg Ala Ser Gly
            260                 265                 270

Leu Ser Leu Ser Ala Gln Gln Tyr Asn Leu Leu Asn Asp Leu Thr Asn
        275                 280                 285

Leu Lys Ile Asp Gly Glu Ile Pro Leu Ser Pro Glu Gln Lys Glu Tyr
    290                 295                 300

Ile Leu Ala Glu Leu Met Thr Lys Glu Phe Thr Arg Phe Gly Ile Asn
305                 310                 315                 320

Asp Val Ala Lys Leu Leu Gly Val Lys Lys Glu Arg Leu Ser Gly Trp
                325                 330                 335
```

```
Arg Leu Asp Lys Lys Gly Lys Pro Glu Ile His Thr Leu Lys Gly Tyr
            340                 345                 350

Arg Asn Trp Arg Lys Ile Phe Ala Glu Ser Gly Ile Asp Leu Ala Thr
        355                 360                 365

Leu Pro Thr Glu Thr Ile Asp Cys Leu Ala Lys Val Leu Thr Leu Asn
    370                 375                 380

Thr Glu Arg Glu Gly Ile Glu Asn Thr Leu Ala Phe Glu Leu Pro Glu
385                 390                 395                 400

Leu Ala Glu Ser Val Lys Leu Leu Val Leu Asp Arg Tyr Lys Glu Leu
                405                 410                 415

Ser Gln Ser Val Ser Thr Gln Ala Trp His Arg Phe Ser Leu Lys Thr
            420                 425                 430

Leu His Leu Leu Ile Pro Glu Leu Met Asn Ala Thr Ser Glu Gln Asn
        435                 440                 445

Thr Leu Leu Glu Gln Phe Gln Leu Lys Ser Asp Val Arg Lys Arg Tyr
    450                 455                 460

Ser Glu Tyr Lys Lys Leu Pro Thr Lys Asp Val Leu Thr Glu Ile Tyr
465                 470                 475                 480

Asn Pro Thr Val Asn Lys Thr Val Ser Gln Ala Phe Lys Val Ile Asp
                485                 490                 495

Ala Leu Leu Val Lys Tyr Gly Lys Glu Gln Ile Arg Tyr Ile Thr Ile
            500                 505                 510

Glu Met Pro Arg Asp Asp Asn Glu Glu Asp Glu Lys Lys Arg Ile Lys
        515                 520                 525

Glu Leu His Ala Lys Asn Ser Gln Arg Lys Asn Asp Ser Gln Ser Tyr
    530                 535                 540
```

```
Phe Met Gln Lys Ser Gly Trp Ser Gln Glu Lys Phe Gln Thr Thr Ile
545                 550                 555                 560

Gln Lys Asn Arg Arg Phe Leu Ala Lys Leu Leu Tyr Tyr Tyr Glu Gln
                565                 570                 575

Asp Gly Ile Cys Ala Tyr Thr Gly Leu Ser Ile Ser Pro Glu Leu Leu
            580                 585                 590

Val Ser Asp Ser Thr Glu Ile Asp His Ile Ile Pro Ile Ser Ile Ser
        595                 600                 605

Leu Asp Asp Ser Ile Asn Asn Lys Val Leu Val Leu Ser Lys Ala Asn
    610                 615                 620

Gln Val Lys Gly Gln Gln Thr Pro Tyr Asp Ala Trp Met Asp Gly Ser
625                 630                 635                 640

Phe Lys Lys Ile Asn Gly Lys Phe Ser Asn Trp Asp Asp Tyr Gln Lys
                645                 650                 655

Trp Val Glu Ser Arg His Phe Ser His Lys Lys Glu Asn Asn Leu Leu
            660                 665                 670

Glu Thr Arg Asn Ile Phe Asp Ser Glu Gln Val Glu Lys Phe Leu Ala
        675                 680                 685

Arg Asn Leu Asn Asp Thr Arg Tyr Ala Ser Arg Leu Val Leu Asn Thr
    690                 695                 700

Leu Gln Ser Phe Phe Ala Asn Gln Glu Thr Lys Val Arg Val Val Asn
705                 710                 715                 720

Gly Ser Phe Thr His Thr Leu Arg Lys Lys Trp Gly Ala Asp Leu Asp
                725                 730                 735
```

```
Lys Thr Arg Glu Thr His His His His Ala Val Asp Ala Thr Leu Cys
            740                 745                 750

Ala Val Thr Pro Phe Val Lys Val Ser Arg Tyr His Tyr Ala Val Lys
        755                 760                 765

Glu Glu Thr Gly Glu Lys Val Met Arg Glu Ile Asp Phe Glu Thr Gly
    770                 775                 780

Glu Ile Val Asp Glu Met Ser Tyr Arg Glu Phe Lys Lys Ser Lys Lys
785                 790                 795                 800

Tyr Glu Arg Lys Thr Tyr Gln Val Lys Trp Pro Asn Phe Arg Glu Gln
                805                 810                 815

Leu Lys Pro Val Asn Leu His Pro Arg Ile Lys Phe Ser His Gln Val
            820                 825                 830

Asp Arg Lys Ala Asn Arg Lys Leu Ser Asp Ala Thr Ile Tyr Ser Val
        835                 840                 845

Arg Glu Lys Thr Glu Val Lys Thr Leu Lys Ser Gly Lys Gln Lys Ile
    850                 855                 860

Thr Thr Asp Glu Tyr Thr Ile Gly Lys Ile Lys Asp Ile Tyr Thr Val
865                 870                 875                 880

Asp Gly Trp Glu Ala Phe Lys Lys Lys Gln Asp Lys Leu Leu Met Lys
                885                 890                 895

Asp Leu Asp Glu Lys Thr Tyr Glu Arg Leu Leu Ser Ile Ala Glu Thr
            900                 905                 910

Thr Pro Asp Phe Gln Glu Val Glu Glu Lys Asn Gly Lys Val Lys Arg
        915                 920                 925

Val Lys Arg Ser Pro Phe Ala Val Tyr Cys Glu Glu Asn Asp Ile Pro
    930                 935                 940
```

```
Ala Ile Arg Lys Tyr Ala Lys Asn Asn Asn Gly Pro Leu Ile Arg Ser
945                 950                 955                 960


Leu Lys Tyr Tyr Asp Gly Lys Leu Asn Lys His Ile Asn Ile Thr Lys
                965                 970                 975


Asp Ser Gln Gly Arg Pro Val Glu Lys Thr Lys Asn Gly Arg Lys Val
            980                 985                 990


Thr Leu Gln Ser Leu Lys Pro Tyr  Arg Tyr Asp Ile Tyr  Gln Asp Leu
        995                 1000                1005


Glu Thr  Lys Ala Tyr Tyr Thr  Val Gln Leu Tyr Tyr  Ser Asp Leu
    1010                1015                1020


Arg Phe  Val Glu Gly Lys Tyr  Gly Ile Thr Glu Lys  Glu Tyr Met
    1025                1030                1035


Lys Lys  Val Ala Glu Gln Thr  Lys Gly Gln Val Val  Arg Phe Cys
    1040                1045                1050


Phe Ser  Leu Gln Lys Asn Asp  Gly Leu Glu Ile Glu  Trp Lys Asp
    1055                1060                1065


Ser Gln  Cys Tyr Asp Val Arg  Phe Tyr Asn Phe Gln  Ser Ala Asn
    1070                1075                1080


Ser Ile  Asn Phe Lys Gly Leu  Glu Gln Glu Met Met  Pro Ala Glu
    1085                1090                1095


Asn Gln  Phe Lys Gln Lys Pro  Tyr Asn Asn Gly Ala  Ile Asn Leu
    1100                1105                1110


Asn Ile  Ala Lys Tyr Gly Lys  Glu Gly Lys Lys Leu  Arg Lys Phe
    1115                1120                1125
```

```
Asn Thr  Asp Ile Leu Gly Lys  Lys His Tyr Leu Tyr  Tyr Glu Lys
    1130                1135                1140


Glu Pro  Lys Asn Ile Ile Lys
    1145                1150
```

<210> 416
<211> 1340
<212> PRT
<213> Enterococcus faecium

<400> 416

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Met Lys Lys Glu Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Val Leu Thr Asp Asp Tyr Arg Leu Val Ser Lys Lys Met
            20                  25                  30


Lys Val Ala Gly Asn Thr Glu Lys Ser Ser Thr Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Ala Arg Arg Ser
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Leu Ala Arg Arg Arg Gln Arg Ile Leu
65                  70                  75                  80


Glu Leu Gln Lys Ile Phe Ala Pro Glu Ile Leu Lys Ile Asp Glu His
                85                  90                  95


Phe Phe Ala Arg Leu Asn Glu Ser Phe Leu Val Leu Asp Glu Lys Lys
            100                 105                 110


Gln Ser Arg His Pro Val Phe Ala Thr Ile Lys Gln Glu Lys Ser Tyr
        115                 120                 125


His Gln Thr Tyr Pro Thr Ile Tyr His Leu Arg Gln Ala Leu Ala Asp
    130                 135                 140
```

```
Ser Ser Glu Lys Ala Asp Ile Arg Leu Val Tyr Leu Ala Met Ala His
145                 150                 155                 160

Leu Leu Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Thr
                165                 170                 175

Glu Asn Ser Ser Val Thr Glu Thr Phe Arg Gln Phe Leu Ser Thr Tyr
            180                 185                 190

Asn Gln Gln Phe Ser Glu Ala Asp Asp Lys Gln Thr Glu Lys Leu Asp
        195                 200                 205

Glu Ala Val Asp Cys Ser Phe Val Phe Thr Glu Lys Met Ser Lys Thr
    210                 215                 220

Lys Lys Ala Glu Thr Leu Leu Lys Tyr Phe Pro His Glu Lys Ser Asn
225                 230                 235                 240

Gly Tyr Leu Ser Gln Phe Ile Lys Leu Met Val Gly Asn Gln Gly Asn
                245                 250                 255

Phe Lys Asn Val Phe Gly Leu Glu Glu Glu Ala Lys Leu Gln Phe Ser
            260                 265                 270

Lys Glu Thr Tyr Glu Glu Asp Leu Glu Glu Leu Leu Glu Lys Ile Gly
        275                 280                 285

Asp Asp Tyr Ile Asp Leu Phe Val Gln Ala Lys Asn Val Tyr Asp Ala
    290                 295                 300

Val Leu Leu Ser Glu Ile Leu Ser Asp Ser Thr Lys Asn Thr Arg Ala
305                 310                 315                 320

Lys Leu Ser Ala Gly Met Ile Arg Arg Tyr Asp Ala His Lys Glu Asp
                325                 330                 335

Leu Val Leu Leu Lys Arg Phe Val Lys Glu Asn Leu Pro Lys Lys Tyr
```

```
            340                 345                 350

Arg Ala Phe Phe Gly Asp Asn Ser Val Asn Gly Tyr Ala Gly Tyr Ile
        355                 360                 365

Glu Gly His Ala Thr Gln Glu Asp Phe Tyr Lys Phe Val Lys Lys Glu
    370                 375                 380

Leu Thr Gly Ile Arg Gly Ser Glu Val Phe Leu Thr Lys Ile Glu Gln
385                 390                 395                 400

Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro
                405                 410                 415

His Gln Ile His Leu Thr Glu Leu Arg Ala Ile Ile Ala Asn Gln Lys
            420                 425                 430

Lys His Tyr Pro Phe Leu Lys Glu Glu Gln Glu Lys Leu Glu Ser Leu
        435                 440                 445

Leu Thr Phe Lys Ile Pro Tyr Tyr Val Gly Pro Leu Ala Lys Lys Gln
    450                 455                 460

Glu Asn Ser Pro Phe Ala Trp Leu Ile Arg Lys Ser Glu Glu Lys Ile
465                 470                 475                 480

Lys Pro Trp Asn Leu Pro Glu Ile Val Asp Met Glu Gly Ser Ala Val
                485                 490                 495

Arg Phe Ile Glu Arg Met Asn Asn Thr Asp Met Tyr Ile Pro His Asn
            500                 505                 510

Lys Val Leu Pro Lys Asn Ser Leu Leu Tyr Gln Lys Phe Ser Ile Tyr
        515                 520                 525

Asn Glu Leu Thr Lys Val Arg Tyr Gln Asp Glu Arg Gly Gln Met Asn
    530                 535                 540
```

```
Tyr Phe Ser Ser Ile Glu Lys Lys Glu Ile Phe His Glu Leu Phe Glu
545                 550                 555                 560


Lys Asn Arg Lys Val Thr Lys Lys Asp Leu Gln Glu Phe Leu Tyr Leu
                565                 570                 575


Lys Tyr Asp Ile Lys His Ala Glu Leu Ser Gly Ile Glu Lys Ala Phe
            580                 585                 590


Asn Ala Ser Tyr Thr Thr Tyr His Asp Phe Leu Thr Met Ser Glu Asn
        595                 600                 605


Lys Arg Glu Met Lys Gln Trp Leu Glu Asp Pro Glu Leu Ala Ser Met
    610                 615                 620


Phe Glu Glu Ile Ile Lys Thr Leu Thr Val Phe Glu Asp Arg Glu Met
625                 630                 635                 640


Ile Lys Thr Arg Leu Ser His His Glu Ala Thr Leu Gly Lys His Ile
                645                 650                 655


Ile Lys Lys Leu Thr Lys Lys His Tyr Thr Gly Trp Gly Arg Leu Ser
            660                 665                 670


Lys Glu Leu Ile Gln Gly Ile Arg Asp Lys Gln Ser Asn Lys Thr Ile
        675                 680                 685


Leu Asp Tyr Leu Ile Asn Asp Asp Asp Phe Pro His His Arg Asn Arg
    690                 695                 700


Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu Ser Phe Lys Lys Glu
705                 710                 715                 720


Ile Lys Lys Ala Gln Met Ile Thr Asp Thr Glu Asn Leu Glu Glu Ile
                725                 730                 735


Val Lys Glu Leu Thr Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
```

```
            740                 745                 750

Ser Leu Lys Ile Val Asp Glu Ile Val Gly Ile Met Gly Tyr Glu Pro
        755                 760                 765

Ala Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Arg
    770                 775                 780

Gly Leu Lys Ser Ser Arg Pro Arg Leu Lys Ala Leu Glu Glu Ser Leu
785                 790                 795                 800

Lys Asp Phe Gly Ser Gln Leu Leu Lys Glu Tyr Pro Thr Asp Asn Ser
                805                 810                 815

Ser Leu Gln Lys Asp Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Arg
            820                 825                 830

Asp Met Tyr Thr Gly Ala Pro Leu Asp Ile His Arg Leu Ser Asp Tyr
        835                 840                 845

Asp Ile Asp His Ile Ile Pro Arg Ser Phe Thr Thr Asp Asn Ser Ile
    850                 855                 860

Asp Asn Lys Val Leu Val Ser Ser Lys Glu Asn Arg Leu Lys Lys Asp
865                 870                 875                 880

Asp Val Pro Ser Glu Lys Val Val Lys Lys Met Arg Ser Phe Trp Tyr
                885                 890                 895

Asp Leu Tyr Ser Ser Lys Leu Ile Ser Lys Arg Lys Leu Asp Asn Leu
            900                 905                 910

Thr Lys Ile Lys Leu Thr Glu Glu Asp Lys Ala Gly Phe Ile Lys Arg
        915                 920                 925

Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gly Ile Leu
    930                 935                 940
```

```
His His Arg Phe Asn Lys Ala Glu Asp Thr Asn Glu Pro Ile Arg Lys
945                 950                 955                 960


Val Arg Ile Ile Thr Leu Lys Ser Ala Leu Val Ser Gln Phe Arg Asn
                965                 970                 975


Arg Phe Gly Ile Tyr Lys Val Arg Glu Ile Asn Glu Tyr His His Ala
            980                 985                 990


His Asp Ala Tyr Leu Asn Gly Val  Val Ala Leu Ala Leu  Leu Lys Lys
        995                 1000                1005


Tyr Pro  Gln Leu Ala Pro Glu  Phe Val Tyr Gly Glu  Tyr Leu Lys
    1010                1015                1020


Phe Asn  Ala His Lys Ala Asn  Lys Ala Thr Val Lys  Lys Glu Phe
    1025                1030                1035


Tyr Ser  Asn Ile Met Lys Phe  Phe Glu Ser Asp Thr  Pro Val Cys
    1040                1045                1050


Asp Glu  Asn Gly Glu Ile Phe  Trp Asp Lys Ser Lys  Ser Ile Ala
    1055                1060                1065


Gln Val  Lys Lys Val Ile Asn  His His His Met Asn  Ile Val Lys
    1070                1075                1080


Lys Thr  Glu Ile Gln Lys Gly  Gly Phe Ser Lys Glu  Thr Val Glu
    1085                1090                1095


Pro Lys  Lys Asp Ser Ser Lys  Leu Leu Pro Arg Lys  Asn Asn Trp
    1100                1105                1110


Asp Pro  Ala Lys Tyr Gly Gly  Leu Gly Ser Pro Asn  Val Ala Tyr
    1115                1120                1125


Thr Val  Ala Phe Thr Tyr Glu  Lys Gly Lys Ala Arg  Lys Arg Thr
```

```
    1130                1135                1140

Asn Ala  Leu Glu Gly Ile Thr  Ile Met Glu Arg Glu  Ala Phe Glu
    1145                1150                1155

Gln Ser  Pro Val Leu Phe Leu  Lys Asn Lys Gly Tyr  Glu Gln Ala
    1160                1165                1170

Glu Ile  Glu Met Lys Leu Pro  Lys Tyr Ala Leu Phe  Glu Leu Glu
    1175                1180                1185

Asn Gly  Arg Lys Arg Met Val  Ala Ser Asn Lys Glu  Ala Gln Lys
    1190                1195                1200

Ala Asn  Ser Phe Leu Leu Pro  Glu His Leu Val Thr  Leu Leu Tyr
    1205                1210                1215

His Ala  Lys Gln Tyr Asp Glu  Ile Ser His Lys Glu  Ser Phe Asp
    1220                1225                1230

Tyr Val  Asn Glu His His Lys  Glu Phe Ser Glu Val  Phe Ala Arg
    1235                1240                1245

Val Leu  Glu Phe Ala Gly Lys  Tyr Thr Leu Ala Glu  Lys Asn Ile
    1250                1255                1260

Glu Lys  Leu Glu Lys Ile Tyr  Lys Glu Asn Gln Thr  Asp Asp Leu
    1265                1270                1275

Ala Lys  Leu Ala Ser Ser Phe  Val Asn Leu Met Gln  Phe Asn Ala
    1280                1285                1290

Met Gly  Ala Pro Ala Asp Phe  Lys Phe Phe Asp Val  Thr Ile Pro
    1295                1300                1305

Arg Lys  Arg Tyr Thr Ser Leu  Thr Glu Ile Trp Gln  Ser Thr Ile
    1310                1315                1320
```

```
Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Arg Met
    1325                1330                1335


Gly Lys
    1340
```

<210> 417
<211> 1339
<212> PRT
<213> Enterococcus faecium

<400> 417

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Met Lys Lys Glu Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Val Leu Thr Asp Asp Tyr Arg Leu Val Ser Lys Lys Met
            20                  25                  30


Lys Val Ala Gly Asn Thr Glu Lys Ser Ser Thr Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Ala Arg Arg Ser
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Leu Ala Arg Arg Arg Gln Arg Ile Leu
65                  70                  75                  80


Glu Leu Gln Lys Ile Phe Ala Pro Glu Ile Leu Lys Ile Asp Glu His
                85                  90                  95


Phe Phe Ala Arg Leu Asn Glu Ser Phe Leu Val Leu Asp Glu Lys Lys
            100                 105                 110


Gln Ser Arg His Pro Val Phe Ala Thr Ile Lys Gln Glu Lys Ser Tyr
        115                 120                 125


His Gln Thr Tyr Pro Thr Ile Tyr His Leu Arg Gln Ala Leu Ala Asp
    130                 135                 140
```

```
Ser Ser Glu Lys Ala Asp Ile Arg Leu Val Tyr Leu Ala Met Ala His
145                 150                 155                 160

Leu Leu Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Thr
                165                 170                 175

Glu Asn Ser Ser Val Thr Glu Thr Phe Arg Gln Phe Leu Ser Thr Tyr
            180                 185                 190

Asn Gln Gln Phe Ser Glu Ala Asp Asp Lys Gln Thr Glu Lys Leu Asp
        195                 200                 205

Glu Ala Val Asp Cys Ser Phe Val Phe Thr Glu Lys Met Ser Lys Thr
    210                 215                 220

Lys Lys Ala Glu Thr Leu Leu Lys Tyr Phe Pro His Glu Lys Ser Asn
225                 230                 235                 240

Gly Tyr Leu Ser Gln Phe Ile Lys Leu Met Val Gly Asn Gln Gly Asn
                245                 250                 255

Phe Lys Asn Val Phe Gly Leu Glu Glu Ala Lys Leu Gln Phe Ser Lys
            260                 265                 270

Glu Thr Tyr Glu Glu Asp Leu Glu Glu Leu Leu Glu Lys Ile Gly Asp
        275                 280                 285

Asp Tyr Ile Asp Leu Phe Val Gln Ala Lys Asn Val Tyr Asp Ala Val
    290                 295                 300

Leu Leu Ser Glu Ile Leu Ser Asp Ser Thr Lys Asn Thr Arg Ala Lys
305                 310                 315                 320

Leu Ser Ala Gly Met Ile Arg Arg Tyr Asp Ala His Lys Glu Asp Leu
                325                 330                 335
```

```
Val Leu Leu Lys Arg Phe Val Lys Glu Asn Leu Pro Lys Lys Tyr Arg
            340                 345                 350

Ala Phe Phe Gly Asp Asn Ser Val Asn Gly Tyr Ala Gly Tyr Ile Glu
        355                 360                 365

Gly His Ala Thr Gln Glu Asp Phe Tyr Lys Phe Val Lys Lys Glu Leu
    370                 375                 380

Thr Gly Ile Arg Gly Ser Glu Val Phe Leu Thr Lys Ile Glu Gln Glu
385                 390                 395                 400

Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His
                405                 410                 415

Gln Ile His Leu Thr Glu Leu Arg Ala Ile Ile Ala Asn Gln Lys Lys
            420                 425                 430

His Tyr Pro Phe Leu Lys Glu Glu Gln Glu Lys Leu Glu Ser Leu Leu
        435                 440                 445

Thr Phe Lys Ile Pro Tyr Tyr Val Gly Pro Leu Ala Lys Lys Gln Glu
    450                 455                 460

Asn Ser Pro Phe Ala Trp Leu Ile Arg Lys Ser Glu Glu Lys Ile Lys
465                 470                 475                 480

Pro Trp Asn Leu Pro Glu Ile Val Asp Met Glu Gly Ser Ala Val Arg
                485                 490                 495

Phe Ile Glu Arg Met Ile Asn Thr Asp Met Tyr Met Pro His Asn Lys
            500                 505                 510

Val Leu Pro Lys Asn Ser Leu Leu Tyr Gln Lys Phe Ser Ile Tyr Asn
        515                 520                 525

Glu Leu Thr Lys Val Arg Tyr Gln Asp Glu Arg Gly Gln Met Asn Tyr
    530                 535                 540
```

```
Phe Ser Ser Ile Glu Lys Lys Glu Ile Phe His Glu Leu Phe Glu Lys
545                 550                 555                 560

Asn Arg Lys Val Thr Lys Lys Asp Leu Gln Glu Phe Leu Tyr Leu Lys
                565                 570                 575

Tyr Asp Ile Lys His Ala Glu Leu Ser Gly Ile Glu Lys Ala Phe Asn
            580                 585                 590

Ala Ser Tyr Thr Thr Tyr His Asp Phe Leu Thr Met Ser Glu Asn Lys
        595                 600                 605

Arg Glu Met Lys Gln Trp Leu Glu Asp Pro Glu Leu Ala Ser Met Phe
    610                 615                 620

Glu Glu Ile Ile Lys Thr Leu Thr Val Phe Glu Asp Arg Glu Met Ile
625                 630                 635                 640

Lys Thr Arg Leu Ser His His Glu Ala Thr Leu Gly Lys His Ile Ile
                645                 650                 655

Lys Lys Leu Thr Lys Lys His Tyr Thr Gly Trp Gly Arg Leu Ser Lys
            660                 665                 670

Glu Leu Ile Gln Gly Ile Arg Asp Lys Gln Ser Asn Lys Thr Ile Leu
        675                 680                 685

Asp Tyr Leu Ile Asn Asp Asp Asp Phe Pro His His Arg Asn Arg Asn
    690                 695                 700

Phe Met Gln Leu Ile Asn Asp Asp Ser Leu Ser Phe Lys Lys Glu Ile
705                 710                 715                 720

Lys Lys Ala Gln Met Ile Thr Asp Thr Glu Asn Leu Glu Glu Ile Val
                725                 730                 735
```

```
Lys Glu Leu Thr Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Ser
            740                 745                 750

Leu Lys Ile Val Asp Glu Ile Val Gly Ile Met Gly Tyr Glu Pro Ala
        755                 760                 765

Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Arg Gly
    770                 775                 780

Leu Lys Ser Ser Arg Pro Arg Leu Lys Ala Leu Glu Glu Ser Leu Lys
785                 790                 795                 800

Asp Phe Gly Ser Gln Leu Leu Lys Glu Tyr Pro Thr Asp Asn Ser Ser
                805                 810                 815

Leu Gln Lys Asp Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Arg Asp
            820                 825                 830

Met Tyr Thr Gly Ala Pro Leu Asp Ile His Arg Leu Ser Asp Tyr Asp
        835                 840                 845

Ile Asp His Ile Ile Pro Arg Ser Phe Thr Thr Asp Asn Ser Ile Asp
    850                 855                 860

Asn Lys Val Leu Val Ser Ser Lys Glu Asn Arg Leu Lys Lys Asp Asp
865                 870                 875                 880

Val Pro Ser Glu Lys Val Val Lys Lys Met Arg Ser Phe Trp Tyr Asp
                885                 890                 895

Leu Tyr Ser Ser Lys Leu Ile Ser Lys Arg Lys Leu Asp Asn Leu Thr
            900                 905                 910

Lys Ile Lys Leu Thr Glu Glu Asp Lys Ala Gly Phe Ile Lys Arg Gln
        915                 920                 925

Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gly Ile Leu His
    930                 935                 940
```

```
His Arg Phe Asn Lys Ala Glu Asp Thr Asn Glu Pro Ile Arg Lys Val
945                 950                 955                 960


Arg Ile Ile Thr Leu Lys Ser Ala Leu Val Ser Gln Phe Arg Asn Arg
                965                 970                 975


Phe Gly Ile Tyr Lys Val Arg Glu Ile Asn Glu Tyr His His Ala His
            980                 985                 990


Asp Ala Tyr Leu Asn Gly Val Val  Ala Leu Ala Leu Leu  Lys Lys Tyr
        995                 1000                1005


Pro Gln  Leu Ala Pro Glu Phe  Val Tyr Gly Glu Tyr  Leu Lys Phe
    1010                1015                1020


Asn Ala  His Lys Ala Asn Lys  Ala Thr Val Lys Lys  Glu Phe Tyr
    1025                1030                1035


Ser Asn  Ile Met Lys Phe Phe  Glu Ser Asp Thr Pro  Val Cys Asp
    1040                1045                1050


Glu Asn  Gly Glu Ile Phe Trp  Asp Lys Ser Lys Ser  Ile Ala Gln
    1055                1060                1065


Val Lys  Lys Val Ile Asn His  His His Met Asn Ile  Val Lys Lys
    1070                1075                1080


Thr Glu  Ile Gln Lys Gly Gly  Phe Ser Lys Glu Thr  Val Glu Pro
    1085                1090                1095


Lys Lys  Asp Ser Ser Lys Leu  Leu Pro Arg Lys Asn  Asn Trp Asp
    1100                1105                1110


Pro Ala  Lys Tyr Gly Gly Leu  Gly Ser Pro Asn Val  Ala Tyr Thr
    1115                1120                1125
```

```
Val Ala  Phe Thr Tyr Glu Lys  Gly Lys Ala Arg Lys  Arg Thr Asn
    1130                1135                1140

Ala Leu  Glu Gly Ile Thr Ile  Met Glu Arg Glu Ala  Phe Glu Gln
    1145                1150                1155

Ser Pro  Val Leu Phe Leu Lys  Asn Lys Gly Tyr Glu  Gln Ala Glu
    1160                1165                1170

Ile Glu  Met Lys Leu Pro Lys  Tyr Ala Leu Phe Glu  Leu Glu Asn
    1175                1180                1185

Gly Arg  Lys Arg Met Val Ala  Ser Asn Lys Glu Ala  Gln Lys Ala
    1190                1195                1200

Asn Ser  Phe Leu Leu Pro Glu  His Leu Val Thr Leu  Leu Tyr His
    1205                1210                1215

Ala Lys  Gln Tyr Asp Glu Ile  Ser His Lys Glu Ser  Phe Asp Tyr
    1220                1225                1230

Val Asn  Glu His His Lys Glu  Phe Ser Glu Val Phe  Ala Arg Val
    1235                1240                1245

Leu Glu  Phe Ala Gly Lys Tyr  Thr Leu Ala Glu Lys  Asn Ile Glu
    1250                1255                1260

Lys Leu  Glu Lys Ile Tyr Lys  Glu Asn Gln Thr Asp  Asp Leu Ala
    1265                1270                1275

Lys Leu  Ala Ser Ser Phe Val  Asn Leu Met Gln Phe  Asn Ala Met
    1280                1285                1290

Gly Ala  Pro Ala Asp Phe Lys  Phe Phe Asp Val Thr  Ile Pro Arg
    1295                1300                1305

Lys Arg  Tyr Thr Ser Leu Thr  Glu Ile Trp Gln Ser  Thr Ile Ile
    1310                1315                1320
```

His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Arg Met Gly
    1325   1330   1335

Lys

<210> 418
<211> 1340
<212> PRT
<213> Enterococcus faecium

<400> 418

Met Lys Lys Glu Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ser Val Leu Thr Asp Asp Tyr Arg Leu Val Ser Lys Lys Met
            20   25   30

Lys Val Ala Gly Asn Thr Glu Lys Ser Ser Thr Lys Lys Asn Phe Trp
        35   40   45

Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Ala Arg Arg Ser
    50   55   60

Lys Arg Thr Ala Arg Arg Arg Leu Ala Arg Arg Arg Gln Arg Ile Leu
65   70   75   80

Glu Leu Gln Lys Ile Phe Ala Pro Glu Ile Leu Lys Ile Asp Glu His
                85   90   95

Phe Phe Ala Arg Leu Asn Glu Ser Phe Leu Val Leu Asp Glu Lys Lys
            100   105   110

Gln Ser Arg His Pro Val Phe Ala Thr Ile Lys Gln Glu Lys Ser Tyr
        115   120   125

His Gln Thr Tyr Pro Thr Ile Tyr His Leu Arg Gln Ala Leu Ala Asp

```
    130                 135                 140

Ser Ser Glu Lys Ala Asp Ile Arg Leu Val Tyr Leu Ala Met Ala His
145                 150                 155                 160

Leu Leu Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Thr
                165                 170                 175

Glu Asn Ser Ser Val Thr Glu Thr Phe Arg Gln Phe Leu Ser Thr Tyr
            180                 185                 190

Asn Gln Gln Phe Ser Glu Ala Asp Asp Lys Gln Thr Glu Lys Leu Asp
        195                 200                 205

Glu Ala Val Asp Cys Ser Phe Val Phe Thr Glu Lys Met Ser Lys Thr
    210                 215                 220

Lys Lys Ala Glu Thr Leu Leu Lys Tyr Phe Pro His Glu Lys Ser Asn
225                 230                 235                 240

Gly Tyr Leu Ser Gln Phe Ile Lys Leu Met Val Gly Asn Gln Gly Asn
                245                 250                 255

Phe Lys Asn Val Phe Gly Leu Glu Glu Glu Ala Lys Leu Gln Phe Ser
            260                 265                 270

Lys Glu Thr Tyr Glu Glu Asp Leu Glu Glu Leu Leu Glu Lys Ile Gly
        275                 280                 285

Asp Asp Tyr Ile Asp Leu Phe Val Gln Ala Lys Asn Val Tyr Asp Ala
    290                 295                 300

Val Leu Leu Ser Glu Ile Leu Ser Asp Ser Thr Lys Asn Thr Arg Ala
305                 310                 315                 320

Lys Leu Ser Ala Gly Met Ile Arg Arg Tyr Asp Ala His Lys Glu Asp
                325                 330                 335
```

```
Leu Val Leu Leu Lys Arg Phe Val Lys Glu Asn Leu Pro Lys Lys Tyr
            340                 345                 350

Arg Ala Phe Phe Gly Asp Asn Ser Val Asn Gly Tyr Ala Gly Tyr Ile
        355                 360                 365

Glu Gly His Ala Thr Gln Glu Asp Phe Tyr Lys Phe Val Lys Lys Glu
    370                 375                 380

Leu Thr Gly Ile Arg Gly Ser Glu Val Phe Leu Thr Lys Ile Glu Gln
385                 390                 395                 400

Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro
                405                 410                 415

His Gln Ile His Leu Thr Glu Leu Arg Ala Ile Ile Ala Asn Gln Lys
            420                 425                 430

Lys His Tyr Pro Phe Leu Lys Glu Glu Gln Glu Lys Leu Glu Ser Leu
        435                 440                 445

Leu Thr Phe Lys Ile Pro Tyr Tyr Val Gly Pro Leu Ala Lys Lys Gln
    450                 455                 460

Glu Asn Ser Pro Phe Ala Trp Leu Ile Arg Lys Ser Glu Glu Lys Ile
465                 470                 475                 480

Lys Pro Trp Asn Leu Pro Glu Ile Val Asp Met Glu Gly Ser Ala Val
                485                 490                 495

Arg Phe Ile Glu Arg Met Ile Asn Thr Asp Met Tyr Ile Pro His Asn
            500                 505                 510

Lys Val Leu Pro Lys Asn Ser Leu Leu Tyr Gln Lys Phe Ser Ile Tyr
        515                 520                 525

Asn Glu Leu Thr Lys Val Arg Tyr Gln Asp Glu Arg Gly Gln Met Asn
```

```
    530                 535                 540

Tyr Phe Ser Ser Ile Glu Lys Lys Glu Ile Phe His Glu Leu Phe Glu
545                 550                 555                 560

Lys Asn Arg Lys Val Thr Lys Lys Asp Leu Gln Glu Phe Leu Tyr Leu
                565                 570                 575

Lys Tyr Asp Ile Lys His Ala Glu Leu Ser Gly Ile Glu Lys Ala Phe
            580                 585                 590

Asn Ala Ser Tyr Thr Thr Tyr His Asp Phe Leu Thr Met Ser Glu Asn
        595                 600                 605

Lys Arg Glu Met Lys Gln Trp Leu Glu Asp Pro Glu Leu Ala Ser Met
    610                 615                 620

Phe Glu Glu Ile Ile Lys Thr Leu Thr Val Phe Glu Asp Arg Glu Met
625                 630                 635                 640

Ile Lys Thr Arg Leu Ser His His Glu Ala Thr Leu Gly Lys His Ile
                645                 650                 655

Ile Lys Lys Leu Thr Lys Lys His Tyr Thr Gly Trp Gly Arg Leu Ser
            660                 665                 670

Lys Glu Leu Ile Gln Gly Ile Arg Asp Lys Gln Ser Asn Lys Thr Ile
        675                 680                 685

Leu Asp Tyr Leu Ile Asn Asp Asp Asp Phe Pro His His Arg Asn Arg
    690                 695                 700

Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu Ser Phe Lys Lys Glu
705                 710                 715                 720

Ile Lys Lys Ala Gln Met Ile Thr Asp Thr Glu Asn Leu Glu Glu Ile
                725                 730                 735
```

```
Val Lys Glu Leu Thr Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
            740                 745                 750

Ser Leu Lys Ile Val Asp Glu Ile Val Gly Ile Met Gly Tyr Glu Pro
        755                 760                 765

Ala Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Arg
    770                 775                 780

Gly Leu Lys Ser Ser Arg Pro Arg Leu Lys Ala Leu Glu Glu Ser Leu
785                 790                 795                 800

Lys Asp Phe Gly Ser Gln Leu Leu Lys Glu Tyr Pro Thr Asp Asn Ser
                805                 810                 815

Ser Leu Gln Lys Asp Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Arg
            820                 825                 830

Asp Met Tyr Thr Gly Ala Pro Leu Asp Ile His Arg Leu Ser Asp Tyr
        835                 840                 845

Asp Ile Asp His Ile Ile Pro Arg Ser Phe Thr Thr Asp Asn Ser Ile
    850                 855                 860

Asp Asn Lys Val Leu Val Ser Ser Lys Glu Asn Arg Leu Lys Lys Asp
865                 870                 875                 880

Asp Val Pro Ser Glu Lys Val Val Lys Lys Met Arg Ser Phe Trp Tyr
                885                 890                 895

Asp Leu Tyr Ser Ser Lys Leu Ile Ser Lys Arg Lys Leu Asp Asn Leu
            900                 905                 910

Thr Lys Ile Lys Leu Thr Glu Glu Asp Lys Ala Gly Phe Ile Lys Arg
        915                 920                 925

Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gly Ile Leu
```

```
    930                 935                 940

His His Arg Phe Asn Lys Ala Glu Asp Thr Asn Glu Pro Ile Arg Lys
945                 950                 955                 960

Val Arg Ile Ile Thr Leu Lys Ser Ala Leu Val Ser Gln Phe Arg Asn
                965                 970                 975

Arg Phe Gly Ile Tyr Lys Val Arg Glu Ile Asn Glu Tyr His His Ala
            980                 985                 990

His Asp Ala Tyr Leu Asn Gly Val  Val Ala Leu Ala Leu  Leu Lys Lys
        995                 1000                1005

Tyr Pro  Gln Leu Ala Pro Glu  Phe Val Tyr Gly Glu  Tyr Leu Lys
    1010                1015                1020

Phe Asn  Ala His Lys Ala Asn  Lys Ala Thr Val Lys  Lys Glu Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Lys Phe  Phe Glu Ser Asp Thr  Pro Val Cys
    1040                1045                1050

Asp Glu  Asn Gly Glu Ile Phe  Trp Asp Lys Ser Lys  Ser Ile Ala
    1055                1060                1065

Gln Val  Lys Lys Val Ile Asn  His His His Met Asn  Ile Val Lys
    1070                1075                1080

Lys Thr  Glu Ile Gln Lys Gly  Gly Phe Ser Lys Glu  Thr Val Glu
    1085                1090                1095

Pro Lys  Lys Asp Ser Ser Lys  Leu Leu Pro Arg Lys  Asn Asn Trp
    1100                1105                1110

Asp Pro  Ala Lys Tyr Gly Gly  Leu Gly Ser Pro Asn  Val Ala Tyr
    1115                1120                1125
```

```
Thr Val  Ala Phe Thr Tyr Glu  Lys Gly Lys Ala Arg  Lys Arg Thr
    1130                1135                1140

Asn Ala  Leu Glu Gly Ile Thr  Ile Met Glu Arg Glu  Ala Phe Glu
    1145                1150                1155

Gln Ser  Pro Val Leu Phe Leu  Lys Asn Lys Gly Tyr  Glu Gln Ala
    1160                1165                1170

Glu Ile  Glu Met Lys Leu Pro  Lys Tyr Ala Leu Phe  Glu Leu Glu
    1175                1180                1185

Asn Gly  Arg Lys Arg Met Val  Ala Ser Asn Lys Glu  Ala Gln Lys
    1190                1195                1200

Ala Asn  Ser Phe Leu Leu Pro  Glu His Leu Val Thr  Leu Leu Tyr
    1205                1210                1215

His Ala  Lys Gln Tyr Asp Glu  Ile Ser His Lys Glu  Ser Phe Asp
    1220                1225                1230

Tyr Val  Asn Glu His His Lys  Glu Phe Ser Glu Val  Phe Ala Arg
    1235                1240                1245

Val Leu  Glu Phe Ala Gly Lys  Tyr Thr Leu Ala Glu  Lys Asn Ile
    1250                1255                1260

Glu Lys  Leu Glu Lys Ile Tyr  Lys Glu Asn Gln Thr  Asp Asp Leu
    1265                1270                1275

Ala Lys  Leu Ala Ser Ser Phe  Val Asn Leu Met Gln  Phe Asn Ala
    1280                1285                1290

Met Gly  Ala Pro Ala Asp Phe  Lys Phe Phe Asp Val  Thr Ile Pro
    1295                1300                1305

Arg Lys  Arg Tyr Thr Ser Leu  Thr Glu Ile Trp Gln  Ser Thr Ile
```

1310 1315 1320

Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Arg Met
1325 1330 1335

Gly Lys
1340

<210> 419
<211> 1340
<212> PRT
<213> Enterococcus faecium

<400> 419

Met Lys Lys Glu Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ser Val Leu Thr Asp Asp Tyr Arg Leu Val Ser Lys Lys Met
20 25 30

Lys Val Ala Gly Asn Thr Glu Lys Ser Ser Thr Lys Lys Asn Phe Trp
35 40 45

Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Ala Arg Arg Ser
50 55 60

Lys Arg Thr Ala Arg Arg Arg Leu Ala Arg Arg Arg Gln Arg Ile Leu
65 70 75 80

Glu Leu Gln Lys Ile Phe Ala Pro Glu Ile Leu Lys Ile Asp Glu His
85 90 95

Phe Phe Ala Arg Leu Asn Glu Ser Phe Leu Val Leu Asp Glu Lys Lys
100 105 110

Gln Ser Arg His Pro Val Phe Ala Thr Ile Lys Gln Glu Lys Ser Tyr
115 120 125

```
His Gln Thr Tyr Pro Thr Ile Tyr His Leu Arg Gln Ala Leu Ala Asp
    130                 135                 140

Ser Ser Glu Lys Ala Asp Ile Arg Leu Val Tyr Leu Ala Met Ala His
145                 150                 155                 160

Leu Leu Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Thr
                165                 170                 175

Glu Asn Ser Ser Val Thr Glu Thr Phe Arg Gln Phe Leu Ser Thr Tyr
            180                 185                 190

Asn Gln Gln Phe Ser Glu Ala Asp Asp Lys Gln Thr Glu Lys Leu Asp
        195                 200                 205

Glu Ala Val Asp Cys Ser Phe Val Phe Thr Glu Lys Met Ser Lys Thr
    210                 215                 220

Lys Lys Ala Glu Thr Leu Leu Lys Tyr Phe Pro His Glu Lys Ser Asn
225                 230                 235                 240

Gly Tyr Leu Ser Gln Phe Ile Lys Leu Met Val Gly Asn Gln Gly Asn
                245                 250                 255

Phe Lys Asn Val Phe Gly Leu Glu Glu Glu Ala Lys Leu Gln Phe Ser
            260                 265                 270

Lys Glu Thr Tyr Glu Glu Asp Leu Glu Glu Leu Leu Glu Lys Ile Gly
        275                 280                 285

Asp Asp Tyr Ile Asp Leu Phe Val Gln Ala Lys Asn Val Tyr Asp Ala
    290                 295                 300

Val Leu Leu Ser Glu Ile Leu Ser Asp Ser Thr Lys Asn Thr Arg Ala
305                 310                 315                 320

Lys Leu Ser Ala Gly Met Ile Arg Arg Tyr Asp Ala His Lys Glu Asp
                325                 330                 335
```

```
Leu Val Leu Leu Lys Arg Phe Val Lys Glu Asn Leu Pro Lys Lys Tyr
            340                 345                 350

Arg Ala Phe Phe Gly Asp Asn Ser Val Asn Gly Tyr Ala Gly Tyr Ile
        355                 360                 365

Glu Gly His Ala Thr Gln Glu Asp Phe Tyr Lys Phe Val Lys Lys Glu
    370                 375                 380

Leu Thr Gly Ile Arg Gly Ser Glu Val Phe Leu Thr Lys Ile Glu Gln
385                 390                 395                 400

Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro
                405                 410                 415

His Gln Ile His Leu Thr Glu Leu Arg Ala Ile Ile Ala Asn Gln Lys
            420                 425                 430

Lys His Tyr Pro Phe Leu Lys Glu Glu Gln Glu Lys Leu Glu Ser Leu
        435                 440                 445

Leu Thr Phe Lys Ile Pro Tyr Tyr Val Gly Pro Leu Ala Lys Lys Gln
    450                 455                 460

Glu Asn Ser Pro Phe Ala Trp Leu Ile Arg Lys Ser Glu Glu Lys Ile
465                 470                 475                 480

Lys Pro Trp Asn Leu Pro Glu Ile Val Asp Met Glu Gly Ser Ala Val
                485                 490                 495

Arg Phe Ile Glu Arg Met Ile Asn Thr Asp Met Tyr Met Pro His Asn
            500                 505                 510

Lys Val Leu Pro Lys Asn Ser Leu Leu Tyr Gln Lys Phe Ser Ile Tyr
        515                 520                 525
```

```
Asn Glu Leu Thr Lys Val Arg Tyr Gln Asp Glu Arg Gly Gln Met Asn
    530                 535                 540

Tyr Phe Ser Ser Ile Glu Lys Lys Glu Ile Phe His Glu Leu Phe Glu
545                 550                 555                 560

Lys Asn Arg Lys Val Thr Lys Lys Asp Leu Gln Glu Phe Leu Tyr Leu
                565                 570                 575

Lys Tyr Asp Ile Lys His Ala Glu Leu Ser Gly Ile Glu Lys Ala Phe
            580                 585                 590

Asn Ala Ser Tyr Thr Thr Tyr His Asp Phe Leu Thr Met Ser Glu Asn
        595                 600                 605

Lys Arg Glu Met Lys Gln Trp Leu Glu Asp Pro Glu Leu Ala Ser Met
    610                 615                 620

Phe Glu Glu Ile Ile Lys Thr Leu Thr Val Phe Glu Asp Arg Glu Met
625                 630                 635                 640

Ile Lys Thr Arg Leu Ser His His Glu Ala Thr Leu Gly Lys His Ile
                645                 650                 655

Ile Lys Lys Leu Thr Lys Lys His Tyr Thr Gly Trp Gly Arg Leu Ser
            660                 665                 670

Lys Glu Leu Ile Gln Gly Ile Arg Asp Lys Gln Ser Asn Lys Thr Ile
        675                 680                 685

Leu Asp Tyr Leu Ile Asn Asp Asp Asp Phe Pro His His Arg Asn Arg
    690                 695                 700

Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu Ser Phe Lys Lys Glu
705                 710                 715                 720

Ile Lys Lys Ala Gln Met Ile Thr Asp Thr Glu Asn Leu Glu Glu Ile
                725                 730                 735
```

```
Val Lys Glu Leu Thr Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
            740                 745                 750

Ser Leu Lys Ile Val Asp Glu Ile Val Gly Ile Met Gly Tyr Glu Pro
        755                 760                 765

Ala Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Arg
    770                 775                 780

Gly Leu Lys Ser Ser Arg Pro Arg Leu Lys Ala Leu Glu Glu Ser Leu
785                 790                 795                 800

Lys Asp Phe Gly Ser Gln Leu Leu Lys Glu Tyr Pro Thr Asp Asn Ser
                805                 810                 815

Ser Leu Gln Lys Asp Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Arg
            820                 825                 830

Asp Met Tyr Thr Gly Ala Pro Leu Asp Ile His Arg Leu Ser Asp Tyr
        835                 840                 845

Asp Ile Asp His Ile Ile Pro Arg Ser Phe Thr Thr Asp Asn Ser Ile
    850                 855                 860

Asp Asn Lys Val Leu Val Ser Ser Lys Glu Asn Arg Leu Lys Lys Asp
865                 870                 875                 880

Asp Val Pro Ser Glu Lys Val Val Lys Lys Met Arg Ser Phe Trp Tyr
                885                 890                 895

Asp Leu Tyr Ser Ser Lys Leu Ile Ser Lys Arg Lys Leu Asp Asn Leu
            900                 905                 910

Thr Lys Ile Lys Leu Thr Glu Glu Asp Lys Ala Gly Phe Ile Lys Arg
        915                 920                 925
```

```
Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gly Ile Leu
    930                 935                 940

His His Arg Phe Asn Lys Ala Glu Asp Thr Asn Glu Pro Ile Arg Lys
945                 950                 955                 960

Val Arg Ile Ile Thr Leu Lys Ser Ala Leu Val Ser Gln Phe Arg Asn
                965                 970                 975

Arg Phe Gly Ile Tyr Lys Val Arg Glu Ile Asn Glu Tyr His His Ala
            980                 985                 990

His Asp Ala Tyr Leu Asn Gly Val  Val Ala Leu Ala Leu  Leu Lys Lys
        995                 1000                1005

Tyr Pro  Gln Leu Ala Pro Glu  Phe Val Tyr Gly Glu  Tyr Leu Lys
    1010                1015                1020

Phe Asn  Ala His Lys Ala Asn  Lys Ala Thr Val Lys  Lys Glu Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Lys Phe  Phe Glu Ser Asp Thr  Pro Val Cys
    1040                1045                1050

Asp Glu  Asn Gly Glu Ile Phe  Trp Asp Lys Ser Lys  Ser Ile Ala
    1055                1060                1065

Gln Val  Lys Lys Val Ile Asn  His His His Met Asn  Ile Val Lys
    1070                1075                1080

Lys Thr  Glu Ile Gln Lys Gly  Gly Phe Ser Lys Glu  Thr Val Glu
    1085                1090                1095

Pro Lys  Lys Asp Ser Ser Lys  Leu Leu Pro Arg Lys  Asn Asn Trp
    1100                1105                1110

Asp Pro  Ala Lys Tyr Gly Gly  Leu Gly Ser Pro Asn  Val Ala Tyr
    1115                1120                1125
```

```
Thr Val  Ala Phe Thr Tyr Glu  Lys Gly Lys Ala Arg  Lys Arg Thr
    1130                1135                1140

Asn Ala  Leu Glu Gly Ile Thr  Ile Met Glu Arg Glu  Ala Phe Glu
    1145                1150                1155

Gln Ser  Pro Val Leu Phe Leu  Lys Asn Lys Gly Tyr  Glu Gln Ala
    1160                1165                1170

Glu Ile  Glu Met Lys Leu Pro  Lys Tyr Ala Leu Phe  Glu Leu Glu
    1175                1180                1185

Asn Gly  Arg Lys Arg Met Val  Ala Ser Asn Lys Glu  Ala Gln Lys
    1190                1195                1200

Ala Asn  Ser Phe Leu Leu Pro  Glu His Leu Val Thr  Leu Leu Tyr
    1205                1210                1215

His Ala  Lys Gln Tyr Asp Glu  Ile Ser His Lys Glu  Ser Phe Asp
    1220                1225                1230

Tyr Val  Asn Glu His His Lys  Glu Phe Ser Glu Val  Phe Ala Arg
    1235                1240                1245

Val Leu  Glu Phe Ala Gly Lys  Tyr Thr Leu Ala Glu  Lys Asn Ile
    1250                1255                1260

Glu Lys  Leu Glu Lys Ile Tyr  Lys Glu Asn Gln Thr  Asp Asp Leu
    1265                1270                1275

Ala Lys  Leu Ala Ser Ser Phe  Val Asn Leu Met Gln  Phe Asn Ala
    1280                1285                1290

Met Gly  Ala Pro Ala Asp Phe  Lys Phe Phe Asp Val  Thr Ile Pro
    1295                1300                1305
```

```
Arg Lys  Arg Tyr Thr Ser Leu  Thr Glu Ile Trp Gln  Ser Thr Ile
    1310                1315                1320


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Arg Met
    1325                1330                1335


Gly Lys
    1340
```

<210> 420
<211> 1339
<212> PRT
<213> Enterococcus faecium

<400> 420

```
Met Lys Lys Glu Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Val Leu Thr Asp Asp Tyr Arg Leu Val Ser Lys Lys Met
            20                  25                  30


Lys Val Ala Gly Asn Thr Glu Lys Ser Ser Thr Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Ala Arg Arg Ser
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Leu Ala Arg Arg Arg Gln Arg Ile Leu
65                  70                  75                  80


Glu Leu Gln Lys Ile Phe Ala Pro Glu Ile Leu Lys Ile Asp Glu His
                85                  90                  95


Phe Phe Ala Arg Leu Asn Glu Ser Phe Leu Val Leu Asp Glu Lys Lys
            100                 105                 110


Gln Ser Arg His Pro Val Phe Ala Thr Ile Lys Gln Glu Lys Ser Tyr
        115                 120                 125
```

```
His Gln Thr Tyr Pro Thr Ile Tyr His Leu Arg Gln Ala Leu Ala Asp
    130                 135                 140

Ser Ser Glu Lys Ala Asp Ile Arg Leu Val Tyr Leu Ala Met Ala His
145                 150                 155                 160

Leu Leu Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Thr
                165                 170                 175

Glu Asn Ser Ser Val Thr Glu Thr Phe Arg Gln Phe Leu Ser Thr Tyr
            180                 185                 190

Asn Gln Gln Phe Ser Glu Ala Asp Asp Lys Gln Thr Glu Lys Leu Asp
        195                 200                 205

Glu Ala Val Asp Cys Ser Phe Val Phe Thr Glu Lys Met Ser Lys Thr
    210                 215                 220

Lys Lys Ala Glu Thr Leu Leu Lys Tyr Phe Pro His Glu Lys Ser Asn
225                 230                 235                 240

Gly Tyr Leu Ser Gln Phe Ile Lys Leu Met Val Gly Asn Gln Gly Asn
                245                 250                 255

Phe Lys Asn Val Phe Gly Leu Glu Glu Ala Lys Leu Gln Phe Ser Lys
            260                 265                 270

Glu Thr Tyr Glu Glu Asp Leu Glu Glu Leu Leu Glu Lys Ile Gly Asp
        275                 280                 285

Asp Tyr Ile Asp Leu Phe Val Gln Ala Lys Asn Val Tyr Asp Ala Val
    290                 295                 300

Leu Leu Ser Glu Ile Leu Ser Asp Ser Thr Lys Asn Thr Arg Ala Lys
305                 310                 315                 320

Leu Ser Ala Gly Met Ile Arg Arg Tyr Asp Ala His Lys Glu Asp Leu
```

```
                325                 330                 335

Val Leu Leu Lys Arg Phe Val Lys Glu Asn Leu Pro Lys Lys Tyr Arg
            340                 345                 350

Ala Phe Phe Gly Asp Asn Ser Val Asn Gly Tyr Ala Gly Tyr Ile Glu
        355                 360                 365

Gly His Ala Thr Gln Glu Asp Phe Tyr Lys Phe Val Lys Lys Glu Leu
    370                 375                 380

Thr Gly Ile Arg Gly Ser Glu Val Phe Leu Thr Lys Ile Glu Gln Glu
385                 390                 395                 400

Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His
                405                 410                 415

Gln Ile His Leu Thr Glu Leu Arg Ala Ile Ile Ala Asn Gln Lys Lys
            420                 425                 430

His Tyr Pro Phe Leu Lys Glu Glu Gln Glu Lys Leu Glu Ser Leu Leu
        435                 440                 445

Thr Phe Lys Ile Pro Tyr Tyr Val Gly Pro Leu Ala Lys Lys Gln Glu
    450                 455                 460

Asn Ser Pro Phe Ala Trp Leu Ile Arg Lys Ser Glu Glu Lys Ile Lys
465                 470                 475                 480

Pro Trp Asn Leu Pro Glu Ile Val Asp Met Glu Gly Ser Ala Val Arg
                485                 490                 495

Phe Ile Glu Arg Met Ile Asn Thr Asp Met Tyr Ile Pro His Asn Lys
            500                 505                 510

Val Leu Pro Lys Asn Ser Leu Leu Tyr Gln Lys Phe Ser Ile Tyr Asn
        515                 520                 525
```

```
Glu Leu Thr Lys Val Arg Tyr Gln Asp Glu Arg Gly Gln Met Asn Tyr
    530                 535                 540

Phe Ser Ser Ile Glu Lys Lys Glu Ile Phe His Glu Leu Phe Glu Lys
545                 550                 555                 560

Asn Arg Lys Val Thr Lys Lys Asp Leu Gln Glu Phe Leu Tyr Leu Lys
                565                 570                 575

Tyr Asp Ile Lys His Ala Glu Leu Ser Gly Ile Glu Lys Ala Phe Asn
            580                 585                 590

Ala Ser Tyr Thr Thr Tyr His Asp Phe Leu Thr Met Ser Glu Asn Lys
        595                 600                 605

Arg Glu Met Lys Gln Trp Leu Glu Asp Pro Glu Leu Ala Ser Met Phe
    610                 615                 620

Glu Glu Ile Ile Lys Thr Leu Thr Val Phe Glu Asp Arg Glu Met Ile
625                 630                 635                 640

Lys Thr Arg Leu Ser His His Glu Ala Thr Leu Gly Lys His Ile Ile
                645                 650                 655

Lys Lys Leu Thr Lys Lys His Tyr Thr Gly Trp Gly Arg Leu Ser Lys
            660                 665                 670

Glu Leu Ile Gln Gly Ile Arg Asp Lys Gln Ser Asn Lys Thr Ile Leu
        675                 680                 685

Asp Tyr Leu Ile Asn Asp Asp Asp Phe Pro His His Arg Asn Arg Asn
    690                 695                 700

Phe Met Gln Leu Ile Asn Asp Asp Ser Leu Ser Phe Lys Lys Glu Ile
705                 710                 715                 720

Lys Lys Ala Gln Met Ile Thr Asp Thr Glu Asn Leu Glu Glu Ile Val
```

```
                725                 730                 735

Lys Glu Leu Thr Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Ser
            740                 745                 750

Leu Lys Ile Val Asp Glu Ile Val Gly Ile Met Gly Tyr Glu Pro Ala
        755                 760                 765

Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Arg Gly
    770                 775                 780

Leu Lys Ser Ser Arg Pro Arg Leu Lys Ala Leu Glu Glu Ser Leu Lys
785                 790                 795                 800

Asp Phe Gly Ser Gln Leu Leu Lys Glu Tyr Pro Thr Asp Asn Ser Ser
                805                 810                 815

Leu Gln Lys Asp Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Arg Asp
            820                 825                 830

Met Tyr Thr Gly Ala Pro Leu Asp Ile His Arg Leu Ser Asp Tyr Asp
        835                 840                 845

Ile Asp His Ile Ile Pro Arg Ser Phe Thr Thr Asp Asn Ser Ile Asp
    850                 855                 860

Asn Lys Val Leu Val Ser Ser Lys Glu Asn Arg Leu Lys Lys Asp Asp
865                 870                 875                 880

Val Pro Ser Glu Lys Val Val Lys Lys Met Arg Ser Phe Trp Tyr Asp
                885                 890                 895

Leu Tyr Ser Ser Lys Leu Ile Ser Lys Arg Lys Leu Asp Asn Leu Thr
            900                 905                 910

Lys Ile Lys Leu Thr Glu Glu Asp Lys Ala Gly Phe Ile Lys Arg Gln
        915                 920                 925
```

```
Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gly Ile Leu His
    930                 935                 940

His Arg Phe Asn Lys Ala Glu Asp Thr Asn Glu Pro Ile Arg Lys Val
945                 950                 955                 960

Arg Ile Ile Thr Leu Lys Ser Ala Leu Val Ser Gln Phe Arg Asn Arg
                965                 970                 975

Phe Gly Ile Tyr Lys Val Arg Glu Ile Asn Glu Tyr His His Ala His
            980                 985                 990

Asp Ala Tyr Leu Asn Gly Val Val  Ala Leu Ala Leu Leu  Lys Lys Tyr
        995                 1000                1005

Pro Gln  Leu Ala Pro Glu Phe  Val Tyr Gly Glu Tyr  Leu Lys Phe
    1010                1015                1020

Asn Ala  His Lys Ala Asn Lys  Ala Thr Val Lys Lys  Glu Phe Tyr
    1025                1030                1035

Ser Asn  Ile Met Lys Phe Phe  Glu Ser Asp Thr Pro  Val Cys Asp
    1040                1045                1050

Glu Asn  Gly Glu Ile Phe Trp  Asp Lys Ser Lys Ser  Ile Ala Gln
    1055                1060                1065

Val Lys  Lys Val Ile Asn His  His His Met Asn Ile  Val Lys Lys
    1070                1075                1080

Thr Glu  Ile Gln Lys Gly Gly  Phe Ser Glu Glu Thr  Val Glu Pro
    1085                1090                1095

Lys Lys  Asp Ser Ser Lys Leu  Leu Pro Arg Lys Asn  Asn Trp Asp
    1100                1105                1110

Pro Ala  Lys Tyr Gly Gly Leu  Gly Ser Pro Asn Val  Ala Tyr Thr
```

```
    1115                1120                1125

Val Ala  Phe Thr Tyr Glu Lys  Gly Lys Ala Arg Lys  Arg Thr Asn
    1130                1135                1140

Ala Leu  Glu Gly Ile Thr Ile  Met Glu Arg Glu Ala  Phe Glu Gln
    1145                1150                1155

Ser Pro  Val Leu Phe Leu Lys  Asn Lys Gly Tyr Glu  Gln Ala Glu
    1160                1165                1170

Ile Glu  Met Lys Leu Pro Lys  Tyr Ala Leu Phe Glu  Leu Glu Asn
    1175                1180                1185

Gly Arg  Lys Arg Met Val Ala  Ser Asn Lys Glu Ala  Gln Lys Ala
    1190                1195                1200

Asn Ser  Phe Leu Leu Pro Glu  His Leu Val Thr Leu  Leu Tyr His
    1205                1210                1215

Ala Lys  Gln Tyr Asp Glu Ile  Ser His Lys Glu Ser  Phe Asp Tyr
    1220                1225                1230

Val Asn  Glu His His Lys Glu  Phe Ser Glu Val Phe  Ala Arg Val
    1235                1240                1245

Leu Glu  Phe Ala Gly Lys Tyr  Thr Leu Ala Glu Lys  Asn Ile Glu
    1250                1255                1260

Lys Leu  Glu Lys Ile Tyr Lys  Glu Asn Gln Thr Asp  Asp Leu Ala
    1265                1270                1275

Lys Leu  Ala Ser Ser Phe Val  Asn Leu Met Gln Phe  Asn Ala Met
    1280                1285                1290

Gly Ala  Pro Ala Asp Phe Lys  Phe Phe Asp Val Thr  Ile Pro Arg
    1295                1300                1305
```

Lys Arg Tyr Thr Ser Leu Thr Glu Ile Trp Gln Ser Thr Ile Ile
    1310   1315   1320

His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Arg Met Gly
    1325   1330   1335

Lys

<210> 421
<211> 1340
<212> PRT
<213> Enterococcus faecium

<400> 421

Met Lys Lys Glu Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ser Val Leu Thr Asp Asp Tyr Arg Leu Val Ser Lys Lys Met
            20   25   30

Lys Val Ala Gly Asn Thr Glu Lys Ser Ser Thr Lys Lys Asn Phe Trp
        35   40   45

Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Ala Arg Arg Ser
    50   55   60

Lys Arg Thr Ala Arg Arg Arg Leu Ala Arg Arg Arg Gln Arg Ile Leu
65   70   75   80

Glu Leu Gln Lys Ile Phe Ala Pro Glu Ile Leu Lys Ile Asp Glu His
                85   90   95

Phe Phe Ala Arg Leu Asn Glu Ser Phe Leu Val Leu Asp Glu Lys Lys
            100   105   110

Gln Ser Arg His Pro Val Phe Ala Thr Ile Lys Gln Glu Lys Ser Tyr
        115   120   125

```
His Gln Thr Tyr Pro Thr Ile Tyr His Leu Arg Gln Ala Leu Ala Asp
    130                 135                 140

Ser Ser Glu Lys Ala Asp Ile Arg Leu Val Tyr Leu Ala Met Ala His
145                 150                 155                 160

Leu Leu Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Thr
                165                 170                 175

Glu Asn Ser Ser Val Thr Glu Thr Phe Arg Gln Phe Leu Ser Thr Tyr
            180                 185                 190

Asn Gln Gln Phe Ser Glu Ala Asp Asp Lys Gln Thr Glu Lys Leu Asp
        195                 200                 205

Glu Ala Val Asp Cys Ser Phe Val Phe Thr Glu Lys Met Ser Lys Thr
    210                 215                 220

Lys Lys Ala Glu Thr Leu Leu Lys Tyr Phe Pro His Glu Lys Ser Asn
225                 230                 235                 240

Gly Tyr Leu Ser Gln Phe Ile Lys Leu Met Val Gly Asn Gln Gly Asn
                245                 250                 255

Phe Lys Asn Val Phe Gly Leu Glu Glu Glu Ala Lys Leu Gln Phe Ser
            260                 265                 270

Lys Glu Thr Tyr Glu Glu Asp Leu Glu Glu Leu Leu Glu Lys Ile Gly
        275                 280                 285

Asp Asp Tyr Ile Asp Leu Phe Val Gln Ala Lys Asn Val Tyr Asp Ala
    290                 295                 300

Val Leu Leu Ser Glu Ile Leu Ser Asp Ser Thr Lys Asn Thr Arg Ala
305                 310                 315                 320
```

```
Lys Leu Ser Ala Gly Met Ile Arg Arg Tyr Asp Ala His Lys Glu Asp
                325                 330                 335

Leu Val Leu Leu Lys Arg Phe Val Lys Glu Asn Leu Pro Lys Lys Tyr
            340                 345                 350

Arg Ala Phe Phe Gly Asp Asn Ser Val Asn Gly Tyr Ala Gly Tyr Ile
        355                 360                 365

Glu Gly His Ala Thr Gln Glu Asp Phe Tyr Lys Phe Val Lys Lys Glu
    370                 375                 380

Leu Thr Gly Ile Arg Gly Ser Glu Val Phe Leu Thr Lys Ile Glu Gln
385                 390                 395                 400

Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro
                405                 410                 415

His Gln Ile His Leu Thr Glu Leu Arg Ala Ile Ile Ala Asn Gln Lys
            420                 425                 430

Lys His Tyr Pro Phe Leu Lys Glu Glu Gln Glu Lys Leu Glu Ser Leu
        435                 440                 445

Leu Thr Phe Lys Ile Pro Tyr Tyr Val Gly Pro Leu Ala Lys Lys Gln
    450                 455                 460

Glu Asn Ser Pro Phe Ala Trp Leu Ile Arg Lys Ser Glu Glu Lys Ile
465                 470                 475                 480

Lys Pro Trp Asn Leu Pro Glu Ile Val Asp Met Glu Gly Ser Ala Val
                485                 490                 495

Arg Phe Ile Glu Arg Met Ile Asn Thr Asp Met Tyr Ile Pro His Asn
            500                 505                 510

Lys Val Leu Pro Lys Asn Ser Leu Leu Tyr Gln Lys Phe Ser Ile Tyr
        515                 520                 525
```

```
Asn Glu Leu Thr Lys Val Arg Tyr Gln Asp Glu Arg Gly Gln Met Asn
    530                 535                 540

Tyr Phe Ser Ser Ile Glu Lys Lys Glu Ile Phe His Glu Leu Phe Glu
545                 550                 555                 560

Lys Asn Arg Lys Val Thr Lys Lys Asp Leu Gln Glu Phe Leu Tyr Leu
                565                 570                 575

Lys Tyr Asp Ile Lys His Ala Glu Leu Ser Gly Ile Glu Lys Ala Phe
            580                 585                 590

Asn Ala Ser Tyr Thr Thr Tyr His Asp Phe Leu Thr Met Ser Glu Asn
        595                 600                 605

Lys Arg Glu Met Lys Gln Trp Leu Glu Asp Pro Glu Leu Ala Ser Met
    610                 615                 620

Phe Glu Glu Ile Ile Lys Thr Leu Thr Val Phe Glu Asp Arg Glu Met
625                 630                 635                 640

Ile Lys Thr Arg Leu Ser His His Glu Ala Thr Leu Gly Lys His Ile
                645                 650                 655

Ile Lys Lys Leu Thr Lys Lys His Tyr Thr Gly Trp Gly Arg Leu Ser
            660                 665                 670

Lys Glu Leu Ile Gln Gly Ile Arg Asp Lys Gln Ser Asn Lys Thr Ile
        675                 680                 685

Leu Asp Tyr Leu Ile Asn Asp Asp Asp Phe Pro His His Arg Asn Arg
    690                 695                 700

Asn Cys Met Gln Leu Ile Asn Asp Asp Ser Leu Ser Phe Lys Lys Glu
705                 710                 715                 720
```

```
Ile Lys Lys Ala Gln Met Ile Thr Asp Thr Glu Asn Leu Glu Glu Ile
                725                 730                 735

Val Lys Glu Leu Thr Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
            740                 745                 750

Ser Leu Lys Ile Val Asp Glu Ile Val Gly Ile Met Gly Tyr Glu Pro
        755                 760                 765

Ala Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Arg
    770                 775                 780

Gly Leu Lys Ser Ser Arg Pro Arg Leu Lys Ala Leu Glu Glu Ser Leu
785                 790                 795                 800

Lys Asp Phe Gly Ser Gln Leu Leu Lys Glu Tyr Pro Thr Asp Asn Ser
                805                 810                 815

Ser Leu Gln Lys Asp Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Arg
            820                 825                 830

Asp Met Tyr Thr Gly Ala Pro Leu Asp Ile His Arg Leu Ser Asp Tyr
        835                 840                 845

Asp Ile Asp His Ile Ile Pro Arg Ser Phe Thr Thr Asp Asn Ser Ile
    850                 855                 860

Asp Asn Lys Val Leu Val Ser Ser Lys Glu Asn Arg Leu Lys Lys Asp
865                 870                 875                 880

Asp Val Pro Ser Glu Lys Val Val Lys Lys Met Arg Ser Phe Trp Tyr
                885                 890                 895

Asp Leu Tyr Ser Ser Lys Leu Ile Ser Lys Arg Lys Leu Asp Asn Leu
            900                 905                 910

Thr Lys Ile Lys Leu Thr Glu Glu Asp Lys Ala Gly Phe Ile Lys Arg
        915                 920                 925
```

```
Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gly Ile Leu
    930                 935                 940

His His Arg Phe Asn Lys Ala Glu Asp Thr Asn Glu Pro Ile Arg Lys
945                 950                 955                 960

Val Arg Ile Ile Thr Leu Lys Ser Ala Leu Val Ser Gln Phe Arg Asn
                965                 970                 975

Arg Phe Gly Ile Tyr Lys Val Arg Glu Ile Asn Glu Tyr His His Ala
            980                 985                 990

His Asp Ala Tyr Leu Asn Gly Val  Val Ala Leu Ala Leu  Leu Lys Lys
        995                 1000                1005

Tyr Pro  Gln Leu Ala Pro Glu  Phe Val Tyr Gly Glu  Tyr Leu Lys
    1010                1015                1020

Phe Asn  Ala His Lys Ala Asn  Lys Ala Thr Val Lys  Lys Glu Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Lys Phe  Phe Glu Ser Asp Thr  Pro Val Cys
    1040                1045                1050

Asp Glu  Asn Gly Glu Ile Phe  Trp Asp Lys Ser Lys  Ser Ile Ala
    1055                1060                1065

Gln Val  Lys Lys Val Ile Asn  His His His Met Asn  Ile Val Lys
    1070                1075                1080

Lys Thr  Glu Ile Gln Lys Gly  Gly Phe Ser Lys Glu  Thr Val Glu
    1085                1090                1095

Pro Lys  Lys Asp Ser Ser Lys  Leu Leu Pro Arg Lys  Asn Asn Trp
    1100                1105                1110
```

```
Asp Pro  Thr Lys Tyr Gly Gly  Leu Gly Ser Pro Asn  Val Ala Tyr
    1115                1120                1125

Thr Val  Ala Phe Thr Tyr Glu  Lys Gly Lys Ala Arg  Lys Arg Thr
    1130                1135                1140

Asn Ala  Leu Glu Gly Ile Thr  Ile Met Glu Arg Glu  Ala Phe Glu
    1145                1150                1155

Gln Ser  Pro Val Leu Phe Leu  Lys Asn Lys Gly Tyr  Glu Gln Ala
    1160                1165                1170

Glu Ile  Glu Met Lys Leu Pro  Lys Tyr Ala Leu Phe  Glu Leu Glu
    1175                1180                1185

Asn Gly  Arg Lys Arg Met Val  Ala Ser Asn Lys Glu  Ala Gln Lys
    1190                1195                1200

Ala Asn  Ser Phe Leu Leu Pro  Glu His Leu Val Thr  Leu Leu Tyr
    1205                1210                1215

His Ala  Lys Gln Tyr Asp Glu  Ile Ser His Lys Glu  Ser Phe Asp
    1220                1225                1230

Tyr Val  Asn Glu His His Lys  Glu Phe Ser Glu Val  Phe Ala Arg
    1235                1240                1245

Val Leu  Glu Phe Ala Gly Lys  Tyr Thr Leu Ala Glu  Lys Asn Ile
    1250                1255                1260

Glu Lys  Leu Glu Lys Ile Tyr  Lys Glu Asn Gln Thr  Asp Asp Leu
    1265                1270                1275

Ala Lys  Leu Ala Ser Ser Phe  Val Asn Leu Met Gln  Phe Asn Ala
    1280                1285                1290

Met Gly  Ala Pro Ala Asp Phe  Lys Phe Phe Asp Val  Thr Ile Pro
    1295                1300                1305
```

```
Arg Lys  Arg Tyr Thr Ser Leu  Thr Glu Ile Trp Gln  Ser Thr Ile
    1310                1315                1320


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Arg Met
    1325                1330                1335


Gly Lys
    1340
```

<210> 422
<211> 892
<212> PRT
<213> Enterococcus faecium

<400> 422

```
Met Thr Phe Lys Ile Pro Tyr Tyr Val Gly Pro Leu Ala Lys Lys Gln
1               5                   10                  15


Glu Asn Ser Pro Phe Ala Trp Leu Ile Arg Lys Ser Glu Glu Lys Ile
            20                  25                  30


Lys Pro Trp Asn Leu Pro Glu Ile Val Asp Met Glu Gly Ser Ala Val
        35                  40                  45


Arg Phe Ile Glu Arg Met Ile Asn Thr Asp Met Tyr Met Pro His Asn
    50                  55                  60


Lys Val Leu Pro Lys Asn Ser Leu Leu Tyr Gln Lys Phe Ser Ile Tyr
65                  70                  75                  80


Asn Glu Leu Thr Lys Val Arg Tyr Gln Asp Glu Arg Gly Gln Met Asn
                85                  90                  95


Tyr Phe Ser Ser Ile Glu Lys Lys Glu Ile Phe His Glu Leu Phe Glu
            100                 105                 110


Lys Asn Arg Lys Val Thr Lys Lys Asp Leu Gln Glu Phe Leu Tyr Leu
```

```
        115                 120                 125

Lys Tyr Asp Ile Lys His Ala Glu Leu Ser Gly Ile Glu Lys Ala Phe
    130                 135                 140

Asn Ala Ser Tyr Thr Thr Tyr His Asp Phe Leu Thr Met Ser Glu Asn
145                 150                 155                 160

Lys Arg Glu Met Glu Gln Trp Leu Glu Asp Pro Glu Leu Ala Ser Met
                165                 170                 175

Phe Glu Glu Ile Ile Lys Thr Leu Thr Val Phe Glu Asp Arg Glu Met
            180                 185                 190

Ile Lys Thr Arg Leu Ser His His Lys Ala Thr Leu Gly Lys His Ile
        195                 200                 205

Ile Lys Lys Leu Thr Lys Lys His Tyr Thr Gly Trp Gly Arg Leu Ser
    210                 215                 220

Lys Glu Leu Ile Gln Gly Ile Arg Asp Lys Gln Ser Asn Lys Thr Ile
225                 230                 235                 240

Leu Asp Tyr Leu Ile Asn Asp Asp Asp Phe Pro His His Arg Asn Arg
                245                 250                 255

Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu Ser Phe Lys Lys Glu
            260                 265                 270

Ile Lys Lys Ala Gln Met Ile Thr Asp Thr Glu Asn Leu Glu Glu Ile
        275                 280                 285

Val Lys Glu Leu Thr Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
    290                 295                 300

Ser Leu Lys Ile Val Asp Glu Ile Val Gly Ile Met Gly Tyr Glu Pro
305                 310                 315                 320
```

```
Ala Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Arg
                325                 330                 335

Gly Leu Lys Ser Ser Arg Pro Arg Leu Lys Ala Leu Glu Glu Ser Leu
            340                 345                 350

Lys Asp Phe Gly Ser Gln Leu Leu Lys Glu Tyr Pro Thr Asp Asn Ser
        355                 360                 365

Ser Leu Gln Lys Asp Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Arg
    370                 375                 380

Asp Met Tyr Thr Gly Ala Pro Leu Asp Ile His Arg Leu Ser Asp Tyr
385                 390                 395                 400

Asp Ile Asp His Ile Ile Pro Arg Ser Phe Thr Thr Asp Asn Ser Ile
                405                 410                 415

Asp Asn Lys Val Leu Val Ser Ser Lys Glu Asn Arg Leu Lys Lys Asp
            420                 425                 430

Asp Val Pro Ser Glu Lys Val Val Lys Lys Met Arg Ser Phe Trp Tyr
        435                 440                 445

Asp Leu Tyr Ser Ser Lys Leu Ile Ser Lys Arg Lys Leu Asp Asn Leu
    450                 455                 460

Thr Lys Ile Lys Leu Thr Glu Glu Asp Lys Ala Gly Phe Ile Lys Arg
465                 470                 475                 480

Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gly Ile Leu
                485                 490                 495

His His Arg Phe Asn Lys Ala Glu Asp Thr Asn Glu Pro Ile Arg Lys
            500                 505                 510

Val Arg Ile Ile Thr Leu Lys Ser Ala Leu Val Ser Gln Phe Arg Asn
```

```
        515                 520                 525

Arg Phe Gly Ile Tyr Lys Val Arg Glu Ile Asn Glu Tyr His His Ala
    530                 535                 540

His Asp Ala Tyr Leu Asn Gly Val Ile Ala Leu Ala Leu Leu Lys Lys
545                 550                 555                 560

Tyr Pro Gln Leu Ala Pro Glu Phe Val Tyr Gly Glu Tyr Leu Lys Phe
                565                 570                 575

Asn Ala His Lys Ala Asn Lys Ala Thr Val Lys Lys Glu Phe Tyr Ser
            580                 585                 590

Asn Ile Met Lys Phe Phe Glu Ser Asp Thr Pro Val Cys Asp Glu Asn
        595                 600                 605

Gly Glu Ile Phe Trp Asp Lys Ser Lys Ser Ile Ala Gln Val Lys Lys
    610                 615                 620

Val Ile Asn His His His Met Asn Ile Val Lys Lys Thr Glu Ile Gln
625                 630                 635                 640

Lys Gly Gly Phe Ser Lys Glu Thr Val Glu Pro Lys Lys Asp Ser Ser
                645                 650                 655

Lys Leu Leu Pro Arg Lys Asn Asn Trp Asp Pro Ala Lys Tyr Gly Gly
            660                 665                 670

Leu Gly Ser Pro Asn Val Ala Tyr Thr Val Ala Phe Thr Tyr Glu Lys
        675                 680                 685

Gly Lys Ala Arg Lys Arg Thr Asn Ala Leu Glu Gly Ile Thr Ile Met
    690                 695                 700

Glu Arg Glu Ala Phe Glu Gln Ser Pro Val Leu Phe Leu Lys Asn Lys
705                 710                 715                 720
```

```
Gly Tyr Glu Gln Ala Glu Ile Glu Met Lys Leu Pro Lys Tyr Ala Leu
                725                 730                 735

Phe Glu Leu Glu Asn Gly Arg Lys Arg Met Val Ala Ser Asn Lys Glu
            740                 745                 750

Ala Gln Lys Ala Asn Ser Phe Leu Leu Pro Glu His Leu Val Thr Leu
        755                 760                 765

Leu Tyr His Ala Lys Gln Tyr Asp Glu Ile Ser His Lys Glu Ser Phe
    770                 775                 780

Asp Tyr Val Asn Glu His His Lys Glu Phe Ser Glu Val Phe Ala Arg
785                 790                 795                 800

Val Leu Glu Phe Ala Gly Lys Tyr Thr Leu Ala Glu Lys Asn Ile Glu
                805                 810                 815

Lys Leu Glu Lys Ile Tyr Lys Glu Asn Gln Thr Asp Asp Leu Ala Lys
            820                 825                 830

Leu Ala Ser Ser Phe Val Asn Leu Met Gln Phe Asn Ala Met Gly Ala
        835                 840                 845

Pro Ala Asp Phe Lys Phe Phe Asp Val Thr Ile Pro Arg Lys Arg Tyr
    850                 855                 860

Thr Ser Leu Thr Glu Ile Trp Gln Ser Thr Ile Ile His Gln Ser Ile
865                 870                 875                 880

Thr Gly Leu Tyr Glu Thr Arg Ile Arg Met Gly Lys
                885                 890
```

<210> 423
<211> 1336
<212> PRT
<213> Enterococcus hirae

<400> 423

```
Met Thr Lys Asp Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Leu Thr Asp Asp Tyr Gln Leu Met Lys Arg Lys Met
            20                  25                  30


Ser Val His Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Ala Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Phe Arg Arg Thr
    50                  55                  60


Lys Arg Thr Asn Arg Arg Arg Leu Ala Arg Arg Lys Tyr Arg Leu Ser
65                  70                  75                  80


Lys Leu Gln Asp Leu Phe Ala Glu Glu Leu Cys Lys Gln Asp Asp Cys
                85                  90                  95


Phe Phe Val Arg Leu Glu Glu Ser Phe Leu Val Pro Glu Glu Lys Gln
            100                 105                 110


Tyr Lys Pro Ala Ser Ile Phe Pro Thr Leu Glu Glu Glu Lys Glu Tyr
        115                 120                 125


Tyr Gln Lys Tyr Pro Thr Ile Tyr His Leu Arg Gln Lys Leu Val Asp
    130                 135                 140


Ser Thr Glu Lys Glu Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Leu Leu Lys Tyr Arg Gly His Phe Leu Phe Glu Gly Asp Leu Asp Thr
                165                 170                 175


Glu Asn Thr Ser Ile Glu Glu Ser Phe Arg Val Phe Leu Glu Gln Tyr
            180                 185                 190
```

```
Ser Lys Gln Ser Asp Gln Pro Leu Ile Val His Gln Pro Val Leu Thr
        195                 200                 205

Ile Leu Thr Asp Lys Leu Ser Lys Thr Lys Lys Val Glu Glu Ile Leu
    210                 215                 220

Lys Tyr Tyr Pro Thr Glu Lys Ile Asn Ser Phe Phe Ala Gln Cys Leu
225                 230                 235                 240

Lys Leu Ile Val Gly Asn Gln Ala Asn Phe Lys Arg Ile Phe Asp Leu
                245                 250                 255

Glu Ala Glu Val Lys Leu Gln Phe Ser Lys Glu Thr Tyr Glu Glu Asp
            260                 265                 270

Leu Glu Ser Leu Leu Glu Lys Ile Gly Asp Glu Tyr Leu Asp Ile Phe
        275                 280                 285

Leu Gln Ala Lys Lys Val His Asp Ala Ile Leu Leu Ser Glu Ile Ile
    290                 295                 300

Ser Ser Thr Val Lys His Thr Lys Ala Lys Leu Ser Ser Gly Met Val
305                 310                 315                 320

Glu Arg Tyr Glu Arg His Lys Ala Asp Leu Ala Lys Phe Lys Gln Phe
                325                 330                 335

Val Lys Glu Asn Val Pro Gln Lys Ala Thr Val Phe Phe Lys Asp Thr
            340                 345                 350

Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Lys Gly Lys Thr Thr Gln Glu
        355                 360                 365

Glu Phe Tyr Lys Phe Val Lys Lys Glu Leu Ser Gly Val Val Gly Ser
    370                 375                 380

Glu Pro Phe Leu Glu Lys Ile Asp Gln Glu Thr Phe Leu Leu Lys Gln
385                 390                 395                 400
```

```
Arg Thr Tyr Thr Asn Gly Val Ile Pro His Gln Val His Leu Ile Glu
                405                 410                 415

Leu Lys Ala Ile Ile Asp Gln Gln Lys Gln His Tyr Pro Phe Leu Glu
            420                 425                 430

Glu Ala Gly Pro Lys Ile Ile Ala Leu Phe Lys Phe Arg Ile Pro Tyr
        435                 440                 445

Tyr Val Gly Pro Leu Ala Lys Glu Gln Glu Ala Ser Ser Phe Ala Trp
    450                 455                 460

Ile Glu Arg Lys Thr Ala Glu Lys Ile Asn Pro Trp Asn Phe Ser Glu
465                 470                 475                 480

Val Val Asp Ile Glu Lys Ser Ala Met Arg Phe Ile Gln Arg Met Thr
                485                 490                 495

Lys Gln Asp Thr Tyr Leu Pro Thr Glu Lys Val Leu Pro Lys Asn Ser
            500                 505                 510

Leu Leu Tyr Gln Lys Tyr Met Ile Phe Asn Glu Leu Thr Lys Val Ser
        515                 520                 525

Tyr Lys Asp Glu Arg Gly Val Lys Gln Tyr Phe Ser Gly Asp Glu Lys
    530                 535                 540

Gln Gln Ile Phe Lys Gln Leu Phe Gln Lys Glu Arg Gly Lys Ile Thr
545                 550                 555                 560

Val Lys Lys Leu Gln Asn Phe Leu Tyr Thr His Tyr His Ile Glu Asn
                565                 570                 575

Ala Gln Ile Phe Gly Ile Glu Lys Ala Phe Asn Ala Ser Tyr Ser Thr
            580                 585                 590
```

```
Tyr His Asp Phe Met Lys Leu Ala Lys Thr Asn Gln Lys Ala Met Gln
        595                 600                 605

Glu Trp Leu Glu Gln Pro Glu Met Glu Pro Ile Phe Glu Asp Ile Val
    610                 615                 620

Lys Ile Leu Thr Ile Phe Glu Asp Arg Gln Met Ile Lys His Gln Leu
625                 630                 635                 640

Ser Lys Tyr Gln Glu Val Phe Gly Glu Lys Leu Leu Lys Glu Phe Ala
                645                 650                 655

Arg Lys His Tyr Thr Gly Trp Gly Arg Phe Ser Ala Lys Leu Ile His
            660                 665                 670

Gly Ile Arg Asp Arg Lys Thr Asn Lys Thr Ile Leu Asp Tyr Leu Ile
        675                 680                 685

Asn Asp Asp Asp Val Pro Ala Asn Arg Asn Arg Asn Leu Met Gln Leu
    690                 695                 700

Ile Asn Asp Glu His Leu Ser Phe Lys Glu Glu Ile Ala Lys Ala Thr
705                 710                 715                 720

Val Phe Ser Lys His Lys Ser Leu Val Asp Val Ile Gln Asp Leu Pro
                725                 730                 735

Gly Ser Pro Ala Ile Lys Lys Gly Ile Trp Gln Ser Leu Lys Ile Val
            740                 745                 750

Glu Glu Leu Ile Ala Ile Ile Gly Tyr Lys Pro Lys Asn Ile Val Ile
        755                 760                 765

Glu Met Ala Arg Glu Asn Gln Lys Thr His Arg Thr Ser Pro Arg Leu
    770                 775                 780

Lys Ala Leu Glu Asn Gly Leu Lys Gln Ile Gly Ser Thr Leu Leu Lys
785                 790                 795                 800
```

```
Glu Gln Pro Thr Asp Asn Lys Ala Leu Gln Lys Glu Arg Leu Tyr Leu
                805                 810                 815

Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Pro Leu Glu
            820                 825                 830

Ile Glu Asn Leu His Gln Tyr Glu Val Asp His Ile Ile Pro Arg Ser
        835                 840                 845

Phe Ile Val Asp Asn Ser Ile Asp Asn Lys Val Leu Val Ala Ser Lys
    850                 855                 860

Gln Asn Gln Lys Lys Arg Asp Asp Val Pro Lys Lys Gln Ile Val Asn
865                 870                 875                 880

Glu Gln Arg Ile Phe Trp Asn Gln Leu Lys Glu Ala Lys Leu Ile Ser
                885                 890                 895

Pro Lys Lys Tyr Ala Tyr Leu Thr Lys Ile Glu Leu Thr Pro Glu Asp
            900                 905                 910

Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Asn Ile Leu His Gln Ser Phe Asn Gln Glu Glu Glu
    930                 935                 940

Gly Thr Asp Cys Asp Gly Val Gln Ile Ile Thr Leu Lys Ala Thr Leu
945                 950                 955                 960

Thr Ser Gln Phe Arg Gln Thr Phe Gly Leu Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Pro His His His Ala His Asp Ala Tyr Leu Asn Gly Phe Ile Ala
            980                 985                 990
```

```
Asn Val Leu Leu Lys Arg Tyr Pro  Lys Leu Ala Pro Glu  Phe Val Tyr
        995                 1000                1005


Gly Lys  Tyr Val Lys Tyr Ser  Leu Ala Arg Glu Asn  Lys Ala Thr
    1010                1015                1020


Ala Lys  Lys Glu Phe Tyr Ser  Asn Ile Leu Lys Phe  Leu Glu Ser
    1025                1030                1035


Asp Glu  Pro Phe Cys Asp Glu  Asn Gly Glu Ile Tyr  Trp Glu Lys
    1040                1045                1050


Ser His  His Leu Pro Arg Ile  Lys Lys Val Leu Ser  Ser His Gln
    1055                1060                1065


Val Asn  Val Val Lys Lys Val  Glu Gln Gln Lys Gly  Gly Phe Tyr
    1070                1075                1080


Lys Glu  Thr Val Asn Ser Lys  Glu Lys Pro Asp Lys  Leu Ile Glu
    1085                1090                1095


Arg Lys  Asn Asn Trp Asp Val  Thr Lys Tyr Gly Gly  Phe Gly Ser
    1100                1105                1110


Pro Val  Ile Ala Tyr Ala Ile  Ala Phe Val Tyr Ala  Lys Gly Lys
    1115                1120                1125


Thr Gln  Lys Lys Thr Arg Ala  Ile Glu Gly Ile Thr  Ile Met Glu
    1130                1135                1140


Gln Ala  Ala Phe Glu Lys Asp  Pro Thr Thr Phe Leu  Lys Glu Lys
    1145                1150                1155


Gly Phe  Pro Gln Val Thr Glu  Phe Ile Lys Leu Pro  Lys Tyr Thr
    1160                1165                1170


Leu Phe  Glu Phe Asp Asn Gly  Arg Arg Arg Phe Leu  Ala Ser His
    1175                1180                1185
```

```
Lys Glu  Ser Gln Lys Gly Asn  Pro Phe Ile Leu Ser  Asp Gln Leu
    1190                1195                1200


Val Thr  Leu Leu Tyr His Ala  Gln His Tyr Asp Lys  Ile Thr Tyr
    1205                1210                1215


Gln Glu  Ser Phe Asp Tyr Val  Asn Thr His Leu Ser  Asp Phe Ser
    1220                1225                1230


Ala Ile  Leu Thr Glu Val Leu  Ala Phe Ala Glu Lys  Tyr Thr Leu
    1235                1240                1245


Ala Asp  Lys Asn Ile Glu Arg  Ile Gln Glu Leu Tyr  Glu Glu Asn
    1250                1255                1260


Lys Tyr  Gly Glu Thr Ser Met  Ile Ala Gln Ser Phe  Leu Gln Leu
    1265                1270                1275


Leu Gln  Phe Asn Ala Ile Gly  Ala Pro Ala Asp Phe  Lys Phe Phe
    1280                1285                1290


Gly Val  Thr Ile Pro Arg Lys  Arg Tyr Thr Ser Leu  Thr Glu Ile
    1295                1300                1305


Trp Asp  Ala Thr Ile Ile Tyr  Gln Ser Val Thr Gly  Leu Tyr Glu
    1310                1315                1320


Thr Arg  Ile Arg Met Gly Asp  Leu Trp Ala Gly Glu  Gln
    1325                1330                1335


<210>  424
<211>  116
<212>  PRT
<213>  Enterococcus sp.

<400>  424

Met Tyr Ser Ile Gly Leu Asp Leu Gly Ile Ser Ser Val Gly Trp Ser
```

```
1               5                   10                  15

Val Ile Asp Glu Arg Thr Gly Asn Val Ile Asp Leu Gly Val Arg Leu
            20                  25                  30

Phe Ser Ala Lys Asn Ser Glu Lys Asn Leu Glu Arg Arg Thr Asn Arg
        35                  40                  45

Gly Gly Arg Arg Leu Ile Arg Arg Lys Thr Asn Arg Leu Lys Asp Ala
    50                  55                  60

Lys Lys Ile Leu Ala Ala Val Gly Phe Tyr Glu Asp Lys Ser Leu Lys
65                  70                  75                  80

Asn Ser Cys Pro Tyr Gln Leu Arg Val Lys Gly Leu Thr Glu Leu Leu
                85                  90                  95

Ser Lys Gly Glu Ile Tyr Lys Val Thr Leu His Ile Leu Lys Asn Val
            100                 105                 110

Glu Leu Val Thr
        115
```

<210> 425
<211> 1391
<212> PRT
<213> Eubacterium sp.

<400> 425

```
Met Glu Asn Lys Gln Tyr Tyr Ile Gly Leu Asp Val Gly Thr Asn Ser
1               5                   10                  15

Val Gly Trp Ala Val Thr Asp Thr Ser Tyr Asn Leu Leu Arg Ala Lys
            20                  25                  30

Gly Lys Asp Met Trp Gly Ala Arg Leu Phe Asp Glu Ala Lys Thr Ala
        35                  40                  45
```

```
Val Glu Arg Arg Thr Lys Arg Thr Ser Arg Arg Arg Ser Glu Arg Glu
    50                  55                  60

Lys Ala Arg Lys Ala Met Leu Lys Glu Leu Phe Ala Asp Glu Ile Asn
65                  70                  75                  80

Lys Val Asp Pro Asn Phe Phe Ile Arg Leu Glu Glu Ser Lys Phe Phe
                85                  90                  95

Leu Asp Asp Arg Ser Glu Asn Asn Arg Gln Arg Tyr Thr Leu Phe Asn
            100                 105                 110

Asp Ala Lys Phe Thr Asp Lys Asp Tyr Tyr Glu Lys Tyr Lys Thr Ile
        115                 120                 125

Phe His Leu Arg Ser Ala Leu Ile Asn Ser Asp Glu Lys Phe Asp Val
    130                 135                 140

Arg Leu Val Phe Leu Ala Ile Leu Asn Leu Phe Ser His Arg Gly His
145                 150                 155                 160

Phe Leu Asn Ala Ser Leu Lys Gly Asp Gly Glu Ile Gln Gly Val Asp
                165                 170                 175

Ile Phe Tyr Asn Asp Leu Tyr Glu Val Cys Glu Glu Phe Glu Ile Asp
            180                 185                 190

Leu Pro Gln Ile Ser Asn Ile Asp Asn Phe Glu Lys Ile Leu Ser Gln
        195                 200                 205

Lys Gly Lys Ser Arg Thr Lys Ile Leu Glu Glu Leu Ser Glu Glu Leu
    210                 215                 220

Ser Ile Ser Lys Lys Glu Lys Ile Lys Tyr Ser Leu Leu Lys Leu Ile
225                 230                 235                 240

Cys Gly Met Lys Ile Lys Val Val Asp Ile Tyr Ala Asp Glu Asp Ile
                245                 250                 255
```

```
Gln Glu Asp Asp Lys Lys Lys Asp Leu Gly Phe Arg Glu Ser Asp Tyr
            260                 265                 270

Glu Lys Ser Ser Leu Glu Val Lys Glu Ile Ile Gly Asp Asp His Phe
        275                 280                 285

Glu Leu Ile Glu Arg Ala Lys Ala Val His Asp Ile Gly Leu Leu Ala
    290                 295                 300

Asn Ile Ile Gly Asn Ser Lys Tyr Leu Cys Glu Ala Arg Val Glu Ala
305                 310                 315                 320

Tyr Asp Asn His His Lys Asp Leu Gln Lys Ile Lys Glu Leu Leu Lys
                325                 330                 335

Lys Tyr Asp Ile Lys Ala Tyr Thr Asp Met Phe Arg Lys Met Thr Asp
            340                 345                 350

Lys Asn Tyr Ser Ala Tyr Val Gly Ser Val Asn Ser Asn Ile Ala Lys
        355                 360                 365

Glu Arg Arg Ser Val Asp Asn Arg Lys Ile Glu Asp Leu Tyr Glu Tyr
    370                 375                 380

Ile Lys Lys Ile Ala Leu Lys Asn Ile Ser Asp Asp Asn Glu Asp Lys
385                 390                 395                 400

Ile Glu Ile Leu Lys Lys Ile Glu Thr Gly Glu Phe Leu Lys Lys Gln
                405                 410                 415

Leu Thr Ala Ser Asn Gly Val Ile Pro Asn Gln Leu Gln Ser Arg Glu
            420                 425                 430

Leu Arg Ala Ile Leu Lys Lys Ala Glu Asn Tyr Leu Pro Phe Leu Lys
        435                 440                 445
```

```
Glu Lys Gly Glu Lys Asn Leu Thr Val Ser Glu Met Ile Ile Gln Leu
    450                 455                 460

Phe Glu Phe Gln Ile Pro Tyr Tyr Val Gly Pro Leu Asp Lys Asn Pro
465                 470                 475                 480

Lys Lys Asp Lys Asn Ala Asn Ser Trp Ala Val Ile Pro Ser Gly Gly
                485                 490                 495

Arg Ile Leu Pro Trp Asn Phe Glu Asp Lys Val Asp Val Lys Gly Ser
            500                 505                 510

Arg Lys Glu Phe Ile Glu Lys Met Val Arg Lys Cys Thr Tyr Leu Ser
        515                 520                 525

Glu Glu His Thr Leu Pro Lys Gln Ser Leu Leu Tyr Glu Lys Phe Met
    530                 535                 540

Val Leu Asn Glu Ile Asn Asn Ile Lys Ile Asp Gly Glu Lys Ile Ser
545                 550                 555                 560

Val Glu Ala Lys Gln Lys Ile Tyr Asn Asp Leu Phe Met Lys Gly Lys
                565                 570                 575

Lys Val Ser Gln Lys Ala Ile Lys Gln Glu Leu Ile Ser Leu Asn Ile
            580                 585                 590

Met Ser Lys Asp Ser Val Leu Ser Gly Ile Asp Thr Val Cys Asn Ala
        595                 600                 605

Tyr Leu Ser Ser Ile Ala Lys Phe Arg Gly Val Phe Asp Glu Asn Val
    610                 615                 620

Asn Asn Gln Ser Thr Ile Asp Met Ile Glu Asp Ile Ile Phe Leu Lys
625                 630                 635                 640

Thr Val Tyr Ser Asp Glu Lys Arg Phe Val Lys Glu Glu Ile Val Glu
                645                 650                 655
```

```
Lys Tyr Gly Asp Glu Ile Asp Lys Asp Lys Ile Lys Arg Ile Leu Gly
            660                 665                 670

Phe Lys Phe Ser Asn Trp Gly Asn Ile Ser Lys Ser Phe Leu Glu Leu
        675                 680                 685

Glu Gly Ala Asp Val Gly Thr Gly Glu Ile Arg Ser Ile Ile Gln Ser
    690                 695                 700

Leu Trp Glu Thr Asn Phe Asn Leu Met Glu Leu Leu Ser Ser Arg Phe
705                 710                 715                 720

Thr Tyr Met Asp Glu Leu Glu Lys Arg Val Lys Lys Leu Glu Lys Pro
                725                 730                 735

Leu Ser Glu Trp Thr Ile Glu Asp Leu Asp Asp Met Tyr Leu Ser Ser
            740                 745                 750

Pro Val Lys Arg Met Ile Trp Gln Ser Met Lys Ile Val Asp Glu Ile
        755                 760                 765

Gln Thr Val Ile Gly Tyr Ala Pro Lys Arg Ile Phe Val Glu Met Thr
    770                 775                 780

Arg Ser Glu Gly Glu Lys Val Arg Thr Lys Ser Arg Lys Asp Arg Leu
785                 790                 795                 800

Lys Glu Leu Tyr Ser Ala Ile Lys Glu Asp Ser Lys Gln Trp Val Lys
                805                 810                 815

Glu Leu Asp Ala Lys Asp Glu Ser Tyr Phe Arg Ser Lys Lys Met Tyr
            820                 825                 830

Leu Tyr Tyr Leu Gln Lys Gly Arg Cys Met Tyr Ser Gly Glu Val Ile
        835                 840                 845
```

```
Glu Leu Asp Lys Leu Met Asp Asp Asn Leu Tyr Asp Ile Asp His Ile
    850                 855                 860

Tyr Pro Arg Ser Phe Val Lys Asp Asp Ser Leu Asp Asn Leu Val Leu
865                 870                 875                 880

Val Lys Lys Glu Ile Asn Asn Arg Lys Gln Asn Asp Pro Ile Thr Pro
                885                 890                 895

Gln Ile Gln Ala Ser Cys Gln Gly Phe Trp Lys Val Leu His Glu Gln
            900                 905                 910

Gly Phe Ile Ser Asn Glu Lys Tyr Ser Arg Leu Thr Arg Lys Thr Gln
        915                 920                 925

Glu Phe Ser Asp Glu Glu Lys Leu Ser Phe Ile Asn Arg Gln Ile Val
    930                 935                 940

Glu Thr Gly Gln Ala Thr Lys Cys Met Ala Gln Ile Leu Gln Lys Ser
945                 950                 955                 960

Met Gly Glu Asp Val Asp Val Val Phe Ser Lys Ala Arg Leu Val Ser
                965                 970                 975

Glu Phe Arg His Lys Phe Glu Leu Phe Lys Ser Arg Leu Ile Asn Asp
            980                 985                 990

Phe His His Ala Asn Asp Ala Tyr  Leu Asn Ile Val Val  Gly Asn Ser
        995                 1000                1005

Tyr Phe  Val Lys Phe Thr Arg  Asn Pro Ala Asn Phe  Ile Lys Asp
    1010                1015                1020

Ala Arg  Lys Asn Pro Asp Asn  Pro Ala Tyr Lys Tyr  His Met Asp
    1025                1030                1035

Arg Phe  Phe Glu Arg Asp Val  Lys Ser Lys Ser Glu  Val Ala Trp
    1040                1045                1050
```

```
Ile Gly  Gln Ser Glu Gly Asn  Ala Gly Thr Ile Ala  Ile Val Lys
    1055                1060                1065

Lys Thr  Met Ser Lys Asn Ser  Pro Leu Ile Thr Lys  Lys Val Glu
    1070                1075                1080

Glu Gly  His Gly Ser Ile Thr  Lys Glu Thr Ile Val  Gly Val Lys
    1085                1090                1095

Glu Ile  Lys Phe Gly Arg Asn  Lys Val Glu Lys Ala  Asp Lys Thr
    1100                1105                1110

Pro Lys  Lys Ala Asn Leu Gln  Ala Tyr Arg Pro Ile  Lys Thr Ser
    1115                1120                1125

Asp Glu  Arg Leu Cys Asn Ile  Leu Arg Tyr Gly Gly  Arg Thr Ser
    1130                1135                1140

Ile Ser  Ile Ser Gly Tyr Cys  Leu Val Glu Tyr Val  Lys Lys Arg
    1145                1150                1155

Lys Thr  Ile Arg Ser Leu Glu  Ala Ile Pro Val Tyr  Leu Gly Arg
    1160                1165                1170

Lys Asp  Ser Leu Ser Glu Glu  Lys Leu Leu Asn Tyr  Phe Arg Tyr
    1175                1180                1185

Asn Leu  Asn Asp Gly Gly Lys  Asp Ser Val Ser Asp  Ile Arg Leu
    1190                1195                1200

Cys Leu  Pro Phe Ile Ser Thr  Asn Ser Leu Val Lys  Ile Asp Gly
    1205                1210                1215

Tyr Leu  Tyr Tyr Leu Gly Gly  Lys Asn Asp Asp Arg  Ile Gln Leu
    1220                1225                1230
```

```
Tyr Asn  Ala Tyr Gln Leu Lys  Met Lys Lys Glu Glu  Val Glu Tyr
    1235                1240                1245

Ile Arg  Lys Ile Glu Lys Ala  Val Ser Met Ser Lys  Phe Asp Glu
    1250                1255                1260

Ile Asp  Arg Glu Lys Asn Pro  Val Leu Thr Glu Glu  Lys Asn Ile
    1265                1270                1275

Glu Leu  Tyr Asn Lys Ile Gln  Asp Lys Phe Glu Asn  Thr Val Phe
    1280                1285                1290

Ser Lys  Arg Met Ser Leu Val  Lys Tyr Asn Lys Lys  Asp Leu Ser
    1295                1300                1305

Phe Gly  Asp Phe Leu Lys Asn  Lys Lys Ser Lys Phe  Glu Glu Ile
    1310                1315                1320

Asp Leu  Glu Lys Gln Cys Lys  Val Leu Tyr Asn Ile  Ile Phe Asn
    1325                1330                1335

Leu Ser  Asn Leu Lys Glu Val  Asp Leu Ser Asp Ile  Gly Gly Ser
    1340                1345                1350

Lys Ser  Thr Gly Lys Cys Arg  Cys Lys Lys Asn Ile  Thr Asn Tyr
    1355                1360                1365

Lys Glu  Phe Lys Leu Ile Gln  Gln Ser Ile Thr Gly  Leu Tyr Ser
    1370                1375                1380

Cys Glu  Lys Asp Leu Met Thr  Ile
    1385                1390
```

<210> 426
<211> 1391
<212> PRT
<213> Eubacterium yurii

<400> 426

```
Met Glu Asn Lys Gln Tyr Tyr Ile Gly Leu Asp Val Gly Thr Asn Ser
1               5                  10                  15

Val Gly Trp Ala Val Thr Asp Thr Ser Tyr Asn Leu Leu Arg Ala Lys
            20                  25                  30

Gly Lys Asp Met Trp Gly Ala Arg Leu Phe Glu Lys Ala Asn Thr Ala
        35                  40                  45

Ala Glu Arg Arg Thr Lys Arg Thr Ser Arg Arg Arg Ser Glu Arg Glu
    50                  55                  60

Lys Ala Arg Lys Ala Met Leu Lys Glu Leu Phe Ala Asp Glu Ile Asn
65                  70                  75                  80

Arg Val Asp Pro Ser Phe Phe Ile Arg Leu Glu Glu Ser Lys Phe Phe
                85                  90                  95

Leu Asp Asp Arg Ser Glu Asn Asn Arg Gln Arg Tyr Thr Leu Phe Asn
            100                 105                 110

Asp Ala Thr Phe Thr Asp Lys Asp Tyr Tyr Glu Lys Tyr Lys Thr Ile
        115                 120                 125

Phe His Leu Arg Ser Ala Leu Ile Asn Ser Asp Glu Lys Phe Asp Val
    130                 135                 140

Arg Leu Val Phe Leu Ala Ile Leu Asn Leu Phe Ser His Arg Gly His
145                 150                 155                 160

Phe Leu Asn Ala Ser Leu Lys Gly Asp Gly Asp Ile Gln Gly Met Asp
                165                 170                 175

Val Phe Tyr Asn Asp Leu Val Glu Ser Cys Glu Tyr Phe Glu Ile Glu
            180                 185                 190

Leu Pro Arg Ile Thr Asn Ile Asp Asn Phe Glu Lys Ile Leu Ser Gln
```

```
        195                 200                 205

Lys Gly Lys Ser Arg Thr Lys Ile Leu Glu Glu Leu Ser Glu Glu Leu
    210                 215                 220

Ser Ile Ser Lys Lys Asp Lys Ser Lys Tyr Asn Leu Ile Lys Leu Ile
225                 230                 235                 240

Ser Gly Leu Glu Ala Ser Val Val Glu Leu Tyr Asn Ile Glu Asp Ile
                245                 250                 255

Gln Asp Glu Asn Lys Lys Ile Lys Ile Gly Phe Arg Glu Ser Asp Tyr
            260                 265                 270

Glu Glu Ser Ser Leu Lys Val Lys Glu Ile Ile Gly Asp Glu Tyr Phe
        275                 280                 285

Asp Leu Val Glu Arg Ala Lys Ser Val His Asp Met Gly Leu Leu Ser
    290                 295                 300

Asn Ile Ile Gly Asn Ser Lys Tyr Leu Cys Glu Ala Arg Val Glu Ala
305                 310                 315                 320

Tyr Glu Asn His His Lys Asp Leu Leu Lys Ile Lys Glu Leu Leu Lys
                325                 330                 335

Lys Tyr Asp Lys Lys Ala Tyr Asn Asp Met Phe Arg Lys Met Thr Asp
            340                 345                 350

Lys Asn Tyr Ser Ala Tyr Val Gly Ser Val Asn Ser Asn Ile Ala Lys
        355                 360                 365

Glu Arg Arg Ser Val Asp Lys Arg Lys Ile Glu Asp Leu Tyr Lys Tyr
    370                 375                 380

Ile Glu Asp Thr Ala Leu Lys Asn Ile Pro Asp Asp Asn Lys Asp Lys
385                 390                 395                 400
```

```
Ile Glu Ile Leu Glu Lys Ile Lys Leu Gly Glu Phe Leu Lys Lys Gln
                405                 410                 415

Leu Thr Ala Ser Asn Gly Val Ile Pro Asn Gln Leu Gln Ser Arg Glu
            420                 425                 430

Leu Arg Ala Ile Leu Lys Lys Ala Glu Asn Tyr Leu Pro Phe Leu Lys
        435                 440                 445

Glu Lys Gly Glu Lys Asn Leu Thr Val Ser Glu Met Ile Ile Gln Leu
    450                 455                 460

Phe Glu Phe Gln Ile Pro Tyr Tyr Val Gly Pro Leu Asp Lys Asn Pro
465                 470                 475                 480

Lys Lys Asp Asn Lys Ala Asn Ser Trp Ala Lys Ile Lys Gln Gly Gly
                485                 490                 495

Arg Ile Leu Pro Trp Asn Phe Glu Asp Lys Val Asp Val Lys Gly Ser
            500                 505                 510

Arg Lys Glu Phe Ile Glu Lys Met Val Arg Lys Cys Thr Tyr Ile Ser
        515                 520                 525

Asp Glu His Thr Leu Pro Lys Gln Ser Leu Leu Tyr Glu Lys Phe Met
    530                 535                 540

Val Leu Asn Glu Ile Asn Asn Ile Lys Ile Asp Gly Glu Lys Ile Ser
545                 550                 555                 560

Val Glu Ala Lys Gln Lys Ile Tyr Asn Asp Leu Phe Val Lys Gly Lys
                565                 570                 575

Lys Val Ser Gln Lys Asp Ile Lys Lys Glu Leu Ile Ser Leu Asn Ile
            580                 585                 590

Met Asp Lys Asp Ser Val Leu Ser Gly Thr Asp Thr Val Cys Asn Ala
```

```
        595                 600                 605

Tyr Leu Ser Ser Ile Gly Lys Phe Thr Gly Val Phe Lys Glu Glu Ile
    610                 615                 620

Asn Lys Gln Ser Ile Val Asp Met Ile Glu Asp Ile Ile Phe Leu Lys
625                 630                 635                 640

Thr Val Tyr Gly Asp Glu Lys Arg Phe Val Lys Glu Glu Ile Val Glu
                645                 650                 655

Lys Tyr Gly Asp Glu Ile Asp Lys Asp Lys Ile Lys Arg Ile Leu Gly
            660                 665                 670

Phe Lys Phe Ser Asn Trp Gly Asn Leu Ser Lys Ser Phe Leu Glu Leu
        675                 680                 685

Glu Gly Ala Asp Val Gly Thr Gly Glu Val Arg Ser Ile Ile Gln Ser
    690                 695                 700

Leu Trp Glu Thr Asn Phe Asn Leu Met Glu Leu Leu Ser Ser Arg Phe
705                 710                 715                 720

Thr Tyr Met Asp Glu Leu Glu Lys Arg Val Lys Lys Leu Glu Lys Pro
                725                 730                 735

Leu Ser Glu Trp Thr Ile Glu Asp Leu Asp Asp Met Tyr Leu Ser Ser
            740                 745                 750

Pro Val Lys Arg Met Ile Trp Gln Ser Met Lys Ile Val Asp Glu Ile
        755                 760                 765

Gln Thr Val Ile Gly Tyr Ala Pro Lys Arg Ile Phe Val Glu Met Thr
    770                 775                 780

Arg Ser Glu Gly Glu Lys Val Arg Thr Lys Ser Arg Lys Asp Arg Leu
785                 790                 795                 800
```

```
Lys Glu Leu Tyr Asn Gly Ile Lys Glu Asp Ser Lys Gln Trp Val Lys
                805                 810                 815

Glu Leu Asp Ser Lys Asp Glu Ser Tyr Phe Arg Ser Lys Lys Met Tyr
            820                 825                 830

Leu Tyr Tyr Leu Gln Lys Gly Arg Cys Met Tyr Ser Gly Glu Val Ile
        835                 840                 845

Glu Leu Asp Lys Leu Met Asp Asp Asn Leu Tyr Asp Ile Asp His Ile
    850                 855                 860

Tyr Pro Arg Ser Phe Val Lys Asp Asp Ser Leu Asp Asn Leu Val Leu
865                 870                 875                 880

Val Lys Lys Glu Ile Asn Asn Arg Lys Gln Asn Asp Pro Ile Thr Pro
                885                 890                 895

Gln Ile Gln Ala Ser Cys Gln Gly Phe Trp Lys Ile Leu His Asp Gln
            900                 905                 910

Gly Phe Met Ser Asn Glu Lys Tyr Ser Arg Leu Thr Arg Lys Thr Gln
        915                 920                 925

Glu Phe Ser Asp Glu Glu Lys Leu Ser Phe Ile Asn Arg Gln Ile Val
    930                 935                 940

Glu Thr Gly Gln Ala Thr Lys Cys Met Ala Gln Ile Leu Gln Lys Ser
945                 950                 955                 960

Met Gly Glu Asp Val Asp Val Val Phe Ser Lys Ala Arg Leu Val Ser
                965                 970                 975

Glu Phe Arg His Lys Phe Glu Leu Phe Lys Ser Arg Leu Ile Asn Asp
            980                 985                 990

Phe His His Ala Asn Asp Ala Tyr  Leu Asn Ile Val Val  Gly Asn Ser
```

995 1000 1005

Tyr Phe Val Lys Phe Thr Arg Asn Pro Ala Asn Phe Ile Lys Asp
1010 1015 1020

Ala Arg Lys Asn Pro Asp Asn Pro Val Tyr Lys Tyr His Met Asp
1025 1030 1035

Arg Phe Phe Glu Arg Asp Val Lys Ser Lys Ser Glu Val Ala Trp
1040 1045 1050

Ile Gly Gln Ser Glu Gly Asn Ser Gly Thr Ile Val Ile Val Lys
1055 1060 1065

Lys Thr Met Ala Lys Asn Ser Pro Leu Ile Thr Lys Lys Val Glu
1070 1075 1080

Glu Gly His Gly Ser Ile Thr Lys Glu Thr Ile Val Gly Val Lys
1085 1090 1095

Glu Ile Lys Phe Gly Arg Asn Lys Val Glu Lys Ala Asp Lys Thr
1100 1105 1110

Pro Lys Lys Pro Asn Leu Gln Ala Tyr Arg Pro Ile Lys Thr Ser
1115 1120 1125

Asp Glu Arg Leu Cys Asn Ile Leu Arg Tyr Gly Gly Arg Thr Ser
1130 1135 1140

Ile Ser Ile Ser Gly Tyr Cys Leu Val Glu Tyr Val Lys Lys Arg
1145 1150 1155

Lys Thr Ile Arg Ser Leu Glu Ala Ile Pro Val Tyr Leu Gly Arg
1160 1165 1170

Lys Asp Ser Leu Ser Glu Glu Lys Leu Leu Asn Tyr Phe Arg Tyr
1175 1180 1185

```
Asn Leu  Asn Asp Gly Gly Lys  Asp Ser Val Ser Asp  Ile Arg Leu
    1190                1195                1200

Cys Leu  Pro Phe Ile Ser Thr  Asn Ser Leu Val Lys  Ile Asp Gly
    1205                1210                1215

Tyr Leu  Tyr Tyr Leu Gly Gly  Lys Asn Asp Asp Arg  Ile Gln Leu
    1220                1225                1230

Tyr Asn  Ala Tyr Gln Leu Lys  Met Lys Lys Glu Glu  Val Glu Tyr
    1235                1240                1245

Ile Arg  Lys Ile Glu Lys Ala  Val Ser Met Ser Lys  Phe Asp Glu
    1250                1255                1260

Ile Asp  Arg Glu Lys Asn Pro  Val Leu Thr Glu Glu  Lys Asn Ile
    1265                1270                1275

Glu Leu  Tyr Asn Lys Ile Gln  Asp Lys Phe Glu Asn  Thr Val Phe
    1280                1285                1290

Ser Lys  Arg Met Ser Leu Val  Lys Tyr Asn Lys Lys  Asp Leu Ser
    1295                1300                1305

Phe Gly  Asp Phe Leu Lys Asn  Lys Lys Ser Lys Phe  Glu Glu Ile
    1310                1315                1320

Asp Leu  Glu Lys Gln Cys Lys  Val Leu Tyr Asn Ile  Ile Phe Asn
    1325                1330                1335

Leu Ser  Asn Leu Lys Glu Val  Asp Leu Ser Asp Ile  Gly Gly Ser
    1340                1345                1350

Lys Ser  Thr Gly Lys Cys Arg  Cys Lys Lys Asn Ile  Thr Asn Tyr
    1355                1360                1365

Lys Glu  Phe Lys Leu Ile Gln  Gln Ser Ile Thr Gly  Leu Tyr Ser
```

```
    1370                1375                1380


Cys Glu  Lys Asp Leu Met Thr  Ile
    1385                1390
```

<210> 427
<211> 1142
<212> PRT
<213> Facklamia hominis

<400> 427

```
Met Tyr Ser Val Gly Leu Asp Ile Gly Ile Ala Ser Cys Gly Tyr Ser
1               5                   10                  15


Ile Ile Asn Asp Val Asn Gly Asn Ile Val Glu Leu Gly Thr Leu Leu
            20                  25                  30


Phe Lys Ser Arg Asn Ser Asp Asn Asn Glu Glu Arg Arg Thr Asn Arg
        35                  40                  45


Gly Ser Arg Arg Leu Ile Asn Arg Arg Arg Thr Arg Leu Asp Asp Gly
    50                  55                  60


Lys Lys Leu Leu Ala Glu Lys Gly Phe Lys Gln Asp Ser Lys Leu Lys
65                  70                  75                  80


His Val Cys Pro Tyr Glu Leu Arg Val Lys Gly Leu His Glu Lys Leu
                85                  90                  95


Thr Gln Gly Glu Ile Tyr Lys Val Val Leu His Ile Leu Lys Lys Arg
            100                 105                 110


Gly Ile Ser Tyr Leu Asp Glu Ser Asp Glu Asn Ser Ser Gly Ile Asp
        115                 120                 125


Gly Ala Ser Tyr Lys Asp Gln Val Asn Leu Asn Leu Asn Leu Gln Lys
    130                 135                 140
```

```
Glu Leu Thr Pro Gly Gln Ile Gln Leu Lys Arg Leu Lys Glu Asn Gly
145                 150                 155                 160

Arg Ile Lys Ser Gly Val Thr Phe Glu Asn Gly Tyr Gln Leu Asn Val
                165                 170                 175

Phe Ser Val Ser Ala Tyr Ala Asn Glu Leu Asn Lys Ile Leu Thr Lys
            180                 185                 190

Gln Ser Glu Tyr Tyr Ser Glu Ile Asp Gln Ile Trp Ile Asp Arg Phe
        195                 200                 205

Thr Lys Asn Gly Tyr Arg Lys Glu Ala Gly Leu Val Tyr Arg Lys Arg
    210                 215                 220

Pro Tyr Tyr Asp Gly Pro Gly Asn Glu Lys Asn Asn Ser Ile Tyr Gly
225                 230                 235                 240

Arg Trp Ala Asn Phe Lys Glu Asp Gly His Pro Lys Glu Asn Ile Phe
                245                 250                 255

Asp Gln Leu Ile Gly Leu Asp Ser Val Asp Ser Thr Gln Val Arg Ala
            260                 265                 270

Ser Ala Ser Thr Leu Thr Ala Gln Lys Tyr Asn Leu Leu Asn Asp Leu
        275                 280                 285

Asn Asn Leu Thr Ile Ile Glu Asp Asp Arg Lys Phe Thr Thr Asp Glu
    290                 295                 300

Lys Val Ser Ile Ile Asn Tyr Leu Met Thr Gln Asp Ile Thr Arg Phe
305                 310                 315                 320

Gly Pro Lys Glu Leu Ala Lys Phe Tyr Gln Leu Glu Val Asp Gln Ile
                325                 330                 335

Arg Gly Trp Arg Ile Asp Asn Lys Gly Asn Pro Glu Ile His Ser Leu
            340                 345                 350
```

```
Lys Val Tyr Arg Asp Trp Lys Lys Ile Phe Asn Thr Ser Ser Ile Asp
        355                 360                 365

Leu Thr Ser Ile Gln Thr Trp Val Val Asp Glu Leu Ala Asn Val Ile
    370                 375                 380

Thr Leu Asn Thr Glu Ile Pro Ser Thr Leu Ala Thr Leu Lys Ile Lys
385                 390                 395                 400

Ile Pro Asp Ile Asp Gln Gln Ile Leu Asn Phe Val Glu Asn Asn Phe
                405                 410                 415

Tyr Glu Leu Lys Lys Lys Thr Ser Lys Asn Ser Trp His Ser Phe Ser
            420                 425                 430

Leu Lys Thr Leu Asn Ile Leu Ile Pro Glu Leu Leu Asn Thr Ser Glu
        435                 440                 445

Glu Gln Asn Thr Ile Leu Glu Arg Leu Asn Leu Lys Phe Asp Leu Lys
    450                 455                 460

Asn Lys Tyr Ala Glu Lys Asn Gln Ile Pro Val Lys Glu Leu Leu Glu
465                 470                 475                 480

Gln Ile Tyr Asn Pro Thr Val Thr Lys Ser Val His Gln Ser Ile Lys
                485                 490                 495

Leu Phe Asn Glu Ile Ile Glu Lys Tyr Gly Lys Asn Asn Ile Ser Tyr
            500                 505                 510

Val Thr Ile Glu Met Pro Arg Asp Lys Asn Asp Gln Asp Gln Lys Asp
        515                 520                 525

Thr Ile Lys Arg Ile Asn Lys Leu Asn Ser Glu Arg Lys Asn Asp Ser
    530                 535                 540
```

```
Glu Lys Tyr Phe Leu Glu Arg Ser Gly Trp Asp Thr Ile Arg Phe Glu
545                 550                 555                 560

Ser Ala Leu Lys Lys Pro Arg Phe Ala Glu Lys Leu Leu Phe Tyr Tyr
                565                 570                 575

Glu Gln Lys Gly Lys Cys Ala Tyr Ser Gly Gln Asp Ile Leu Ala Glu
            580                 585                 590

Ser Leu Leu Asn Glu Ser Cys Glu Val Asp His Ile Ile Pro Leu Ser
        595                 600                 605

Ile Ser Phe Asp Asp Ser Ile His Asn Lys Val Leu Val Thr Ala Ser
    610                 615                 620

Ser Asn Gln Glu Lys Gly Gln Arg Thr Pro Tyr Met Ala Phe Ile Asp
625                 630                 635                 640

Gly Ala Lys Leu Gly Gln Ser Trp Asp Asp Phe Val Ala Trp Val Asn
                645                 650                 655

Ser Cys Gly Phe His Arg Lys Lys Val Gln Asn Leu Leu Tyr Glu Glu
            660                 665                 670

Asn Ile Phe Asn Pro Asp Val Gln Arg Gly Phe Val Ser Arg Asn Leu
        675                 680                 685

Asn Asp Thr Arg Tyr Ala Ser Arg Ile Val Leu Asn Ala Ile Gln Ser
    690                 695                 700

Phe Phe Tyr Lys Gln Lys Asp Leu Thr Lys Val Lys Val Val Asn Gly
705                 710                 715                 720

Ser Phe Thr His Thr Leu Arg Lys Lys Trp Gly Ser Ser Leu Asp Lys
                725                 730                 735

Asn Arg Asp Thr Tyr His His His Ala Val Asp Ala Thr Leu Cys Ala
            740                 745                 750
```

```
Val Thr Pro Phe Ile Asn Ile Val Lys Tyr Glu Phe Phe Glu Glu Asp
        755                 760                 765

Gly Ile Lys Tyr Met Val Asp Leu Thr Thr Gly Glu Lys Val Ala Tyr
    770                 775                 780

Ser Asp Tyr Lys Lys Met Lys Phe Tyr Asp Lys Arg Ala Tyr Val Pro
785                 790                 795                 800

Ile Trp Asp Gly Phe Ile Lys Gln Leu Thr Pro Ala Asn Leu Tyr Pro
                805                 810                 815

Lys Ile Lys Phe Ser His Gln Val Asp Ser Lys Trp Asn Arg Lys Ile
            820                 825                 830

Ser Asp Ala Thr Ile Tyr Ser Thr Arg Lys Ile Val Glu Thr Lys Ile
        835                 840                 845

Asn Lys Lys Gly Val Ala Lys Glu Thr Val Lys Asp Ile Val Ile Asp
    850                 855                 860

Lys Ile Lys Asp Ile Tyr Thr Pro Glu Gly Trp Arg Lys Phe Lys Glu
865                 870                 875                 880

Lys Gln Asp Lys Leu Leu Met Lys Asn Phe Asp Glu Lys Thr Tyr Asn
                885                 890                 895

Lys Leu Ile Lys Ile Ala Lys Glu Tyr Pro Glu Lys Lys Glu Val Gln
            900                 905                 910

Thr Ser Asn Gly Lys Val Ser Leu Val Glu Val Ser Pro Phe Lys Met
        915                 920                 925

Tyr Cys Glu Glu Gln Asn Val Pro Ala Ile Arg Lys Tyr Ser Lys Lys
    930                 935                 940
```

```
Gly Asn Gly Pro Tyr Ile Arg Ser Leu Lys Phe Tyr Asp Lys Glu Leu
945                 950                 955                 960


Gly Lys His Ile Asn Ile Thr Lys Asp Ser Tyr Gly Asn Asp Ile Glu
                965                 970                 975


Arg Thr Ile Arg Asn Lys Lys Ile Ile Leu Lys Asn Gln Asn Ser Trp
            980                 985                 990


Arg Thr Asp Val Tyr Tyr Asn Ser  Val Asn Asn Cys Tyr  Glu Leu Leu
        995                 1000                1005


Gly Ile  Lys Tyr Cys His Leu  Lys Phe Tyr Arg Gly  Lys Tyr Gly
    1010                1015                1020


Ile Pro  Lys Ser Ile Tyr Asp  Glu Leu Lys Lys Glu  Asp Glu Ile
    1025                1030                1035


Ser Ser  Glu Ser Val Phe Lys  Phe Ser Leu Tyr Arg  His Asp Arg
    1040                1045                1050


Val Arg  Phe Glu Lys Asp Gly  Glu Tyr Ile Glu Ala  Leu Phe Gly
    1055                1060                1065


Ser Lys  Asn Glu Ser Asn Lys  Asn Tyr Leu Glu Leu  Ser Pro Ile
    1070                1075                1080


Asp Lys  Asn Lys Trp Leu Ser  Lys Glu Asn Val Lys  Phe Phe Gly
    1085                1090                1095


Glu Val  Ala Ala Ser Gly Arg  Phe Ile Lys Gly Leu  Lys Pro Gly
    1100                1105                1110


Ile Lys  Val Ile Lys Gln Ser  Thr Asp Tyr Met Gly  His Val Tyr
    1115                1120                1125


Ala Ile  His Gln Glu Lys Leu  Lys Phe Val Leu Ser  Asp Ala
    1130                1135                1140
```

<210> 428
<211> 1347
<212> PRT
<213> Finegoldia magna

<400> 428

```
Met Lys Ser Glu Lys Lys Tyr Tyr Ile Gly Leu Asp Val Gly Thr Asn
1               5                   10                  15


Ser Val Gly Trp Ala Val Thr Asp Glu Phe Tyr Asn Ile Leu Arg Ala
            20                  25                  30


Lys Gly Lys Asp Leu Trp Gly Val Arg Leu Phe Glu Lys Ala Lys Thr
        35                  40                  45


Ala Ala Asp Thr Arg Thr Phe Arg Ser Gly Arg Arg Arg Asn Asp Arg
    50                  55                  60


Lys Gly Met Arg Leu Gln Ile Leu Arg Glu Ile Phe Glu Asp Glu Ile
65                  70                  75                  80


Lys Lys Val Asp Lys Asp Phe Tyr Asp Arg Leu Asp Glu Ser Lys Phe
                85                  90                  95


Trp Ala Glu Asp Lys Lys Val Ser Gly Lys Tyr Ser Leu Phe Asn Asp
            100                 105                 110


Lys Asn Phe Ser Asp Lys Gln Tyr Phe Glu Lys Phe Pro Thr Ile Phe
        115                 120                 125


His Leu Arg Lys Tyr Leu Met Glu Glu His Gly Lys Val Asp Ile Arg
    130                 135                 140


Tyr Tyr Phe Leu Ala Ile Asn Gln Met Met Lys Arg Arg Gly His Phe
145                 150                 155                 160


Leu Ile Asp Gly Gln Ile Ser His Val Thr Asp Asp Lys Pro Leu Lys
```

```
                165                 170                 175

Glu Gln Leu Ile Leu Leu Ile Asn Asp Leu Leu Lys Ile Glu Leu Glu
            180                 185                 190

Glu Glu Leu Met Asp Ser Ile Phe Glu Ile Leu Ala Asp Val Asn Glu
        195                 200                 205

Lys Arg Thr Asp Lys Lys Asn Asn Leu Lys Glu Leu Ile Lys Gly Gln
    210                 215                 220

Asp Phe Asn Lys Gln Glu Gly Asn Ile Leu Asn Ser Ile Phe Glu Ser
225                 230                 235                 240

Ile Val Thr Gly Lys Ala Lys Ile Lys Asn Ile Ile Ser Asp Glu Asp
                245                 250                 255

Ile Leu Glu Lys Ile Lys Glu Asp Asn Lys Glu Asp Phe Val Leu Thr
            260                 265                 270

Gly Asp Ser Tyr Glu Glu Asn Leu Gln Tyr Phe Glu Glu Val Leu Gln
        275                 280                 285

Glu Asn Ile Thr Leu Phe Asn Thr Leu Lys Ser Thr Tyr Asp Phe Val
    290                 295                 300

Ile Leu Gln Ser Ile Leu Lys Gly Lys Ser Thr Leu Ser Asp Ala Gln
305                 310                 315                 320

Val Glu Arg Tyr Asp Glu His Lys Lys Asp Leu Glu Ile Leu Lys Lys
                325                 330                 335

Val Ile Lys Lys Tyr Asp Glu Asp Gly Lys Leu Phe Lys Gln Val Phe
            340                 345                 350

Lys Glu Asp Asn Gly Asn Gly Tyr Val Ser Tyr Ile Gly Tyr Tyr Leu
        355                 360                 365
```

```
Asn Lys Asn Lys Lys Ile Thr Ala Lys Lys Lys Ile Ser Asn Ile Glu
    370                 375                 380

Phe Thr Lys Tyr Val Lys Gly Ile Leu Glu Lys Gln Cys Asp Cys Glu
385                 390                 395                 400

Asp Glu Ala Val Lys Tyr Leu Leu Gly Lys Ile Glu Gln Glu Asn Phe
                405                 410                 415

Leu Leu Lys Gln Ile Ser Ser Ile Asn Ser Val Ile Pro His Gln Ile
            420                 425                 430

His Leu Phe Glu Leu Asp Lys Ile Leu Glu Asn Leu Ala Lys Asn Tyr
        435                 440                 445

Pro Ser Phe Asn Asn Lys Lys Glu Glu Phe Thr Lys Ile Glu Lys Ile
    450                 455                 460

Arg Lys Thr Phe Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Asn
465                 470                 475                 480

Asp Tyr His Lys Asn Asn Gly Gly Asn Ala Trp Ile Phe Arg Asn Lys
                485                 490                 495

Gly Glu Lys Ile Arg Pro Trp Asn Phe Glu Lys Ile Val Asp Leu His
            500                 505                 510

Lys Ser Glu Glu Glu Phe Ile Lys Arg Met Leu Asn Gln Cys Thr Tyr
        515                 520                 525

Leu Pro Glu Glu Thr Val Leu Pro Lys Ser Ser Ile Leu Tyr Ser Glu
    530                 535                 540

Tyr Met Val Leu Asn Glu Leu Asn Asn Leu Arg Ile Lys Gly Lys Pro
545                 550                 555                 560

Leu Asp Thr Asp Val Lys Leu Lys Leu Ile Glu Glu Leu Phe Lys Lys
```

```
                565                 570                 575

Lys Thr Lys Val Thr Leu Lys Ser Ile Arg Asp Tyr Met Ile Arg Asn
            580                 585                 590

Asn Phe Ala Asp Lys Glu Asp Phe Asp Asn Ser Glu Lys Asn Leu Glu
        595                 600                 605

Ile Val Ser Asn Met Lys Ser Tyr Ile Asp Phe Asn Asn Ile Leu Gly
    610                 615                 620

Asp Lys Phe Glu Leu Glu Met Val Glu Asp Leu Ile Glu Lys Ile Thr
625                 630                 635                 640

Ile His Thr Gly Asn Lys Thr Leu Leu Lys Lys Tyr Ile Glu Glu Thr
                645                 650                 655

Tyr Pro Asp Leu Ser Ser Ser Gln Ile Gln Lys Ile Ile Asn Leu Lys
            660                 665                 670

Tyr Lys Asp Trp Gly Arg Leu Ser Arg Lys Leu Leu Asp Gly Ile Lys
        675                 680                 685

Gly Arg Asn Lys Thr Asp Asp Val Asn Thr Val Ile Asn Phe Met Arg
    690                 695                 700

Asn Ser Ser Asp Asn Leu Met Gln Ile Ile Glu Gly Lys Asn Tyr Ser
705                 710                 715                 720

Phe Asn Glu Tyr Ile Asp Asn Leu Arg Lys Lys Tyr Ile Pro Gln Glu
                725                 730                 735

Ile Ser Tyr Glu Val Val Glu Asn Leu Tyr Val Ser Pro Ser Val Lys
            740                 745                 750

Lys Met Ile Trp Gln Val Ile Arg Val Thr Glu Glu Ile Thr Lys Val
        755                 760                 765
```

```
Met Gly Tyr Asp Pro Asp Lys Ile Phe Ile Glu Met Ala Lys Ser Glu
    770                 775                 780

Glu Glu Lys Lys Thr Thr Ile Ser Arg Lys Asn Lys Leu Leu Asp Leu
785                 790                 795                 800

Tyr Lys Ala Ile Lys Lys Asp Glu Arg Asp Ser Gln Tyr Glu Lys Leu
                805                 810                 815

Leu Thr Gly Leu Asn Lys Leu Asp Glu Ser Glu Leu Arg Ser Lys Lys
            820                 825                 830

Leu Tyr Leu Tyr Tyr Thr Gln Met Gly Arg Asp Met Tyr Thr Gly Glu
        835                 840                 845

Lys Ile Asp Leu Asp Lys Leu Phe Asp Ser Thr His Tyr Asp Lys Asp
    850                 855                 860

His Ile Ile Pro Gln Ser Met Lys Lys Asp Asp Ser Ile Ile Asn Asn
865                 870                 875                 880

Leu Val Leu Val Asn Lys Asn Ala Asn Gln Thr Thr Lys Gly Asn Ile
                885                 890                 895

Tyr Pro Val Pro Ser Ser Ile Arg Asn Asn Pro Asp Ile Tyr Asn Tyr
            900                 905                 910

Trp Lys Tyr Leu Met Glu Lys Glu Phe Ile Ser Lys Glu Lys Tyr Asn
        915                 920                 925

Arg Leu Ile Arg Asn Thr Pro Leu Thr Asn Glu Glu Leu Gly Val Phe
    930                 935                 940

Ile Asn Arg Gln Leu Val Glu Thr Arg Gln Ser Thr Lys Ala Ile Lys
945                 950                 955                 960

Glu Leu Phe Glu Lys Phe Tyr Gln Lys Ser Lys Ile Ile Pro Val Lys
```

```
               965                 970                 975

Ala Ser Leu Ala Ser Asp Leu Arg Lys Asp Met Asn Thr Leu Lys Ser
            980                 985                 990

Arg Glu Val Asn Asp Leu His His  Ala His Asp Ala Phe  Leu Asn Ile
        995                 1000                1005

Val Ala  Gly Asp Val Trp Asn  Arg Glu Phe Thr Ser  Asn Pro Ile
    1010                1015                1020

Asn Tyr  Val Asn Glu Asn Arg  Glu Gly Asp Lys Val  Lys Tyr Ser
    1025                1030                1035

Leu Ser  Lys Tyr Phe Thr Arg  Pro Arg Lys Ser Lys  Gly Lys Val
    1040                1045                1050

Ile Trp  Thr Pro Glu Lys Gly  Arg Lys Leu Ile Val  Asp Thr Leu
    1055                1060                1065

Asn Lys  Pro Ser Val Leu Ile  Ser Asn Glu Ser His  Val Lys Lys
    1070                1075                1080

Gly Glu  Leu Phe Asn Ala Thr  Ile Ser Gly Lys Lys  Asp Tyr Lys
    1085                1090                1095

Lys Gly  Lys Ile Tyr Leu Pro  Leu Lys Lys Asp Asp  Arg Leu Lys
    1100                1105                1110

Asp Val  Ser Lys Tyr Gly Gly  Tyr Lys Ala Ile Asn  Gly Ala Phe
    1115                1120                1125

Phe Phe  Leu Val Glu His Thr  Lys Ser Lys Lys Arg  Ile Arg Ser
    1130                1135                1140

Ile Glu  Leu Phe Pro Leu His  Leu Leu Ser Lys Phe  Tyr Glu Asp
    1145                1150                1155
```

```
Lys Asn  Thr Val Leu Asp Tyr  Ala Ile Asn Val Leu  Gln Leu Gln
    1160                1165                1170

Asp Pro  Lys Ile Ile Ile Asp  Lys Ile Asn Tyr Arg  Thr Glu Ile
    1175                1180                1185

Ile Ile  Asp Asn Phe Ser Tyr  Leu Ile Ser Thr Lys  Ser Asn Asp
    1190                1195                1200

Gly Ser  Ile Thr Val Lys Pro  Asn Glu Gln Met Tyr  Trp Arg Val
    1205                1210                1215

Asp Glu  Ile Ser Asn Leu Lys  Lys Ile Glu Asn Lys  Tyr Lys Lys
    1220                1225                1230

Asp Ala  Ile Leu Thr Glu Glu  Asp Arg Lys Ile Met  Glu Ser Tyr
    1235                1240                1245

Ile Asp  Lys Ile Tyr Gln Gln  Phe Lys Ala Gly Lys  Tyr Lys Asn
    1250                1255                1260

Arg Arg  Thr Thr Asp Thr Ile  Ile Glu Lys Tyr Glu  Ile Ile Asp
    1265                1270                1275

Leu Asp  Thr Leu Asp Asn Lys  Gln Leu Tyr Gln Leu  Leu Val Ala
    1280                1285                1290

Phe Ile  Ser Leu Ser Tyr Lys  Thr Ser Asn Asn Ala  Val Asp Phe
    1295                1300                1305

Thr Val  Ile Gly Leu Gly Thr  Glu Cys Gly Lys Pro  Arg Ile Thr
    1310                1315                1320

Asn Leu  Pro Asp Asn Thr Tyr  Leu Val Tyr Lys Ser  Ile Thr Gly
    1325                1330                1335

Ile Tyr  Glu Lys Arg Ile Arg  Ile Lys
```

1340 1345

<210> 429
<211> 1348
<212> PRT
<213> Finegoldia magna

<400> 429

Met Lys Ser Glu Lys Lys Tyr Tyr Ile Gly Leu Asp Val Gly Thr Asn
1 5 10 15

Ser Val Gly Trp Ala Val Thr Asp Glu Phe Tyr Asn Ile Leu Arg Ala
20 25 30

Lys Gly Lys Asp Leu Trp Gly Val Arg Leu Phe Glu Lys Ala Lys Thr
35 40 45

Ala Ala Asp Thr Arg Thr Phe Arg Ser Gly Arg Arg Arg Asn Asp Arg
50 55 60

Lys Gly Val Arg Leu Gln Ile Leu Arg Glu Ile Phe Glu Asp Glu Ile
65 70 75 80

Lys Lys Val Asp Lys Asp Phe Tyr Asp Arg Leu Asp Glu Ser Lys Phe
85 90 95

Trp Ala Glu Asp Lys Lys Val Ser Gly Lys Tyr Ser Leu Phe Asn Asp
100 105 110

Lys Asn Phe Ser Asp Lys Gln Tyr Phe Glu Lys Phe Pro Thr Ile Phe
115 120 125

His Leu Arg Lys Tyr Leu Met Glu Glu His Gly Lys Val Asp Ile Arg
130 135 140

Tyr Tyr Phe Leu Ala Ile Asn Gln Met Met Lys Arg Arg Gly His Phe
145 150 155 160

```
Leu Ile Asp Gly Gln Ile Ser His Val Thr Asp Asp Lys Pro Leu Lys
                165                 170                 175

Gln Gln Leu Ile Leu Leu Ile Asn Asp Leu Leu Lys Ile Glu Leu Glu
            180                 185                 190

Glu Glu Phe Met Asp Ser Ile Phe Glu Ile Leu Ala Asp Val Asn Glu
        195                 200                 205

Lys Lys Thr Glu Lys Lys Asn Ile Leu Lys Glu Leu Ile Asn Ala Gln
    210                 215                 220

Asp Phe Asn Lys Gln Glu Gly Lys Ile Leu Tyr Ser Ile Phe Glu Ser
225                 230                 235                 240

Ile Val Thr Gly Lys Ala Lys Ile Lys Asn Ile Ile Ser Asp Glu Asp
                245                 250                 255

Ile Leu Glu Lys Ile Lys Glu Asp Asn Lys Glu Asp Phe Val Leu Thr
            260                 265                 270

Gly Asp Ser Tyr Glu Glu Asn Leu Gln Tyr Phe Glu Glu Val Leu Gln
        275                 280                 285

Glu Asn Ile Thr Leu Phe Asn Thr Leu Lys Ser Ala Tyr Asp Phe Val
    290                 295                 300

Ile Leu Gln Ser Ile Leu Lys Gly Lys Ser Thr Leu Ser Asp Ala Gln
305                 310                 315                 320

Val Glu Arg Tyr Asp Glu His Lys Lys Asp Leu Glu Ile Leu Lys Lys
                325                 330                 335

Val Ile Lys Lys Tyr Asp Glu Asp Gly Lys Leu Phe Lys Gln Val Phe
            340                 345                 350

Lys Glu Asp Asn Gly Asn Gly Tyr Val Ser Tyr Ile Gly Tyr Tyr Leu
        355                 360                 365
```

```
Asn Lys Asn Lys Lys Ile Thr Ala Lys Lys Lys Ile Ser Asn Ile Glu
    370                 375                 380

Phe Thr Lys Tyr Val Lys Gly Ile Leu Glu Lys Gln Cys Asp Cys Glu
385                 390                 395                 400

Asp Glu Asp Val Lys Tyr Leu Leu Gly Lys Ile Glu Gln Glu Asn Phe
                405                 410                 415

Leu Leu Lys Gln Ile Ser Ser Ile Asn Ser Val Ile Pro His Gln Ile
            420                 425                 430

His Leu Phe Glu Leu Asp Lys Ile Leu Glu Asn Leu Ala Lys Tyr Tyr
        435                 440                 445

Pro Ser Phe Asn Asn Lys Lys Glu Glu Phe Thr Lys Ile Glu Lys Ile
    450                 455                 460

Arg Lys Thr Phe Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Asn
465                 470                 475                 480

Asp Tyr His Lys Asn Asn Gly Gly Asn Ala Trp Ile Phe Arg Asn Lys
                485                 490                 495

Gly Glu Lys Ile Arg Pro Trp Asn Phe Glu Lys Ile Val Asp Leu His
            500                 505                 510

Lys Ser Glu Glu Glu Phe Ile Lys Arg Met Leu Asn Gln Cys Thr Tyr
        515                 520                 525

Leu Pro Glu Glu Thr Val Leu Pro Lys Ser Ser Ile Leu Tyr Ser Glu
    530                 535                 540

Tyr Met Val Leu Asn Glu Leu Asn Asn Leu Arg Ile Asn Gly Lys Pro
545                 550                 555                 560
```

```
Ile Asp Thr Asp Val Lys Leu Lys Leu Ile Glu Glu Leu Phe Lys Lys
                565                 570                 575

Lys Thr Lys Val Thr Leu Lys Ser Ile Arg Asp Tyr Met Ile Arg Asn
            580                 585                 590

Asn Phe Ala Asp Lys Glu Asp Phe Asp Asn Ser Glu Lys Asn Leu Glu
        595                 600                 605

Ile Val Ser Asn Met Lys Ser Tyr Ile Asp Phe Asn Asn Ile Leu Gly
    610                 615                 620

Asp Lys Phe Glu Leu Glu Met Val Glu Asp Leu Ile Glu Lys Ile Thr
625                 630                 635                 640

Ile His Thr Gly Asn Lys Lys Leu Leu Lys Lys Tyr Ile Glu Glu Thr
                645                 650                 655

Tyr Pro Asp Leu Ser Ser Ser Gln Ile Gln Lys Ile Ile Asn Leu Lys
            660                 665                 670

Tyr Lys Asp Trp Gly Arg Leu Ser Arg Lys Leu Leu Asp Gly Ile Thr
        675                 680                 685

Gly Thr Asn Ile Glu Thr Gly Glu Ile Asp Thr Val Ile Asn Phe Leu
    690                 695                 700

Arg Asn Ser Ser Asp Asn Leu Met Gln Ile Ile Gly Ser Gln Asn Tyr
705                 710                 715                 720

Ser Phe Asn Asn Asp Ile Asp Lys Leu Arg Lys Lys Tyr Ile Pro Gln
                725                 730                 735

Glu Ile Ser Tyr Glu Val Val Glu Asn Leu Tyr Val Ser Pro Ser Val
            740                 745                 750

Lys Lys Met Ile Trp Gln Val Ile Arg Ile Thr Glu Glu Ile Thr Lys
        755                 760                 765
```

```
Val Met Gly Tyr Asp Pro Asp Lys Ile Phe Ile Glu Met Ala Lys Ser
    770                 775                 780

Glu Glu Gly Lys Lys Thr Thr Ile Ser Arg Lys Asn Lys Leu Leu Ala
785                 790                 795                 800

Leu Tyr Lys Ala Ile Lys Lys Asp Glu Arg Asp Ser Gln Tyr Glu Lys
                805                 810                 815

Leu Leu Thr Gly Leu Asn Lys Leu Asp Asp Ser Asp Leu Arg Ser Arg
            820                 825                 830

Lys Leu Tyr Leu Tyr Tyr Thr Gln Met Gly Arg Asp Met Tyr Thr Gly
        835                 840                 845

Glu Lys Ile Asp Leu Asp Lys Leu Phe Asp Ser Thr His Tyr Asp Lys
    850                 855                 860

Asp His Ile Ile Pro Gln Ser Met Lys Lys Asp Asp Ser Ile Ile Asn
865                 870                 875                 880

Asn Leu Val Leu Val Asn Lys Asn Ala Asn Gln Thr Thr Lys Gly Asn
                885                 890                 895

Ile Tyr Pro Val Pro Ser Ser Ile Arg Asn Asn Pro Lys Ile Tyr Asn
            900                 905                 910

Tyr Trp Lys Tyr Leu Met Glu Lys Glu Phe Ile Ser Lys Glu Lys Tyr
        915                 920                 925

Asn Arg Leu Ile Arg Asn Thr Pro Leu Thr Asn Glu Glu Leu Gly Gly
    930                 935                 940

Phe Ile Asn Arg Gln Leu Val Glu Thr Arg Gln Ser Thr Lys Ala Ile
945                 950                 955                 960
```

```
Lys Glu Leu Phe Glu Lys Phe Tyr Lys Lys Ser Lys Ile Ile Pro Val
               965                 970                 975

Lys Ala Ile Leu Ala Ser Asp Leu Arg Lys Asp Met Asn Thr Leu Lys
           980                 985                 990

Ser Arg Glu Val Asn Asp Leu His  His Ala His Asp Ala  Phe Leu Asn
        995                1000                1005

Ile Val  Ala Gly Asp Val Trp  Asn Arg Glu Phe Thr  Ser Asn Pro
    1010                1015                1020

Ile Asn  Tyr Val Lys Glu Asn  Arg Glu Gly Asp Lys  Val Lys Tyr
    1025                1030                1035

Ser Leu  Ser Lys Tyr Phe Thr  Arg Pro Arg Lys Ser  Lys Gly Lys
    1040                1045                1050

Val Ile  Trp Thr Pro Glu Lys  Gly Arg Lys Leu Ile  Val Asp Thr
    1055                1060                1065

Leu Asn  Lys Pro Ser Val Leu  Ile Ser Asn Glu Ser  His Val Lys
    1070                1075                1080

Lys Gly  Glu Leu Phe Asn Ala  Thr Ile Ala Gly Lys  Lys Asp Tyr
    1085                1090                1095

Lys Lys  Gly Lys Ile Tyr Leu  Pro Leu Lys Lys Asp  Asp Arg Leu
    1100                1105                1110

Gln Asp  Val Ser Lys Tyr Gly  Gly Tyr Lys Ala Ile  Asn Gly Ala
    1115                1120                1125

Phe Phe  Phe Leu Val Glu His  Thr Lys Ser Lys Lys  Arg Ile Arg
    1130                1135                1140

Ser Ile  Glu Leu Phe Pro Leu  His Leu Leu Ser Lys  Phe Tyr Glu
    1145                1150                1155
```

```
Asp Lys  Asn Thr Val Leu Asp  Tyr Ala Ile Asn Val  Leu Gln Leu
    1160                1165                1170

Gln Asp  Pro Lys Ile Ile Ile  Asp Lys Ile Asn Tyr  Arg Thr Glu
    1175                1180                1185

Ile Ile  Ile Asp Asn Phe Ser  Tyr Leu Ile Ser Thr  Lys Ser Asn
    1190                1195                1200

Asp Gly  Ser Ile Thr Val Lys  Pro Asn Glu Gln Met  Tyr Trp Arg
    1205                1210                1215

Val Asp  Glu Ile Ser Asn Leu  Lys Lys Ile Glu Asn  Lys Tyr Lys
    1220                1225                1230

Lys Asp  Ala Ile Leu Thr Glu  Glu Asp Arg Lys Ile  Met Glu Ser
    1235                1240                1245

Tyr Ile  Asp Lys Ile Tyr Gln  Gln Phe Lys Ala Gly  Lys Tyr Lys
    1250                1255                1260

Asn Arg  Arg Thr Thr Asp Thr  Ile Ile Glu Lys Tyr  Glu Ile Ile
    1265                1270                1275

Asp Leu  Asp Thr Leu Asp Asn  Lys Gln Leu Tyr Gln  Leu Leu Val
    1280                1285                1290

Ala Phe  Ile Ser Leu Ser Tyr  Lys Thr Ser Asn Asn  Ala Val Asp
    1295                1300                1305

Phe Thr  Val Ile Gly Leu Gly  Thr Glu Cys Gly Lys  Pro Arg Ile
    1310                1315                1320

Thr Asn  Leu Pro Asp Asn Thr  Tyr Leu Val Tyr Lys  Ser Ile Thr
    1325                1330                1335
```

Gly Ile Tyr Glu Lys Arg Ile Arg Ile Lys
    1340   1345

<210> 430
<211> 1516
<212> PRT
<213> Flavobacteriaceae bacterium

<400> 430

Met Leu Lys Gln Gln Lys Asp Lys Ile Ile Gly Met Asn Lys Lys Ile
1   5   10   15

Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp Ala Leu Val Lys
            20   25   30

Gln Asp Leu Glu Asn Lys Tyr Gly Glu Ile Ile Gly Cys Gly Ser Arg
        35   40   45

Ile Ile Pro Met Ser Gln Asp Val Leu Gly Lys Phe Asp Ala Gly Ile
    50   55   60

Ser Ile Ser Gln Thr Ala Glu Arg Thr Asn Tyr Arg Ser Val Arg Lys
65   70   75   80

Leu Ile Gln Arg Asn Thr Leu Arg Arg Glu Arg Leu His Arg Val Leu
                85   90   95

His Gln Leu Asp Phe Leu Pro Lys His Tyr Asn Asp Ser Ile Asp Phe
            100   105   110

Glu Lys Lys Leu Gly Gln Phe Lys Thr Asp Lys Glu Thr Lys Leu Asn
        115   120   125

Tyr Phe Val Asn Gln His Gly Lys His Glu Phe Leu Phe Lys Asp Ser
    130   135   140

Phe Asn Glu Met Val Lys Glu Phe Lys Glu Glu Gln Pro Glu Leu Phe
145   150   155   160

```
Tyr Ile Lys Asn Asn Gly Lys Glu Thr Lys Ile Pro Tyr Asp Trp Thr
                165                 170                 175

Ile Tyr Tyr Leu Arg Lys Lys Ala Leu Ser Lys Lys Ile Ser Lys Glu
            180                 185                 190

Glu Leu Ser Trp Leu Val Leu Asn Phe Asn Gln Lys Arg Gly Tyr Tyr
        195                 200                 205

Gln Leu Arg Gly Glu Ile Asp Glu Glu Lys Glu Lys Asn Lys Arg Tyr
    210                 215                 220

Glu Lys Leu Tyr Val Ser Glu Val Val Lys Thr Asn Asn Thr Ile Lys
225                 230                 235                 240

Lys Thr Gly Glu Tyr Leu Tyr Asp Ile Tyr Phe Asp Asn Gly Trp Lys
                245                 250                 255

Tyr Glu Lys Gln Thr Thr Lys Pro Gln Asp Trp Leu His Lys His Lys
            260                 265                 270

Glu Phe Ile Ile Thr Thr Thr Thr Leu Lys Asn Gly Glu Thr Lys Arg
        275                 280                 285

Thr Phe Lys Thr Val Asp Ser Glu Lys Asp Trp Ile Ala Ile Lys Ser
    290                 295                 300

Lys Thr Glu Gln Asp Ile Lys Glu Ser Asn Lys Thr Val Gly Ala Phe
305                 310                 315                 320

Ile Tyr Asp Thr Leu Leu Lys Asn Pro Thr Gln Lys Ile Arg Gly Ser
                325                 330                 335

Leu Val Lys Thr Ile Glu Arg Lys Phe Tyr Arg Glu Glu Phe Glu Lys
            340                 345                 350

Ile Leu Lys Glu Gln Ile Lys His Arg Pro Glu Ile Asn Val Asn Thr
```

```
        355                 360                 365

Ala Ile Gly Lys Glu Asn Tyr Thr Lys Cys Val Thr Glu Leu Tyr Pro
    370                 375                 380

Arg Asn Glu Ala His Ala Asn Asn Ile Leu Thr Asn Asp Phe Asn Tyr
385                 390                 395                 400

Leu Phe Thr Lys Asp Ile Leu Phe Tyr Gln Arg Pro Leu Lys Ser Lys
                405                 410                 415

Lys Ser Glu Ile Ala Asn Cys Gln Tyr Glu Tyr Arg Thr Tyr Ile Lys
            420                 425                 430

Lys Lys Glu Lys Thr Gly Lys Glu Glu Arg Val Lys Gln Pro Leu Lys
        435                 440                 445

Ala Thr Pro Lys Ser His Pro Leu Phe Gln Glu Phe Arg Leu Trp Gln
    450                 455                 460

Phe Ile His Asn Leu Lys Ile Tyr Ile Arg Glu Thr Thr Val Gly Asn
465                 470                 475                 480

Lys Pro Leu Phe Asp Val Asp Ile Thr Asp Thr Phe Phe Thr Ser Glu
                485                 490                 495

Asn Asp Trp Ala Thr Leu Phe Glu Tyr Leu Asn Asn Lys Lys Glu Ile
            500                 505                 510

Glu Gln Lys His Val Leu Glu Tyr Leu Val Ser Lys Lys Ile Ile Ser
        515                 520                 525

Lys Ser Glu Lys Thr Asp Tyr Arg Trp Asn Tyr Val Glu Asp Lys Lys
    530                 535                 540

Tyr Pro Gly Asn Glu Thr Arg Val Asp Phe Ile Asn Arg Leu Lys Lys
545                 550                 555                 560
```

```
Val Glu Asn Leu Asn Val Asp Glu Phe Leu Thr Ser Glu Leu Glu Phe
                565                 570                 575

Lys Leu Trp His Ile Ile Tyr Ser Val Thr Asp Lys Asn Glu Tyr Glu
            580                 585                 590

Lys Ala Leu Glu Asn Phe Ala Ile Arg Gln Asn Ile Asp Lys Asp Ser
        595                 600                 605

Phe Val Asn Ser Phe Lys Lys Phe Pro Pro Phe Lys Ser Asp Tyr Gly
    610                 615                 620

Ala Tyr Ser Thr Lys Ala Ile Lys Lys Leu Leu Pro Leu Met Arg Leu
625                 630                 635                 640

Gly Lys Phe Trp Asp Gly Ser Glu Ile Pro Lys Val Val Val Glu Lys
                645                 650                 655

Ile Thr Asp Ile Lys Thr Arg Leu Thr Ser Val Asn Tyr Asp Glu Ser
            660                 665                 670

Leu Phe Lys Lys Asp Glu Lys Lys Ile Leu Glu Thr Ile Val Asp Asp
        675                 680                 685

Ile Thr Pro Lys Gln Leu Leu Lys Ser Phe Val Lys Leu Lys Gly Lys
    690                 695                 700

Asn His Leu Ala Gly Leu Asn Thr Tyr Gln Ala Cys Tyr Leu Val Tyr
705                 710                 715                 720

Glu Arg His Ser Glu Ser Ser Asp Ile Thr Gln Trp Glu Asn Pro Asp
                725                 730                 735

Asp Ile Asp Ser Phe Leu Asn His Phe Lys Gln His Ser Leu Arg Asn
            740                 745                 750

Pro Ile Val Glu Gln Val Val Thr Glu Thr Leu Arg Thr Val Arg Asp
```

```
        755                 760                 765

Ile Trp Lys Tyr Tyr Gly Asn Gly Ser Pro Asn Tyr Phe Asn Glu Ile
    770                 775                 780

His Ile Glu Leu Gly Arg Glu Met Lys Asn Pro Ala Asp Lys Arg Lys
785                 790                 795                 800

Gln Met Ser Ala Lys Ile Asn Glu Asn Glu Asn Thr Asn Gln Arg Ile
                805                 810                 815

Lys Gly Ile Leu Gln Glu Leu Met Asn Asp Gly Val Gln Asp Ile Lys
            820                 825                 830

Pro Tyr Ser Pro Ser Gln Gln Glu Ile Leu Lys Ile Tyr Glu Glu Gly
        835                 840                 845

Ile Ser Gln Asn Pro Asn Val Asp Tyr Ser Lys Val Ser Glu Asp Glu
    850                 855                 860

Ile Thr Lys Ile Lys Lys Ser Asn Asn Pro Thr Leu Lys Glu Ile Gln
865                 870                 875                 880

Arg Tyr Lys Leu Trp Leu Glu Gln Lys Tyr Ile Ser Pro Tyr Thr Gly
                885                 890                 895

Lys Pro Ile Pro Leu Ser Glu Leu Phe Thr Pro Ala Tyr Gln Ile Glu
            900                 905                 910

His Ile Ile Pro Gln Ser Arg Tyr Phe Asp Asn Ser Leu Ser Asn Lys
        915                 920                 925

Ile Ile Cys Glu Ser Glu Val Asn Glu Asp Lys Ser Asn Lys Thr Ala
    930                 935                 940

Tyr Glu Tyr Leu Lys Thr Asn Gly Gly Ser Ile Val His Gly His His
945                 950                 955                 960
```

```
Leu Leu Ser Leu Lys Glu Tyr Glu Asp His Cys Gln His Tyr Phe Lys
               965                 970                 975

Lys Asn Arg Thr Lys Leu Lys Asn Leu Leu Ser Glu Glu Ile Pro Glu
            980                 985                 990

Gly Phe Ile Asn Arg Gln Leu Asn  Asp Ser Arg Tyr Ile  Ser Lys Leu
        995                 1000                1005

Ile Lys  Gly Leu Leu Ser Asn  Ile Val Arg Glu Glu  Asn Glu Gln
    1010                1015                1020

Glu Ala  Thr Ser Lys Asn Ile  Val Pro Val Thr Gly  Ser Ile Thr
    1025                1030                1035

Ser Lys  Leu Lys Gln Asp Trp  Gly Leu Asn Asp Lys  Trp Asn Glu
    1040                1045                1050

Ile Ile  Ala Pro Arg Phe Lys  Arg Leu Asn Lys Met  Thr Asn Ser
    1055                1060                1065

Asn Asp  Phe Gly Tyr Phe Asp  Glu Lys Ile Asn Thr  Phe Arg Ile
    1070                1075                1080

Gln Val  Pro Asp Ala Ile Ser  Arg Gly Phe Asn Lys  Lys Arg Ile
    1085                1090                1095

Asp His  Arg His His Thr Leu  Asp Ala Leu Val Ile  Ala Cys Cys
    1100                1105                1110

Thr Lys  Lys His Ile Gln Tyr  Leu Asn Ser Leu Asn  Asn Glu Ile
    1115                1120                1125

Ile Lys  His Glu Leu Lys Pro  Ser Ile Leu Ile Lys  Asn Ala Gln
    1130                1135                1140

Gly Asp  Tyr Thr Lys His Phe  Met Leu Pro Trp Asn  Asn Phe Pro
```

```
    1145                1150                1155

Ile Asp  Cys Lys Asn Ala Ile  Glu Asn Thr Ile Val  Ser Phe Lys
    1160                1165                1170

Gln Asn  Leu Arg Val Ile Asn  Lys Thr Ser Asn Lys  Tyr Gln Ser
    1175                1180                1185

Tyr Lys  Asp Glu Asn Gly Asn  Leu Arg Leu Gly Lys  Asp Gly Lys
    1190                1195                1200

Pro Lys  Lys Gly Leu Thr Lys  Gln Thr Lys Gly Asn  Asn Trp Ala
    1205                1210                1215

Val Arg  Lys Ala Met His Glu  Asp Thr Phe Tyr Gly  Glu Ile Val
    1220                1225                1230

Asp Gly  Glu Asn Lys Gly Lys  Leu Lys Ile Lys Thr  Leu Leu Asp
    1235                1240                1245

Thr Ser  Phe Asp Val Lys Lys  Ile Glu Asp Lys Val  Leu Asp Lys
    1250                1255                1260

Ser Ile  Arg Thr Ile Leu Ile  Asn Tyr Leu Lys Gln  Asp Lys Tyr
    1265                1270                1275

Lys Asn  Leu Ser Lys Pro His  Glu Glu Ala Phe Ser  Pro Asn Gly
    1280                1285                1290

Ile Ile  Glu Met Asn Lys Asn  Ile Ile Ser Leu Asn  Asn Asn Ile
    1295                1300                1305

Pro His  Lys Pro Ile Lys Arg  Val Thr Leu Lys His  Glu Lys Gly
    1310                1315                1320

Lys Lys  Phe Ser Ile Lys Thr  Leu Leu Asp Lys Lys  Thr Lys Phe
    1325                1330                1335
```

```
Ala Lys  Ser Ala Thr Gly Thr  Asn Val Phe Phe Cys  Ile Tyr Lys
    1340                1345                1350

Asn Ile  Asn Gly Lys Ile Lys  Tyr His Thr Pro Ser  Phe Glu Glu
    1355                1360                1365

Ile Ile  Glu Ile Gln Lys Gln  Glu Phe Glu Ile Lys  Tyr Lys Ser
    1370                1375                1380

Lys Leu  Asn Val Pro Glu Thr  Leu Phe Asp Lys Lys  Glu Ser Phe
    1385                1390                1395

Glu Leu  Leu Phe Tyr Leu Gln  Pro Asn Asp Leu Val  Tyr Leu Pro
    1400                1405                1410

Asn Asp  Glu Glu Leu Lys Asn  Arg Gln Leu Ile Asp  Phe Asn Asn
    1415                1420                1425

Leu Asn  Lys Lys Gln Ile Lys  Arg Ile Tyr Lys Phe  Thr Asp Gly
    1430                1435                1440

Ser Gly  Thr Thr Ala Asn Phe  Ile Pro Tyr Gln Val  Ala Lys Val
    1445                1450                1455

Ile Phe  Asn Leu Asn Lys Lys  Glu Gln Ala Lys Ser  Ser Phe Lys
    1460                1465                1470

Tyr Pro  Ile Gln Asn Glu Phe  Gly Val Gly Ser Pro  Gln Ser Lys
    1475                1480                1485

Asn Gln  Lys Ser Ile Glu Gly  Ile Leu Ile Lys Glu  Arg Cys Ile
    1490                1495                1500

Lys Leu  Lys Ile Asp Arg Leu  Gly Asn Ile Ser Lys  Ala
    1505                1510                1515
```

<210> 431

<211> 1629
<212> PRT
<213> Francisella cf.

<400> 431

Met Asn Phe Lys Ile Leu Pro Ile Ala Ile Asp Leu Gly Val Lys Asn
1 5 10 15

Thr Gly Val Phe Ser Ala Phe Tyr Gln Lys Gly Thr Ser Leu Glu Arg
20 25 30

Leu Asp Asn Lys Asn Gly Lys Val Tyr Glu Leu Ser Lys Asp Ser Tyr
35 40 45

Thr Leu Leu Met Asn Asn Arg Thr Ala Arg Arg His Gln Arg Arg Gly
50 55 60

Ile Asp Arg Lys Gln Leu Val Lys Arg Leu Phe Lys Leu Ile Trp Thr
65 70 75 80

Glu Gln Leu Asn Leu Glu Trp Asp Lys Asp Thr Gln Gln Ala Ile Ser
85 90 95

Phe Leu Phe Asn Arg Arg Gly Phe Ser Phe Ile Thr Asp Gly Tyr Ser
100 105 110

Pro Glu Tyr Leu Asn Ile Val Pro Glu Gln Val Lys Ala Ile Leu Met
115 120 125

Asp Ile Phe Asp Asp Tyr Asn Gly Glu Asp Asp Leu Asp Ser Tyr Leu
130 135 140

Lys Leu Ala Thr Glu Gln Glu Ser Lys Ile Ser Glu Ile Tyr Asn Lys
145 150 155 160

Leu Met Gln Lys Ile Leu Glu Phe Lys Leu Arg Lys Leu Cys Thr Asp
165 170 175

```
Ile Lys Asp Asp Lys Val Ser Thr Lys Thr Leu Lys Glu Ile Thr Ser
            180                 185                 190

Tyr Glu Phe Glu Leu Leu Ala Asp Tyr Leu Ala Asn Tyr Ser Glu Ile
        195                 200                 205

Leu Lys Thr Gln Lys Phe Ser Tyr Thr Asp Lys Gln Gly Asn Leu Lys
    210                 215                 220

Glu Leu Ser Tyr Tyr His His Asp Lys Tyr Asn Ile Gln Glu Phe Leu
225                 230                 235                 240

Lys Arg His Ala Thr Ile Asn Ile Gln Ile Leu Asp Thr Leu Leu Thr
                245                 250                 255

Asp Asp Leu Asp Ile Trp Asn Phe Asn Phe Glu Lys Phe Asp Phe Asp
            260                 265                 270

Lys Asn Glu Glu Lys Leu Gln Asn Gln Glu Asp Lys Asp His Ile Gln
        275                 280                 285

Ala His Leu His His Phe Val Phe Ala Val Asn Lys Ile Lys Ser Glu
    290                 295                 300

Met Ala Ser Gly Gly Arg His Arg Ser Gln Tyr Phe Gln Glu Ile Thr
305                 310                 315                 320

Asn Val Leu Asp Glu Asn Asn His Gln Glu Gly Tyr Leu Lys Asn Phe
                325                 330                 335

Cys Glu Asn Leu His Asn Lys Lys Tyr Ser Asn Leu Ser Val Lys Asn
            340                 345                 350

Leu Val Asn Leu Ile Gly Asn Leu Ser Asn Leu Glu Leu Lys Pro Leu
        355                 360                 365

Arg Lys Tyr Phe Asn Asp Lys Ile His Ala Lys Ala Asp His Trp Asp
    370                 375                 380
```

```
Glu Gln Lys Phe Thr Glu Thr Tyr Cys His Trp Ile Leu Gly Glu Trp
385                 390                 395                 400

Arg Val Gly Val Lys Asp Gln Asp Lys Lys Asp Gly Ala Lys Tyr Ser
                405                 410                 415

Tyr Lys Asp Leu Cys Asn Glu Leu Lys Gln Lys Val Thr Lys Ala Gly
            420                 425                 430

Leu Val Asp Phe Leu Leu Glu Leu Asp Pro Cys Arg Thr Ile Pro Pro
        435                 440                 445

Tyr Leu Asp Asn Asn Asn Arg Lys Pro Pro Lys Cys Gln Ser Leu Ile
    450                 455                 460

Leu Asn Pro Lys Phe Leu Asp Asn Gln Tyr Pro Asn Trp Gln Gln Tyr
465                 470                 475                 480

Leu Gln Glu Leu Lys Lys Leu Gln Ser Ile Gln Asn Tyr Leu Glu Ser
                485                 490                 495

Phe Glu Thr Asp Leu Lys Val Leu Lys Ser Ser Lys Asp Gln Pro Tyr
            500                 505                 510

Phe Val Glu Tyr Arg Ser Ser Asn Gln Gln Ile Ala Ser Gly Gln Arg
        515                 520                 525

Asp Tyr Lys Asp Leu Asp Ala Arg Ile Leu Gln Phe Ile Phe Asp Arg
    530                 535                 540

Val Lys Ala Ser Asp Glu Leu Leu Leu Asn Glu Ile Tyr Phe Gln Ala
545                 550                 555                 560

Lys Lys Leu Lys Gln Lys Ala Ser Ser Glu Leu Glu Lys Leu Glu Ser
                565                 570                 575
```

```
Ser Lys Lys Leu Asp Glu Val Ile Ala Asn Ser Gln Leu Ser Gln Ile
            580                 585                 590

Leu Lys Ser Gln His Thr Asn Gly Ile Phe Glu Gln Gly Thr Phe Leu
        595                 600                 605

His Leu Val Cys Lys Tyr Tyr Lys Gln Arg Gln Arg Ala Arg Asp Ser
    610                 615                 620

Arg Leu Tyr Ile Met Pro Glu Tyr Arg Tyr Asp Lys Lys Leu His Lys
625                 630                 635                 640

Tyr Asn Asn Thr Gly Arg Phe Asp Asp Asp Asn Gln Leu Leu Thr Tyr
                645                 650                 655

Cys Asn His Lys Pro Arg Gln Lys Arg Tyr Gln Leu Leu Asn Asp Leu
            660                 665                 670

Ala Gly Val Leu Gln Val Ser Pro Asn Phe Leu Lys Asp Lys Ile Gly
        675                 680                 685

Ser Asp Asp Asp Leu Phe Ile Ser Lys Trp Leu Val Glu His Ile Arg
    690                 695                 700

Gly Phe Lys Lys Ala Cys Glu Asp Ser Leu Lys Ile Gln Lys Asp Asn
705                 710                 715                 720

Arg Gly Leu Leu Asn His Lys Ile Asn Ile Ala Arg Asn Thr Lys Gly
                725                 730                 735

Lys Cys Glu Lys Glu Ile Phe Asn Leu Ile Cys Lys Ile Glu Gly Ser
            740                 745                 750

Glu Asp Lys Lys Gly Asn Tyr Lys His Gly Leu Ala Tyr Glu Leu Gly
        755                 760                 765

Val Leu Leu Phe Gly Glu Pro Asn Glu Ala Ser Lys Pro Glu Phe Asp
    770                 775                 780
```

```
Arg Lys Ile Lys Lys Phe Asn Ser Ile Tyr Ser Phe Ala Gln Ile Gln
785                 790                 795                 800

Gln Ile Ala Phe Ala Glu Arg Lys Gly Asn Ala Asn Thr Cys Ala Val
                805                 810                 815

Cys Ser Ala Asp Asn Ala His Arg Met Gln Gln Ile Lys Ile Thr Glu
            820                 825                 830

Pro Val Glu Asp Asn Lys Asp Lys Ile Ile Leu Ser Ala Lys Ala Gln
        835                 840                 845

Arg Leu Pro Ala Ile Thr Thr Arg Ile Val Asp Gly Ala Val Lys Lys
    850                 855                 860

Met Ala Thr Ile Leu Ala Lys Asn Ile Val Asp Asp Asn Trp Gln Asn
865                 870                 875                 880

Ile Lys Gln Val Leu Ser Ala Lys His Gln Leu His Ile Pro Ile Ile
                885                 890                 895

Thr Glu Ser Asn Ala Phe Glu Phe Glu Pro Ala Leu Ala Asp Val Lys
            900                 905                 910

Gly Lys Ser Leu Lys Asp Arg Arg Lys Lys Ala Leu Glu Arg Ile Ser
        915                 920                 925

Pro Glu Asn Ile Phe Lys Asp Lys Asn Asn Arg Ile Lys Glu Phe Ala
    930                 935                 940

Lys Gly Ile Ser Ala Tyr Ser Gly Ala Asn Leu Thr Asp Gly Asp Phe
945                 950                 955                 960

Asp Gly Ala Lys Glu Glu Leu Asp His Ile Ile Pro Arg Ser His Lys
                965                 970                 975
```

```
Lys Tyr Gly Thr Leu Asn Asp Glu Ala Asn Leu Ile Cys Val Thr Arg
            980                 985                 990


Gly Asp Asn Lys Asn Lys Gly Asn  Arg Ile Phe Cys Leu  Arg Asp Leu
        995                 1000                1005


Ala Asn  Asn Tyr Lys Leu Lys  Gln Phe Glu Thr Thr  Asp Asp Leu
    1010                1015                1020


Glu Ile  Glu Lys Lys Ile Ala  Asp Thr Ile Trp Asp  Ala Asn Lys
    1025                1030                1035


Lys Asp  Phe Lys Phe Gly Asn  Tyr Arg Ser Phe Ile  Asn Leu Thr
    1040                1045                1050


Pro Gln  Glu Gln Lys Ala Phe  Arg His Ala Leu Phe  Leu Ala Asp
    1055                1060                1065


Glu Asn  Pro Ile Lys Gln Ala  Val Ile Arg Ala Ile  Asn Asn Arg
    1070                1075                1080


Asn Arg  Thr Phe Val Asn Gly  Thr Gln Arg Tyr Phe  Ala Glu Val
    1085                1090                1095


Leu Ala  Asn Asn Ile Tyr Leu  Arg Ala Lys Lys Glu  Asn Leu Asn
    1100                1105                1110


Thr Asp  Lys Ile Ser Phe Asp  Tyr Phe Gly Ile Pro  Thr Ile Gly
    1115                1120                1125


Asn Gly  Arg Gly Ile Ala Glu  Ile Arg Gln Leu Tyr  Glu Lys Val
    1130                1135                1140


Asp Ser  Asp Ile Gln Ala Tyr  Ala Lys Gly Asp Lys  Pro Gln Ala
    1145                1150                1155


Ser Tyr  Ser His Leu Ile Asp  Ala Met Leu Ala Phe  Cys Ile Ala
    1160                1165                1170
```

```
Ala Asp  Glu His Arg Asn Asp  Gly Ser Ile Gly Leu  Glu Ile Asp
    1175                1180                1185

Lys Asn  Tyr Ser Leu Tyr Pro  Leu Asp Lys Asn Thr  Gly Glu Val
    1190                1195                1200

Phe Thr  Lys Asp Ile Phe Ser  Gln Ile Lys Ile Thr  Asp Asn Glu
    1205                1210                1215

Phe Ser  Asp Lys Lys Leu Val  Arg Lys Lys Ala Thr  Glu Gly Phe
    1220                1225                1230

Asn Thr  His Arg Gln Met Thr  Arg Asp Gly Ile Tyr  Ala Glu Asn
    1235                1240                1245

Tyr Leu  Pro Ile Leu Ile His  Lys Glu Leu Asp Glu  Val Arg Lys
    1250                1255                1260

Gly Tyr  Thr Trp Lys Asn Ser  Glu Glu Ile Lys Ile  Phe Lys Gly
    1265                1270                1275

Lys Lys  Tyr Asp Ile Gln Gln  Leu Asn Asn Leu Leu  Tyr Cys Leu
    1280                1285                1290

Lys Phe  Val Asp Lys Pro Ile  Ser Ile Asp Ile Gln  Ile Ser Thr
    1295                1300                1305

Leu Glu  Glu Leu Arg Asn Ile  Leu Thr Thr Asn Asn  Ile Ala Ala
    1310                1315                1320

Thr Ala  Glu Tyr Tyr Tyr Ile  Asn Leu Lys Thr Gln  Lys Leu His
    1325                1330                1335

Glu Tyr  Tyr Ile Glu Asn Tyr  Asn Thr Ala Leu Gly  Tyr Lys Lys
    1340                1345                1350
```

```
Tyr Thr  Lys Glu Met Glu Phe  Leu Arg Ser Leu Ala  Tyr Arg Ser
    1355                1360                1365

Glu Arg  Val Lys Ile Lys Ser  Ile Asp Asp Val Lys  Gln Val Leu
    1370                1375                1380

Asp Lys  Asp Ser Asn Phe Ile  Ile Gly Lys Ile Thr  Leu Pro Phe
    1385                1390                1395

Lys Lys  Glu Trp Gln Arg Leu  Tyr Arg Glu Trp Gln  Asn Ile Thr
    1400                1405                1410

Ile Lys  Asp Asp Tyr Glu Phe  Leu Lys Ser Phe Phe  Asn Val Lys
    1415                1420                1425

Ser Ile  Thr Lys Leu His Lys  Lys Val Arg Lys Asp  Phe Ser Leu
    1430                1435                1440

Pro Ile  Ser Thr Asn Glu Gly  Lys Phe Leu Val Lys  Arg Lys Thr
    1445                1450                1455

Trp Asp  Asn Asn Phe Ile Tyr  Gln Ile Leu Asn Asp  Ser Asp Ser
    1460                1465                1470

Arg Val  Asp Gly Thr Lys Pro  Phe Ile Pro Ala Phe  Asp Ile Ser
    1475                1480                1485

Lys Asn  Glu Ile Val Glu Ala  Ile Ile Asp Ser Phe  Thr Ser Lys
    1490                1495                1500

Asn Ile  Phe Trp Leu Pro Lys  Asn Ile Glu Leu Gln  Lys Val Asp
    1505                1510                1515

Asn Lys  Asn Ile Phe Ala Ile  Asp Thr Ser Lys Trp  Phe Glu Val
    1520                1525                1530

Glu Thr  Pro Ser Asp Leu Arg  Asp Ile Gly Val Ala  Thr Ile Gln
    1535                1540                1545
```

Tyr Lys Ile Asp Asn Asn Ser Arg Pro Lys Val Arg Val Lys Leu
1550 1555 1560

Asp Tyr Val Ile Asp Asp Asp Ser Lys Ile Asn Tyr Phe Thr Asn
1565 1570 1575

His Ser Leu Leu Lys Ser Arg Tyr Pro Asp Lys Val Leu Glu Ile
1580 1585 1590

Leu Lys Gln Ser Thr Ile Ile Glu Phe Glu Ser Ser Gly Phe Asn
1595 1600 1605

Lys Thr Ile Lys Glu Met Leu Gly Met Thr Leu Ala Gly Ile Tyr
1610 1615 1620

Asn Glu Thr Ser Asn Asn
1625

<210> 432
<211> 1646
<212> PRT
<213> Francisella cf.

<400> 432

Met Asn Ile Lys Ile Leu Pro Ile Ala Ile Asp Leu Gly Ala Lys Asn
1 5 10 15

Thr Gly Val Phe Ser Ala Phe Tyr Gln Lys Gly Thr Ser Leu Glu Ser
20 25 30

Leu Asp Asn Lys Asn Gly Lys Val Tyr Glu Leu Ser Lys Asp Ser Tyr
35 40 45

Thr Leu Leu Met Asn Asn Arg Thr Ala Arg Arg His Gln Arg Arg Gly
50 55 60

Ile Asp Arg Lys Gln Leu Val Lys Arg Leu Phe Lys Leu Ile Trp Thr

```
65                  70                  75                  80

Lys Gln Leu Asn Leu Glu Trp Asn Lys Asp Thr Gln Gln Thr Ile Ser
                85                  90                  95

Phe Leu Leu Asn Arg Arg Gly Phe Ser Phe Ile Thr Asp Gly Tyr Ser
            100                 105                 110

Pro Glu Tyr Leu Asn Ile Ala Pro Glu Ala Val Lys Ala Ile Leu Met
        115                 120                 125

Ser Ile Leu Asp Asp Tyr Asn Gly Glu Asp Asp Leu Asp Ser Tyr Leu
    130                 135                 140

Gln Ser Ala Thr Glu Asn Asp Ser Lys Ile Asp Glu Leu Tyr Asn Lys
145                 150                 155                 160

Leu Leu Gln Lys Ala Leu Glu Phe Lys Leu Arg Lys Leu Cys Ile Asp
                165                 170                 175

Ile Lys Glu Asp Lys Val Thr Thr Lys Thr Leu Lys Glu Leu Ser Asn
            180                 185                 190

Thr Glu Phe Lys Leu Leu Ala Asn Tyr Leu Val Asp Tyr Asp Arg Ile
        195                 200                 205

Leu Arg Thr Gln Lys Phe Ser Tyr Thr Asp Lys Gln Gly Asn Leu Arg
    210                 215                 220

Glu Leu Asn Tyr Tyr His His Asp Lys Tyr Asn Ile Gln Glu Phe Leu
225                 230                 235                 240

Lys Arg Asn Ile Ile Ile Asn Asp Val Ile Leu Glu Lys Leu Thr Asp
                245                 250                 255

Asp Leu Asp Ile Trp Asn Leu Asn Phe Asp Lys Phe Asp Phe Glu Lys
            260                 265                 270
```

```
Asn Leu Glu Lys Leu Glu Asn Gln Glu Asp Lys Asp Tyr Leu Gln Thr
        275                 280                 285

His Leu His His Phe Val Phe Ala Val Asn Lys Ile Lys Ser Glu Met
    290                 295                 300

Ala Ser Gly Gly Arg His Arg Ser Gln Tyr Phe Gln Glu Ile Thr Asn
305                 310                 315                 320

Val Leu Val Glu Asn Asn His Gln Glu Gly Tyr Leu Lys Asn Phe Cys
                325                 330                 335

Glu Asn Leu His Asn Lys Lys Tyr Ser Asn Leu Ser Val Lys Asn Leu
            340                 345                 350

Val Asn Leu Ile Gly Asn Leu Ser Asn Leu Glu Leu Lys Pro Leu Arg
        355                 360                 365

Lys Tyr Phe Asn Asp Lys Ile His Ala Lys Ala Asp Tyr Trp Asp Glu
    370                 375                 380

Gln Lys Phe Ala Glu Thr Tyr Ser Asp Trp Ile Leu Gly Glu Trp Arg
385                 390                 395                 400

Val Gly Ala Lys Asp Lys Asp Lys Lys Asp Gly Ala Lys Tyr Ser Tyr
                405                 410                 415

Lys Asn Leu Cys Asp Glu Leu Lys Gln Lys Val Gly Ile Asn Gln Asp
            420                 425                 430

Gly Ile Ile Asn Gln Thr Lys Ser Asp Phe Val Asp Phe Leu Leu Glu
        435                 440                 445

Leu Asp Pro Cys Arg Thr Ile Pro Pro Tyr Leu Asp Asn Asn Asn Arg
    450                 455                 460

Lys Pro Pro Lys Cys Gln Ser Leu Ile Leu Asn Pro Lys Phe Leu Asp
```

```
465                 470                 475                 480

Asn Lys Tyr Pro Asn Trp Gln Gln Tyr Leu Gln Glu Leu Lys Lys Leu
                485                 490                 495

Gln Thr Val Gln Asn Tyr Leu Gly Asn Phe Glu Ile Asp Leu Lys Asp
            500                 505                 510

Leu Lys Ser Ser Lys Glu Gln Pro Tyr Phe Val Lys Tyr Lys Ser Leu
        515                 520                 525

Asn Gln Gln Ile Ala Ser Gly Gln Arg Asp Tyr Lys Asp Leu Asp Ala
    530                 535                 540

Arg Val Leu Gln Phe Ile Phe Asp Arg Val Lys Ala Ser Asp Glu Leu
545                 550                 555                 560

Leu Leu Asn Glu Ile Tyr Ser His Ala Lys Lys Leu Lys Gln Asn Thr
                565                 570                 575

Ser Ser Glu Leu Glu Lys Leu Glu Leu Cys Lys Lys Leu Asp Glu Val
            580                 585                 590

Ile Ala Asn Ser Gln Leu Ser Gln Ile Leu Lys Ser Gln His Val Asn
        595                 600                 605

Gly Ile Phe Glu Gln Gly Thr Phe Leu His Leu Val Cys Lys Tyr Tyr
    610                 615                 620

Lys Gln Arg Gln Arg Ala Arg Asp Ser Arg Leu Tyr Ile Met Pro Glu
625                 630                 635                 640

Tyr Arg Tyr Asp Lys Lys Leu Asp Lys Tyr Asn Asn Thr Gly Arg Phe
                645                 650                 655

Asp Asp Asp Asn Gln Leu Leu Thr Tyr Cys Asn His Lys Pro Arg Gln
            660                 665                 670
```

```
Lys Arg Tyr Gln Leu Leu Asn Asp Leu Ala Gly Val Leu Gln Val Ser
        675                 680                 685

Pro Asn Phe Leu Lys Asp Lys Ile Gly Ser Asp Asp Asp Leu Phe Ile
    690                 695                 700

Ser Lys Trp Leu Val Glu His Ile Arg Gly Phe Lys Lys Ala Cys Glu
705                 710                 715                 720

Asp Ser Leu Lys Ile Gln Lys Asp Asn Arg Gly Leu Leu Asn His Lys
                725                 730                 735

Ile Asn Ile Ala Arg Asn Thr Lys Gly Lys Cys Glu Lys Glu Ile Phe
            740                 745                 750

Asn Leu Ile Cys Lys Ile Glu Gly Ser Glu Asp Lys Lys Gly Asn Tyr
        755                 760                 765

Lys His Gly Leu Ala Tyr Glu Leu Gly Val Leu Leu Phe Gly Glu Pro
    770                 775                 780

Asn Gln Ala Ser Lys Leu Glu Phe Asp Arg Lys Ile Lys Lys Phe Asn
785                 790                 795                 800

Ser Ile Tyr Ser Phe Ala Gln Ile Gln Gln Ile Ala Phe Ala Glu Arg
                805                 810                 815

Lys Gly Asn Ala Asn Thr Cys Ala Val Cys Ser Ala Asp Asn Ala His
            820                 825                 830

Arg Met Gln Gln Ile Lys Val Ala Lys Pro Val Glu Gly Asn Lys Asp
        835                 840                 845

Asn Ile Ile Leu Ser Ala Lys Ala Gln Arg Leu Pro Ala Ile Pro Thr
    850                 855                 860

Arg Ile Val Asp Gly Ala Val Lys Lys Ile Ala Thr Ile Leu Ala Arg
```

```
865                 870                 875                 880

Asn Ile Val Asp Asp Asn Trp Asp Asn Ile Lys Gln Ala Leu Ser Asn
                885                 890                 895

Asn Gln Gln Leu His Val Pro Ile Ile Thr Glu Ser Asn Ala Phe Glu
            900                 905                 910

Phe Glu Pro Ala Leu Ala Asp Ile Lys Gly Lys Ser Leu Lys Asp Lys
        915                 920                 925

Arg Lys Lys Ala Leu Glu Arg Ile Asp Pro Glu Asn Val Phe Lys Asp
    930                 935                 940

Lys Asn Asn Arg Ile Lys Glu Phe Ala Lys Gly Ile Ser Ala Tyr Ser
945                 950                 955                 960

Asp Ala Asn Leu Ala Asn Gly Asp Phe Asp Gly Ala Lys Glu Glu Leu
                965                 970                 975

Asp His Ile Ile Pro Arg Ser His Lys Lys Tyr Gly Thr Leu Asn Asp
            980                 985                 990

Glu Ala Asn Leu Ile Cys Val Thr  Arg Glu Asp Asn Gln  Asn Arg Gly
        995                 1000                1005

Asn Lys  Ala Val Phe Leu Tyr  Asp Leu Lys Pro Asn  Tyr Lys Leu
    1010                1015                1020

Lys Gln  Phe Asn Thr Thr Asp  Asp Leu Glu Ile Glu  Lys Lys Ile
    1025                1030                1035

Ala Asp  Thr Ile Trp Asp Ala  Ser Lys Gln Asp Phe  Lys Phe Gly
    1040                1045                1050

Asn Tyr  Arg Ser Phe Ile Asn  Leu Thr Pro Gln Glu  Gln Ile Ala
    1055                1060                1065
```

```
Phe Arg  His Ala Leu Phe Leu  Ala Asp Lys Asn Pro  Ile Lys Lys
    1070                1075                1080

Ala Val  Ile Arg Ala Ile Asp  Asn Arg Asn Arg Thr  Phe Val Asn
    1085                1090                1095

Gly Thr  Gln Arg Tyr Phe Ala  Glu Val Leu Ala Asn  Asn Ile Tyr
    1100                1105                1110

Leu Arg  Ala Lys Lys Glu Asn  Leu Ala Thr Asn Arg  Ile Thr Phe
    1115                1120                1125

Asp Tyr  Phe Gly Ile Glu Thr  Thr Asn Ser Asn Gly  Arg Gly Ile
    1130                1135                1140

Ala Asp  Val Arg Lys Leu Tyr  Glu Lys Val Asp Ser  Asp Ile Gln
    1145                1150                1155

Ala Tyr  Ala Lys Gly Asp Lys  Pro Gln Asp Ser Tyr  Ser His Leu
    1160                1165                1170

Ile Asp  Ala Met Ile Ala Phe  Cys Val Ala Ala Asp  Glu His Lys
    1175                1180                1185

Asn Glu  Gly Ser Ile Gly Leu  Lys Met Gly Asn Gln  Tyr Gly Leu
    1190                1195                1200

Phe Pro  Thr Pro Asp Lys Tyr  Asp Glu Asn Thr Gly  Glu Ile Ile
    1205                1210                1215

Ser Trp  His Asn Asp Asp Ile  Phe Arg Lys Ile Lys  Val Ser Asp
    1220                1225                1230

Asn Gln  Phe Ser Asp Lys Lys  Leu Val Arg Lys Lys  Ala Thr Glu
    1235                1240                1245

Gly Phe  Asn Thr His Arg Gln  Met Thr Arg Asp Gly  Ile Tyr Gly
```

```
    1250                1255                1260

Glu Ser  Tyr Leu Pro Ile Leu  Ile His Lys Asn Leu  Asn Glu Val
    1265                1270                1275

Arg Lys  Gly Tyr Asn Trp Glu  Asn Ser Glu Glu Ile  Lys Ile Phe
    1280                1285                1290

Lys Gly  Lys Lys Tyr Asp Ile  Gln Gln Leu Asn Asn  Leu Val Tyr
    1295                1300                1305

Cys Leu  Lys Phe Val Asp Lys  Pro Ile Ser Ile Asp  Ile Gln Ile
    1310                1315                1320

Thr Thr  Leu Glu Glu Leu Arg  Asn Ile Leu Glu Thr  Asn Asn Ile
    1325                1330                1335

Ser Thr  Thr Ala Glu Tyr Tyr  Tyr Ile Asn Leu Lys  Thr Gln Lys
    1340                1345                1350

Leu His  Glu Tyr Tyr Ile Glu  Asn Tyr Asn Thr Ala  Leu Gly Tyr
    1355                1360                1365

Lys Lys  Tyr Thr Lys Glu Met  Glu Phe Leu Arg Ser  Leu Ala Tyr
    1370                1375                1380

Arg Thr  Glu Arg Val Lys Ile  Lys Ser Ile Asp Asp  Val Ser Met
    1385                1390                1395

Ile Leu  Ala Lys Asp Ser Asn  Phe Lys Ala Gly Lys  Ile Glu Leu
    1400                1405                1410

Pro Phe  Lys Thr Glu Trp Gln  Arg Leu Tyr Leu Glu  Trp Gln Asn
    1415                1420                1425

Thr Thr  Ile Lys Asp Asn His  Glu Phe Leu Lys Ser  Tyr Phe Ser
    1430                1435                1440
```

```
Val Lys  Asn Ala Thr Lys Gln  His Lys Lys Val Arg  Lys Asp Phe
    1445                1450                1455

Ser Leu  Pro Ile Ser Thr Asn  Glu Gly Lys Leu Leu  Val Lys Arg
    1460                1465                1470

Lys Thr  Trp Asp Asn Asn Phe  Ile Tyr Gln Ile Leu  Asn Asp Ser
    1475                1480                1485

Asp Ser  Arg Ala Asp Gly Thr  Lys Pro Phe Ile Pro  Ala Phe Asp
    1490                1495                1500

Ile Ser  Lys Asn Glu Ile Val  Glu Thr Ile Ile Lys  Ser Phe Thr
    1505                1510                1515

Ser Lys  Asn Ile Phe Trp Leu  Pro Lys Asn Ile Glu  Leu Gln Lys
    1520                1525                1530

Val Asp  Asn Lys Ser Ile Phe  Ala Ile Asp Thr Ser  Arg Trp Phe
    1535                1540                1545

Glu Val  Glu Thr Pro Lys Asp  Leu Ile Glu Ile Gly  Val Ser Thr
    1550                1555                1560

Ile Gln  Tyr Lys Ile Asp Asn  Asn Ser Arg Pro Lys  Val Arg Val
    1565                1570                1575

Lys Leu  Asp Tyr Val Met Asp  Asp Asp Ser Lys Ile  Asn Tyr Phe
    1580                1585                1590

Met Asn  His Ser Leu Leu Lys  Ser Arg Tyr Pro Asp  Lys Val Leu
    1595                1600                1605

Glu Ile  Leu Lys Gln Ser Thr  Ile Ile Glu Phe Glu  Ser Ser Gly
    1610                1615                1620

Phe Asn  Lys Thr Ile Lys Glu  Met Leu Gly Met Thr  Leu Ala Gly
```

1625 1630 1635

Ile Tyr Asn Glu Thr Ser Asn Asn
1640 1645

<210> 433
<211> 1629
<212> PRT
<213> Francisella novicida

<400> 433

Met Asn Phe Lys Ile Leu Pro Ile Ala Ile Asp Leu Gly Val Lys Asn
1 5 10 15

Thr Gly Val Phe Ser Ala Phe Tyr Gln Lys Gly Thr Ser Leu Glu Arg
20 25 30

Leu Asp Asn Lys Asn Gly Lys Val Tyr Glu Leu Ser Lys Asp Ser Tyr
35 40 45

Thr Leu Leu Met Asn Asn Arg Thr Ala Arg Arg His Gln Arg Arg Gly
50 55 60

Ile Asp Arg Lys Gln Leu Val Lys Lys Leu Phe Lys Leu Ile Trp Thr
65 70 75 80

Glu Gln Leu Asn Leu Glu Trp Asp Lys Asp Thr Gln Gln Ala Ile Ser
85 90 95

Phe Leu Phe Asn Arg Arg Gly Phe Ser Phe Ile Thr Asp Gly Tyr Ser
100 105 110

Pro Glu Tyr Leu Asn Ile Val Pro Glu Gln Val Lys Ala Ile Leu Met
115 120 125

Asp Ile Phe Asp Asp Tyr Asn Gly Glu Asp Asp Leu Asp Ser Tyr Leu
130 135 140

```
Lys Leu Ala Thr Glu Gln Glu Ser Lys Ile Ser Glu Ile Tyr Asn Lys
145                 150                 155                 160

Leu Met Gln Lys Ile Leu Glu Phe Lys Leu Arg Lys Leu Cys Thr Asp
                165                 170                 175

Ile Lys Asp Asp Lys Val Ser Thr Lys Thr Leu Lys Glu Ile Thr Ser
            180                 185                 190

Tyr Glu Phe Glu Leu Leu Ala Asp Tyr Leu Ala Asn Tyr Ser Glu Ser
        195                 200                 205

Leu Lys Thr Gln Lys Phe Ser Tyr Thr Asp Lys Gln Gly Asn Leu Lys
    210                 215                 220

Glu Leu Ser Tyr Tyr His His Asp Lys Tyr Asn Ile Gln Glu Phe Leu
225                 230                 235                 240

Lys Arg His Ala Thr Ile Asn Asp Glu Ile Leu Asp Thr Leu Leu Thr
                245                 250                 255

Asp Asp Leu Asp Ile Trp Asn Phe Asn Phe Glu Lys Phe Asp Phe Asp
            260                 265                 270

Lys Asn Glu Glu Lys Leu Gln Asn Gln Glu Asp Lys Asp His Thr Gln
        275                 280                 285

Ala His Leu His His Phe Val Phe Ala Val Asn Lys Ile Lys Ser Glu
    290                 295                 300

Met Ala Ser Gly Gly Arg His Arg Gly Gln Tyr Phe Gln Glu Ile Thr
305                 310                 315                 320

Asn Val Leu Asp Glu Asn Asn His Gln Glu Gly Tyr Leu Lys Asn Phe
                325                 330                 335

Cys Glu Asn Leu His Asn Lys Lys Tyr Ser Asn Leu Ser Val Lys Asn
            340                 345                 350
```

```
Leu Val Asn Leu Ile Gly Asn Leu Ser Asn Leu Glu Leu Lys Pro Leu
        355                 360                 365

Arg Lys Tyr Phe Asn Asp Lys Ile His Ala Lys Ala Asp His Trp Asp
    370                 375                 380

Glu Gln Lys Phe Thr Glu Thr Tyr Cys His Trp Ile Leu Gly Glu Trp
385                 390                 395                 400

Arg Val Gly Leu Lys Asp Gln Asp Lys Lys Glu Gly Ala Lys Tyr Ser
                405                 410                 415

Tyr Lys Asp Leu Cys Asn Glu Leu Lys Gln Lys Val Thr Asn Ala Gly
            420                 425                 430

Leu Ile Asp Phe Leu Leu Glu Leu Asp Pro Cys Arg Thr Ile Pro Pro
        435                 440                 445

Tyr Leu Asp Asn Asn Asn Arg Lys Pro Pro Lys Cys Gln Ser Leu Ile
    450                 455                 460

Leu Asn Pro Lys Phe Leu Asp Asn Gln Tyr Pro Asn Trp Gln Gln Tyr
465                 470                 475                 480

Leu Gln Glu Leu Lys Lys Leu Gln Ile Ile Gln Asp Tyr Leu Glu Ser
                485                 490                 495

Phe Glu Thr Asp Leu Lys Val Leu Lys Ser Ser Lys Asp Gln Pro Tyr
            500                 505                 510

Phe Val Glu Tyr Lys Ser Ser Asn Gln Gln Ile Ala Ser Gly Gln Arg
        515                 520                 525

Asp Tyr Lys Asp Leu Asp Ala Arg Ile Leu Gln Phe Ile Phe Asp Arg
    530                 535                 540
```

```
Val Lys Ala Ser Asp Glu Leu Leu Leu Asn Glu Ile Tyr Phe Gln Ala
545                 550                 555                 560

Lys Lys Leu Lys Gln Lys Ala Ser Ser Glu Leu Glu Lys Leu Glu Ser
                565                 570                 575

Ser Lys Lys Leu Asp Glu Val Ile Ala Asn Ser Gln Leu Ser Lys Ile
            580                 585                 590

Leu Lys Ser Gln His Thr Asn Gly Ile Phe Glu Gln Gly Thr Phe Leu
        595                 600                 605

His Leu Val Cys Lys Tyr Tyr Lys Gln Arg Gln Arg Ala Arg Asp Ser
    610                 615                 620

Arg Leu Tyr Ile Met Pro Glu Tyr Arg Tyr Asp Lys Lys Leu Asp Lys
625                 630                 635                 640

Tyr Asn Asn Thr Gly Arg Phe Asp Asp Asp Asn Gln Leu Leu Thr Tyr
                645                 650                 655

Cys Asn His Lys Pro Arg Gln Lys Arg Tyr Gln Leu Leu Asn Asp Leu
            660                 665                 670

Ala Gly Val Leu Gln Val Ser Pro Asn Phe Leu Lys Asp Lys Ile Gly
        675                 680                 685

Ser Asp Asp Asp Leu Phe Ile Ser Lys Trp Leu Val Glu His Ile Arg
    690                 695                 700

Gly Phe Lys Lys Ala Cys Glu Asp Ser Leu Lys Ile Gln Lys Asp Asn
705                 710                 715                 720

Arg Gly Leu Leu Asn His Lys Ile Asn Ile Ala Arg Asn Thr Lys Gly
                725                 730                 735

Lys Cys Glu Lys Glu Ile Phe Asn Leu Ile Cys Lys Ile Glu Gly Ser
            740                 745                 750
```

```
Glu Asp Lys Lys Gly Asn Tyr Lys His Gly Leu Ala Tyr Glu Leu Gly
        755                 760                 765

Val Leu Leu Phe Gly Glu Pro Asn Glu Ala Ser Lys Pro Glu Phe Asp
    770                 775                 780

Arg Lys Ile Lys Lys Phe Asn Ser Ile Tyr Ser Phe Ala Gln Ile Gln
785                 790                 795                 800

Gln Ile Ala Phe Ala Glu Arg Lys Gly Asn Ala Asn Thr Cys Ala Val
                805                 810                 815

Cys Ser Ala Asp Asn Ala His Arg Met Gln Gln Ile Lys Ile Thr Glu
            820                 825                 830

Pro Val Glu Asp Asn Lys Asp Lys Ile Ile Leu Ser Ala Lys Ala Gln
        835                 840                 845

Arg Leu Pro Ala Ile Pro Thr Arg Ile Val Asp Gly Ala Val Lys Lys
    850                 855                 860

Met Ala Thr Ile Leu Ala Lys Asn Ile Val Asp Asp Asn Trp Gln Asn
865                 870                 875                 880

Ile Lys Gln Val Leu Ser Ala Lys His Gln Leu His Ile Pro Ile Ile
                885                 890                 895

Thr Glu Ser Asn Ala Phe Glu Phe Glu Pro Ala Leu Ala Asp Val Lys
            900                 905                 910

Gly Lys Ser Leu Lys Asp Arg Arg Lys Lys Ala Leu Glu Arg Ile Ser
        915                 920                 925

Pro Glu Asn Ile Phe Lys Asp Lys Asn Asn Arg Ile Lys Glu Phe Ala
    930                 935                 940
```

```
Lys Gly Ile Ser Ala Tyr Ser Gly Ala Asn Leu Thr Asp Gly Asp Phe
945                 950                 955                 960


Asp Gly Ala Lys Glu Glu Leu Asp His Ile Ile Pro Arg Ser His Lys
                965                 970                 975


Lys Tyr Gly Thr Leu Asn Asp Glu Ala Asn Leu Ile Cys Val Thr Arg
            980                 985                 990


Asp Asp Asn Lys Asn Lys Gly Asn  Arg Ile Phe Cys Leu  His Asp Leu
        995                 1000                1005


Ala Asn  Asn Tyr Lys Leu Lys  Gln Phe Glu Thr Thr  Asp Asp Leu
    1010                1015                1020


Glu Ile  Glu Lys Lys Ile Ala  Asp Thr Ile Trp Asp  Ala Ser Lys
    1025                1030                1035


Lys Asp  Phe Lys Phe Gly Asn  Tyr Arg Ser Phe Ile  Asn Leu Thr
    1040                1045                1050


Pro Gln  Glu Gln Lys Ala Phe  Arg His Ala Leu Phe  Leu Ala Asp
    1055                1060                1065


Glu Asn  Pro Ile Lys Gln Ala  Val Ile Arg Ala Ile  Asn Asn Arg
    1070                1075                1080


Asn Arg  Thr Phe Val Asn Gly  Thr Gln Arg Tyr Phe  Ala Glu Val
    1085                1090                1095


Leu Ala  Asn Asn Ile Tyr Leu  Arg Ala Lys Lys Glu  Asn Leu Asn
    1100                1105                1110


Thr Asp  Lys Ile Ser Phe Asp  Tyr Phe Gly Ile Pro  Thr Ile Gly
    1115                1120                1125


Asn Gly  Arg Gly Ile Ala Glu  Ile Arg Gln Leu Tyr  Glu Lys Val
    1130                1135                1140
```

```
Asp Ser  Asp Ile Gln Val Tyr  Ala Lys Gly Asp Lys  Pro Gln Ala
    1145                1150                1155

Ser Tyr  Ser His Leu Ile Asp  Ala Met Leu Ala Phe  Cys Ile Ala
    1160                1165                1170

Ala Asp  Glu His Arg Asn Asp  Gly Ser Ile Gly Leu  Glu Ile Asp
    1175                1180                1185

Lys Asn  Tyr Ser Leu Tyr Pro  Leu Asp Lys Asn Thr  Gly Glu Val
    1190                1195                1200

Phe Thr  Lys Asp Ile Phe Ser  Gln Ile Lys Ile Thr  Asp Asn Glu
    1205                1210                1215

Phe Ser  Asp Lys Lys Leu Val  Arg Lys Lys Ala Thr  Glu Gly Phe
    1220                1225                1230

Asn Thr  His Arg Gln Met Thr  Arg Asp Gly Ile Tyr  Ala Glu Asn
    1235                1240                1245

Tyr Leu  Pro Ile Leu Ile His  Lys Glu Leu Asp Glu  Val Arg Lys
    1250                1255                1260

Gly Tyr  Thr Trp Lys Asn Ser  Glu Glu Ile Lys Ile  Phe Lys Gly
    1265                1270                1275

Lys Lys  Tyr Asp Ile Gln Gln  Leu Asn Asn Leu Leu  Tyr Cys Leu
    1280                1285                1290

Lys Phe  Val Asp Lys Pro Ile  Ser Ile Asp Ile Gln  Ile Ser Thr
    1295                1300                1305

Leu Glu  Glu Leu Arg Asn Ile  Leu Thr Thr Asn Asn  Ile Ala Ala
    1310                1315                1320
```

```
Thr Ala  Glu Tyr Tyr Tyr Ile  Asn Leu Lys Thr Gln  Lys Leu His
    1325                1330                1335

Glu Tyr  Tyr Ile Glu Asn Tyr  Asn Thr Ala Leu Gly  Tyr Lys Lys
    1340                1345                1350

Tyr Thr  Lys Glu Met Glu Phe  Leu Arg Ser Leu Ala  Tyr Arg Ser
    1355                1360                1365

Glu Arg  Val Lys Ile Lys Ser  Ile Asp Asp Val Lys  Gln Val Leu
    1370                1375                1380

Asp Lys  Asp Ser Asn Phe Ile  Ile Gly Lys Ile Thr  Leu Pro Phe
    1385                1390                1395

Lys Lys  Glu Trp Gln Arg Leu  Tyr Arg Glu Trp Gln  Asn Thr Thr
    1400                1405                1410

Ile Lys  Asp Asp Tyr Glu Phe  Leu Lys Ser Phe Phe  Asn Val Lys
    1415                1420                1425

Ser Ile  Thr Lys Leu His Lys  Lys Val Arg Lys Asp  Phe Ser Leu
    1430                1435                1440

Pro Ile  Ser Thr Asn Glu Gly  Lys Phe Leu Val Lys  Arg Lys Thr
    1445                1450                1455

Trp Asp  Asn Asn Phe Ile Tyr  Gln Ile Leu Asn Asp  Ser Asp Ser
    1460                1465                1470

Arg Val  Asp Gly Thr Lys Pro  Phe Ile Pro Ala Phe  Asp Ile Ser
    1475                1480                1485

Lys Asn  Glu Ile Val Glu Ala  Ile Ile Asp Ser Phe  Thr Ser Lys
    1490                1495                1500

Asn Ile  Phe Trp Leu Pro Lys  Asn Ile Glu Leu Gln  Lys Val Asp
    1505                1510                1515
```

```
Asn Lys  Asn Ile Phe Ala Ile  Asp Thr Ser Lys Trp  Phe Glu Val
    1520                1525                1530


Glu Thr  Pro Ser Asp Leu Arg  Asp Ile Gly Val Ala  Thr Ile Gln
    1535                1540                1545


Tyr Lys  Ile Asp Asn Asn Ser  Arg Pro Lys Val Arg  Val Lys Leu
    1550                1555                1560


Asp Tyr  Val Ile Asp Asp Asp  Ser Lys Ile Asn Tyr  Phe Thr Asn
    1565                1570                1575


His Ser  Leu Leu Lys Ser Arg  Tyr Pro Asp Lys Val  Leu Glu Ile
    1580                1585                1590


Leu Lys  Gln Ser Thr Ile Ile  Glu Phe Glu Ser Ser  Gly Phe Asn
    1595                1600                1605


Lys Thr  Ile Lys Glu Met Leu  Gly Met Thr Leu Ala  Gly Ile Tyr
    1610                1615                1620


Asn Glu  Thr Ser Asn Asn
    1625


<210>  434
<211>  1629
<212>  PRT
<213>  Francisella novicida

<400>  434

Met Asn Phe Lys Ile Leu Pro Ile Ala Ile Asp Leu Gly Val Lys Asn
1               5                  10                  15


Thr Gly Val Phe Ser Ala Phe Tyr Gln Lys Gly Thr Ser Leu Glu Arg
            20                  25                  30


Leu Asp Asn Lys Asn Gly Lys Val Tyr Glu Leu Ser Lys Asp Ser Tyr
```

```
        35                  40                  45

Thr Leu Leu Met Asn Asn Arg Thr Ala Arg Arg His Gln Arg Arg Gly
    50                  55                  60

Ile Asp Arg Lys Gln Leu Val Lys Arg Leu Phe Lys Leu Ile Trp Thr
65                  70                  75                  80

Glu Gln Leu Asn Leu Glu Trp Asp Lys Asp Thr Gln Gln Ala Ile Ser
                85                  90                  95

Phe Leu Phe Asn Arg Arg Gly Phe Ser Phe Ile Thr Asp Gly Tyr Ser
            100                 105                 110

Pro Glu Tyr Leu Asn Ile Val Pro Glu Gln Val Lys Ala Ile Leu Met
        115                 120                 125

Asp Ile Phe Asp Asp Tyr Asn Gly Glu Asp Asp Leu Asp Ser Tyr Leu
    130                 135                 140

Lys Leu Ala Thr Glu Gln Glu Ser Lys Ile Ser Glu Ile Tyr Asn Lys
145                 150                 155                 160

Leu Met Gln Lys Ile Leu Glu Phe Lys Leu Met Lys Leu Cys Thr Asp
                165                 170                 175

Ile Lys Asp Asp Lys Val Ser Thr Lys Thr Leu Lys Glu Ile Thr Ser
            180                 185                 190

Tyr Glu Phe Glu Leu Leu Ala Asp Tyr Leu Ala Asn Tyr Ser Glu Ser
        195                 200                 205

Leu Lys Thr Gln Lys Phe Ser Tyr Thr Asp Lys Gln Gly Asn Leu Lys
    210                 215                 220

Glu Leu Ser Tyr Tyr His His Asp Lys Tyr Asn Ile Gln Glu Phe Leu
225                 230                 235                 240
```

```
Lys Arg His Ala Thr Ile Asn Asp Arg Ile Leu Asp Thr Leu Leu Thr
               245                 250                 255

Asp Asp Leu Asp Ile Trp Asn Phe Asn Phe Glu Lys Phe Asp Phe Asp
            260                 265                 270

Lys Asn Glu Glu Lys Leu Gln Asn Gln Glu Asp Lys Asp His Ile Gln
        275                 280                 285

Ala His Leu His His Phe Val Phe Ala Val Asn Lys Ile Lys Ser Glu
    290                 295                 300

Met Ala Ser Gly Gly Arg His Arg Ser Gln Tyr Phe Gln Glu Ile Thr
305                 310                 315                 320

Asn Val Leu Asp Glu Asn Asn His Gln Glu Gly Tyr Leu Lys Asn Phe
               325                 330                 335

Cys Glu Asn Leu His Asn Lys Lys Tyr Ser Asn Leu Ser Val Lys Asn
            340                 345                 350

Leu Val Asn Leu Ile Gly Asn Leu Ser Asn Leu Glu Leu Lys Pro Leu
        355                 360                 365

Arg Lys Tyr Phe Asn Asp Lys Ile His Ala Lys Ala Asp His Trp Asp
    370                 375                 380

Glu Gln Lys Phe Thr Glu Thr Tyr Cys His Trp Ile Leu Gly Glu Trp
385                 390                 395                 400

Arg Val Gly Val Lys Asp Gln Asp Lys Lys Asp Gly Ala Lys Tyr Ser
               405                 410                 415

Tyr Lys Asp Leu Cys Asn Glu Leu Lys Gln Lys Val Thr Lys Ala Gly
            420                 425                 430

Leu Val Asp Phe Leu Leu Glu Leu Asp Pro Cys Arg Thr Ile Pro Pro
```

```
        435                 440                 445

Tyr Leu Asp Asn Asn Asn Arg Lys Pro Pro Lys Cys Gln Ser Leu Ile
    450                 455                 460

Leu Asn Pro Lys Phe Leu Asp Asn Gln Tyr Pro Asn Trp Gln Gln Tyr
465                 470                 475                 480

Leu Gln Glu Leu Lys Lys Leu Gln Ser Ile Gln Asn Tyr Leu Asp Ser
                485                 490                 495

Phe Glu Thr Asp Leu Lys Val Leu Lys Ser Ser Lys Asp Gln Pro Tyr
            500                 505                 510

Phe Val Glu Tyr Lys Ser Ser Asn Gln Gln Ile Ala Ser Gly Gln Arg
        515                 520                 525

Asp Tyr Lys Asp Leu Asp Ala Arg Ile Leu Gln Phe Ile Phe Asp Arg
    530                 535                 540

Val Lys Ala Ser Asp Glu Leu Leu Leu Asn Glu Ile Tyr Phe Gln Ala
545                 550                 555                 560

Lys Lys Leu Lys Gln Lys Ala Ser Ser Glu Leu Glu Lys Leu Glu Ser
                565                 570                 575

Ser Lys Lys Leu Asp Glu Val Ile Ala Asn Ser Gln Leu Ser Gln Ile
            580                 585                 590

Leu Lys Ser Gln His Thr Asn Gly Ile Phe Glu Gln Gly Thr Phe Leu
        595                 600                 605

His Leu Val Cys Lys Tyr Tyr Lys Gln Arg Gln Arg Ala Arg Asp Ser
    610                 615                 620

Arg Leu Tyr Ile Met Pro Glu Tyr Arg Tyr Asp Lys Lys Leu His Lys
625                 630                 635                 640
```

```
Tyr Asn Asn Thr Gly Arg Phe Asp Asp Asp Asn Gln Leu Leu Thr Tyr
                645                 650                 655

Cys Asn His Lys Pro Arg Gln Lys Arg Tyr Gln Leu Leu Asn Asp Leu
            660                 665                 670

Ala Gly Val Leu Gln Val Ser Pro Asn Phe Leu Lys Asp Lys Ile Gly
        675                 680                 685

Ser Asp Asp Asp Leu Phe Ile Ser Lys Trp Leu Val Glu His Ile Arg
    690                 695                 700

Gly Phe Lys Lys Ala Cys Glu Asp Ser Leu Lys Ile Gln Lys Asp Asn
705                 710                 715                 720

Arg Gly Leu Leu Asn His Lys Ile Asn Ile Ala Arg Asn Thr Lys Gly
                725                 730                 735

Lys Cys Glu Lys Glu Ile Phe Asn Leu Ile Cys Lys Ile Glu Gly Ser
            740                 745                 750

Glu Asp Lys Lys Gly Asn Tyr Lys His Gly Leu Ala Tyr Glu Leu Gly
        755                 760                 765

Val Leu Leu Phe Gly Glu Pro Asn Glu Ala Ser Lys Pro Glu Phe Asp
    770                 775                 780

Arg Lys Ile Lys Lys Phe Asn Ser Ile Tyr Ser Phe Ala Gln Ile Gln
785                 790                 795                 800

Gln Ile Ala Phe Ala Glu Arg Lys Gly Asn Ala Asn Thr Cys Ala Val
                805                 810                 815

Cys Ser Ala Asp Asn Ala His Arg Met Gln Gln Ile Lys Ile Thr Glu
            820                 825                 830

Pro Val Glu Asp Asn Lys Asp Lys Ile Ile Leu Ser Ala Lys Ala Gln
```

```
        835                 840                 845

Arg Leu Pro Ala Ile Pro Thr Arg Ile Val Asp Gly Ala Val Lys Lys
    850                 855                 860

Met Ala Thr Ile Leu Ala Lys Asn Ile Val Asp Asp Asn Trp Gln Asn
865                 870                 875                 880

Ile Lys Gln Val Leu Ser Ala Lys His Gln Leu His Ile Pro Ile Ile
                885                 890                 895

Thr Glu Ser Asn Ala Phe Glu Phe Glu Pro Ala Leu Ala Asp Val Lys
            900                 905                 910

Gly Lys Ser Leu Lys Asp Arg Arg Lys Lys Ala Leu Glu Arg Ile Ser
        915                 920                 925

Pro Glu Asn Ile Phe Lys Asp Lys Asn Asn Arg Ile Lys Glu Phe Ala
    930                 935                 940

Lys Gly Ile Ser Ala Tyr Ser Gly Ala Asn Leu Thr Asp Gly Asp Phe
945                 950                 955                 960

Asp Gly Ala Lys Glu Glu Leu Asp His Ile Ile Pro Arg Ser His Lys
                965                 970                 975

Lys Tyr Gly Thr Leu Asn Asp Glu Ala Asn Leu Ile Cys Val Thr Arg
            980                 985                 990

Gly Asp Asn Lys Asn Lys Gly Asn  Arg Ile Phe Cys Leu  Arg Asp Leu
        995                 1000                1005

Ala Asp  Asn Tyr Lys Leu Lys  Gln Phe Glu Thr Thr  Asp Asp Leu
    1010                1015                1020

Glu Ile  Glu Lys Lys Ile Ala  Asp Thr Ile Trp Asp  Ala Asn Lys
    1025                1030                1035
```

```
Lys Asp  Phe Lys Phe Gly Asn  Tyr Arg Ser Phe Ile  Asn Leu Thr
    1040                1045                1050

Pro Gln  Glu Gln Lys Ala Phe  Arg His Ala Leu Phe  Leu Ala Asp
    1055                1060                1065

Glu Asn  Pro Ile Lys Gln Ala  Val Ile Arg Ala Ile  Asn Asn Arg
    1070                1075                1080

Asn Arg  Thr Phe Val Asn Gly  Thr Gln Arg Tyr Phe  Ala Glu Val
    1085                1090                1095

Leu Ala  Asn Asn Ile Tyr Leu  Arg Ala Lys Lys Glu  Asn Leu Asn
    1100                1105                1110

Thr Asp  Lys Ile Ser Phe Asp  Tyr Phe Gly Ile Pro  Thr Ile Gly
    1115                1120                1125

Asn Gly  Arg Gly Ile Ala Glu  Ile Arg Gln Leu Tyr  Glu Lys Val
    1130                1135                1140

Asp Ser  Asp Ile Gln Ala Tyr  Ala Lys Gly Asp Lys  Pro Gln Ala
    1145                1150                1155

Ser Tyr  Ser His Leu Ile Asp  Ala Met Leu Ala Phe  Cys Ile Ala
    1160                1165                1170

Ala Asp  Glu His Arg Asn Asp  Gly Ser Ile Gly Leu  Glu Ile Asp
    1175                1180                1185

Lys Asn  Tyr Ser Leu Tyr Pro  Leu Asp Lys Asn Thr  Gly Glu Val
    1190                1195                1200

Phe Thr  Lys Asp Ile Phe Ser  Gln Ile Lys Ile Thr  Asp Asn Glu
    1205                1210                1215

Phe Ser  Asp Lys Lys Leu Val  Arg Lys Lys Ala Ile  Glu Gly Phe
```

```
    1220                1225                1230

Asn Thr  His Arg Gln Met Thr  Arg Asp Gly Ile Tyr  Ala Glu Asn
    1235                1240                1245

Tyr Leu  Pro Ile Leu Ile His  Lys Glu Leu Asn Glu  Val Arg Lys
    1250                1255                1260

Gly Tyr  Thr Trp Lys Asn Ser  Glu Glu Ile Lys Ile  Phe Lys Gly
    1265                1270                1275

Lys Lys  Tyr Asp Ile Gln Gln  Leu Asn Asn Leu Val  Tyr Cys Leu
    1280                1285                1290

Lys Phe  Val Asp Lys Pro Ile  Ser Ile Asp Ile Gln  Ile Ser Thr
    1295                1300                1305

Leu Glu  Glu Leu Arg Asn Ile  Leu Thr Thr Asn Asn  Ile Ala Ala
    1310                1315                1320

Thr Ala  Glu Tyr Tyr Tyr Ile  Asn Leu Lys Thr Gln  Lys Leu His
    1325                1330                1335

Glu Tyr  Tyr Ile Glu Asn Tyr  Asn Thr Ala Leu Gly  Tyr Lys Lys
    1340                1345                1350

Tyr Ser  Lys Glu Met Glu Phe  Leu Arg Ser Leu Ala  Tyr Arg Ser
    1355                1360                1365

Glu Arg  Val Lys Ile Lys Ser  Ile Asp Asp Val Lys  Gln Val Leu
    1370                1375                1380

Asp Lys  Asp Ser Asn Phe Ile  Ile Gly Lys Ile Thr  Leu Pro Phe
    1385                1390                1395

Lys Lys  Glu Trp Gln Arg Leu  Tyr Arg Glu Trp Gln  Asn Thr Thr
    1400                1405                1410
```

```
Ile Lys  Asp Asp Tyr Glu Phe  Leu Lys Ser Phe Phe  Asn Val Lys
    1415                1420                1425

Ser Ile  Thr Lys Leu His Lys  Lys Val Arg Lys Asp  Phe Ser Leu
    1430                1435                1440

Pro Ile  Ser Thr Asn Glu Gly  Lys Phe Leu Val Lys  Arg Lys Thr
    1445                1450                1455

Trp Asp  Asn Asn Phe Ile Tyr  Gln Ile Leu Asn Asp  Ser Asp Ser
    1460                1465                1470

Arg Val  Asp Gly Thr Lys Pro  Phe Ile Pro Ala Phe  Asp Ile Ser
    1475                1480                1485

Lys Asn  Glu Ile Val Glu Ala  Ile Ile Asp Ser Phe  Thr Ser Lys
    1490                1495                1500

Asn Ile  Phe Trp Leu Pro Lys  Asn Ile Glu Leu Gln  Lys Val Asp
    1505                1510                1515

Asn Lys  Asn Ile Phe Ala Ile  Asp Thr Ser Lys Trp  Phe Glu Val
    1520                1525                1530

Glu Thr  Pro Ser Asp Leu Arg  Asp Ile Gly Val Ala  Thr Ile Gln
    1535                1540                1545

Tyr Lys  Ile Asp Asn Asn Ser  Arg Pro Lys Val Arg  Val Lys Leu
    1550                1555                1560

Asp Tyr  Val Ile Asp Asp Asp  Ser Lys Ile Asn Tyr  Phe Thr Asn
    1565                1570                1575

His Ser  Leu Leu Lys Ser Arg  Tyr Pro Asp Lys Val  Leu Glu Ile
    1580                1585                1590

Leu Lys  Gln Ser Thr Thr Ile  Glu Phe Glu Ser Ser  Gly Phe Asn
```

```
    1595                1600                1605

Lys Thr  Ile Lys Glu Met Leu  Gly Met Thr Leu Ala  Gly Ile Tyr
    1610                1615                1620

Asn Glu  Thr Ser Asn Asn
    1625
```

<210> 435
<211> 244
<212> PRT
<213> Francisella tularensis

<400> 435

```
Ala Arg Lys Gln Asn Ser Glu Ile Tyr Asn Lys Leu Met Gln Lys Ile
1               5                   10                  15

Leu Glu Phe Lys Leu Arg Lys Leu Cys Thr Asp Ile Lys Asp Asp Lys
            20                  25                  30

Val Ser Thr Lys Thr Leu Lys Glu Ile Thr Ser Tyr Glu Phe Glu Leu
        35                  40                  45

Leu Ala Asp Tyr Leu Ala Asn Tyr Ser Glu Ser Leu Lys Thr Gln Lys
    50                  55                  60

Phe Ser Tyr Thr Asp Lys Gln Gly Asn Leu Lys Glu Leu Ser Tyr Tyr
65                  70                  75                  80

His His Asp Lys Tyr Asn Ile Gln Glu Phe Leu Lys Arg His Ala Thr
                85                  90                  95

Ile Asn Asp Glu Ile Leu Asp Thr Leu Leu Thr Asp Asp Phe Asp Ile
            100                 105                 110

Trp Asn Phe Asn Phe Glu Lys Phe Asp Phe Asp Lys Asn Glu Glu Lys
        115                 120                 125
```

```
Leu Gln Asn Gln Glu Asp Lys Asp His Thr Gln Ala Tyr Leu His His
    130                 135                 140

Phe Val Phe Ala Val Asn Lys Ile Lys Ser Glu Met Ala Ser Gly Gly
145                 150                 155                 160

Arg His Arg Ser Gln Tyr Phe Gln Glu Ile Thr Asn Val Leu Asp Glu
                165                 170                 175

Asn Asn His Gln Glu Gly Tyr Leu Lys Asn Phe Cys Glu Asn Leu His
            180                 185                 190

Asn Lys Lys Tyr Ser Asn Leu Ser Val Lys Asn Leu Val Asn Leu Val
        195                 200                 205

Gly Asn Leu Ser Asn Leu Glu Leu Lys Pro Leu Arg Lys Tyr Phe Asn
    210                 215                 220

Asp Lys Asn Leu Ile Ile Gly Met Ser Lys Ser Leu Gln Lys Leu Ile
225                 230                 235                 240

Ala Thr Gly Tyr
```

<210> 436
<211> 501
<212> PRT
<213> Francisella tularensis

<400> 436

```
Met Glu Ile Glu Lys Lys Ile Ala Asp Thr Ile Trp Asp Ala Ser Lys
1               5                   10                  15

Gln Asp Phe Lys Phe Gly Asn Tyr Arg Ser Phe Ile Asn Leu Thr Pro
            20                  25                  30

Gln Glu Gln Lys Ala Phe Arg Tyr Ala Leu Phe Leu Ala Asp Glu Asn
        35                  40                  45
```

```
Ser Ile Lys Gln Ala Val Ile Arg Ala Ile Asn Asn Arg Asn Arg Thr
    50                  55                  60

Phe Val Asn Gly Thr Gln Arg Tyr Phe Ala Glu Val Leu Ala Asn Asn
65                  70                  75                  80

Ile Tyr Leu Arg Ala Lys Lys Glu Asn Leu Asn Thr Asp Lys Ile Ser
                85                  90                  95

Phe Asp Tyr Phe Gly Ile Pro Thr Ile Gly Asn Gly Arg Gly Ile Ala
            100                 105                 110

Asp Ile Arg Gln Leu Tyr Glu Lys Val Asp Ser Asp Ile Gln Ala Tyr
        115                 120                 125

Ala Lys Gly Asp Lys Pro Gln Ala Ser Tyr Ser His Leu Ile Asp Ala
    130                 135                 140

Met Ile Ala Phe Cys Val Ala Ala Asp Glu His Arg Asn Asp Gly Ser
145                 150                 155                 160

Ile Gly Leu Glu Ile Asp Lys Asn Tyr Ser Leu Tyr Leu Leu Asp Lys
                165                 170                 175

Asn Thr Gly Glu Val Phe Thr Lys Asp Ile Phe Ser Gln Ile Lys Ile
            180                 185                 190

Thr Asp Asn Glu Phe Ser Asp Lys Lys Leu Val Arg Lys Lys Ala Thr
        195                 200                 205

Glu Gly Phe Asn Thr His Arg Gln Met Thr Arg Asp Gly Ile Tyr Ala
    210                 215                 220

Glu Asn Tyr Leu Pro Ile Leu Ile His Lys Glu Leu Asp Glu Val Arg
225                 230                 235                 240

Lys Gly Tyr Thr Trp Gly Asn Ser Glu Glu Leu Lys Ile His Lys Gly
```

```
                245                 250                 255

Lys Lys Tyr Asn Ile Gln Gln Leu Asn Asn Ile Val Tyr Cys Leu Lys
            260                 265                 270

Phe Ile Asp Lys Ser Ile Ser Ile Asp Ile Gln Ile Ser Thr Leu Glu
        275                 280                 285

Glu Leu Arg Asn Ile Leu Thr Thr Asn Asn Ile Ala Ala Thr Ala Glu
    290                 295                 300

Tyr Tyr Tyr Ile Asn Leu Lys Asn Gln Lys Leu His Glu Tyr Tyr Ile
305                 310                 315                 320

Glu Asn Tyr Asn Thr Ala Leu Asp Tyr Lys Lys Tyr Ser Lys Glu Met
                325                 330                 335

Glu Phe Leu Arg Ser Leu Ala Tyr Arg Ser Glu Arg Val Lys Ile Lys
            340                 345                 350

Ser Ile Asp Asp Val Lys Gln Val Leu Asp Lys Asp Ser Asn Phe Ile
        355                 360                 365

Ile Gly Lys Ile Thr Leu Pro Phe Lys Lys Glu Trp Gln Arg Leu Tyr
    370                 375                 380

Leu Glu Trp Gln Asn Thr Thr Ile Lys Asp Asp Tyr Glu Phe Leu Lys
385                 390                 395                 400

Ser Phe Phe Asn Val Lys Ser Ile Thr Lys Leu His Lys Lys Val Arg
                405                 410                 415

Lys Asp Phe Ser Leu Pro Ile Ser Thr Asn Glu Gly Lys Phe Leu Val
            420                 425                 430

Lys Arg Lys Thr Trp Asp Asn Asn Phe Ile Tyr Gln Ile Leu Asn Asp
        435                 440                 445
```

```
Ser Asp Ser Arg Val Asp Gly Thr Lys Pro Phe Ile Pro Ala Phe Asp
    450                 455                 460

Ile Ser Lys Asn Glu Ile Val Glu Ala Ile Ile Asp Ser Phe Thr Ser
465                 470                 475                 480

Lys Asn Ile Phe Trp Leu Pro Lys Asn Ile Glu Leu Gln Asn Val Asp
                485                 490                 495

Lys Ile Phe Leu Leu
            500
```

<210> 437
<211> 158
<212> PRT
<213> Francisella tularensis

<400> 437

```
Met Ile Asp Phe Leu Leu Glu Leu Asp Pro Cys Ile Thr Ile Pro Pro
1               5                   10                  15

Tyr Leu Asp Asn Asn Asn Arg Lys Pro Pro Lys Cys Gln Ser Leu Ile
            20                  25                  30

Leu Asn Pro Lys Phe Leu Asp Asn Gln Tyr Pro Asn Trp Gln Gln Tyr
        35                  40                  45

Leu Gln Glu Leu Lys Lys Leu Gln Ser Ile Gln Asp Tyr Leu Asp Ser
    50                  55                  60

Phe Glu Thr Asp Leu Lys Asp Leu Lys Ser Ser Lys Asp Gln Pro Tyr
65                  70                  75                  80

Phe Val Glu Tyr Lys Ser Ser Asn Gln Gln Met Ala Ser Gly Gln Arg
                85                  90                  95

Asp Tyr Lys Asp Leu Asp Ala Arg Ile Leu Gln Phe Ile Phe Asp Arg
            100                 105                 110
```

```
Val Lys Ala Ser Asp Glu Leu Leu Leu Asn Glu Ile Tyr Phe Gln Ala
        115                 120                 125


Lys Lys Leu Lys Gln Lys Ala Ser Ser Glu Leu Glu Lys Leu Glu Ser
    130                 135                 140


Ser Lys Lys Leu Asp Glu Val Ile Ala Asn Ser Gln Leu Ser
145                 150                 155


<210>  438
<211>  878
<212>  PRT
<213>  Francisella tularensis

<400>  438

Met Leu Asn Asp Leu Ala Gly Val Leu Gln Val Ser Arg Asn Gln Leu
1               5                   10                  15


Leu Ser Ser Val Glu Glu Trp Phe Gln Gln Ala Gln Arg Val Gly Glu
            20                  25                  30


Ile Ser Lys Ser Gln Asp Glu Gln Ile Phe Glu Trp Leu Lys Ser Phe
        35                  40                  45


Lys Ile Ala Ser Tyr Cys Lys Ala Ala Val Glu Met Gln Lys Gln Tyr
    50                  55                  60


Arg Gly Thr Leu Lys Asn Ala Ile Gln Thr Ala Ile Phe Arg Gln Ser
65                  70                  75                  80


Glu Asn Ile Asn Lys Asn Lys Asn Lys Asn Lys Asn Thr Gly Asn Gln
                85                  90                  95


Gln Gln Ala Leu Ser Glu Asn Ser Lys Asp Val Lys Ser Leu Thr Ala
            100                 105                 110


Asp Glu Lys Lys Leu Leu Lys Leu Ile Glu Asn Ile Ala Lys Ala Ser
```

```
        115                 120                 125

Gln Lys Ile Gly Glu Ser Leu Gly Leu Asn Asp Lys Gln Ile Lys Lys
    130                 135                 140

Phe Asn Ser Ile Tyr Asn Phe Ala Gln Ile Gln Gln Ile Ala Phe Ala
145                 150                 155                 160

Glu Arg Lys Gly Asn Ala Asn Thr Cys Ala Val Tyr Ser Ala Asp Asn
                165                 170                 175

Ala His Arg Met Gln Gln Ile Lys Ile Thr Glu Leu Val Glu Asp Asn
            180                 185                 190

Lys Asp Asn Ile Ile Leu Ser Ala Lys Ala Gln Arg Leu Pro Ala Ile
        195                 200                 205

Pro Thr Arg Ile Val Asp Gly Ala Val Lys Lys Met Ala Thr Ile Leu
    210                 215                 220

Ala Lys Asn Ile Val Asp Asp Asn Trp Gln Asn Ile Lys Gln Val Leu
225                 230                 235                 240

Ser Ala Lys His Gln Leu His Ile Pro Ile Ile Thr Glu Ser Asn Ala
                245                 250                 255

Phe Glu Phe Glu Pro Ala Leu Ala Asp Val Lys Gly Lys Ser Leu Lys
            260                 265                 270

Asp Arg Arg Lys Lys Ala Leu Glu Arg Ile Ser Pro Glu Asn Ile Phe
        275                 280                 285

Lys Asp Lys Asn Asn Arg Ile Lys Glu Phe Ala Lys Gly Ile Ser Ala
    290                 295                 300

Tyr Ser Gly Ala Asn Leu Thr Asp Gly Asp Phe Asp Gly Ala Lys Glu
305                 310                 315                 320
```

```
Glu Leu Asp His Ile Ile Pro Arg Ser Tyr Lys Lys Tyr Gly Thr Leu
               325                 330                 335

Asn Asp Glu Val Asn Leu Ile Cys Val Thr Arg Asp Asp Asn Lys Asn
            340                 345                 350

Lys Gly Lys Arg Ile Phe Cys Leu Asn Asp Leu Ala Asn Asn Tyr Lys
        355                 360                 365

Leu Lys Gln Phe Glu Thr Thr Asp Asp Leu Glu Ile Glu Lys Lys Ile
    370                 375                 380

Ala Asp Thr Ile Trp Asp Ala Ser Lys Gln Asp Phe Lys Phe Gly Asn
385                 390                 395                 400

Tyr Arg Ser Phe Ile Asn Leu Ile Pro Gln Glu Gln Lys Ala Phe Arg
               405                 410                 415

Tyr Ala Leu Phe Leu Ala Asp Glu Asn Ser Ile Lys Gln Ala Val Ile
            420                 425                 430

Arg Ala Ile Asn Asn Arg Asn Arg Thr Phe Val Asn Gly Thr Gln Arg
        435                 440                 445

Tyr Phe Ala Glu Val Leu Ala Asn Asn Ile Tyr Leu Arg Ala Lys Lys
    450                 455                 460

Glu Asn Leu Asn Thr Asp Lys Ile Ser Phe Asp Tyr Phe Gly Ile Pro
465                 470                 475                 480

Thr Ile Gly Asn Gly Arg Gly Ile Ala Asp Ile Arg Gln Leu Tyr Glu
               485                 490                 495

Lys Val Asp Ser Asp Ile Gln Ala Tyr Ala Lys Gly Asp Lys Pro Gln
            500                 505                 510

Ala Ser Tyr Ser His Leu Ile Asp Ala Met Ile Ala Phe Cys Val Ala
```

```
        515                 520                 525

Ala Asp Glu His Arg Asn Asp Gly Ser Ile Gly Leu Glu Ile Asp Lys
    530                 535                 540

Asn Tyr Ser Leu Tyr Pro Leu Asp Lys Asn Thr Gly Glu Val Phe Thr
545                 550                 555                 560

Lys Asp Ile Phe Ser Gln Ile Lys Ile Thr Asp Asn Glu Phe Ser Asp
                565                 570                 575

Lys Lys Leu Val Arg Lys Lys Ala Thr Glu Gly Phe Asn Thr His Arg
            580                 585                 590

Gln Met Thr Arg Asp Gly Ile Tyr Ala Glu Asn Tyr Leu Pro Ile Leu
        595                 600                 605

Ile His Lys Glu Leu Asp Glu Val Arg Lys Gly Tyr Thr Trp Gly Asn
    610                 615                 620

Ser Glu Glu Leu Lys Ile His Lys Gly Lys Lys Tyr Asn Ile Gln Gln
625                 630                 635                 640

Leu Asn Asn Ile Val Tyr Cys Leu Lys Phe Ile Asp Lys Ser Ile Ser
                645                 650                 655

Ile Asp Ile Gln Ile Ser Thr Leu Glu Glu Leu Arg Asn Ile Leu Thr
            660                 665                 670

Thr Asn Asn Ile Ala Ala Thr Ala Glu Tyr Tyr Tyr Ile Asn Leu Lys
        675                 680                 685

Asn Gln Lys Leu His Glu Tyr Tyr Ile Glu Asn Tyr Asn Thr Ala Leu
    690                 695                 700

Asp Tyr Lys Lys Tyr Ser Lys Glu Met Glu Phe Leu Arg Ser Leu Ala
705                 710                 715                 720
```

```
Tyr Arg Ser Glu Arg Val Lys Ile Lys Ser Ile Asp Asp Val Lys Gln
                725                 730                 735

Val Leu Asp Lys Asp Ser Asn Phe Ile Ile Gly Lys Ile Thr Leu Pro
            740                 745                 750

Phe Lys Lys Glu Trp Gln Arg Leu Tyr Leu Glu Trp Gln Asn Thr Thr
        755                 760                 765

Ile Lys Asp Asp Tyr Glu Phe Leu Lys Ser Phe Phe Asn Val Lys Ser
    770                 775                 780

Ile Asn Lys Leu His Lys Lys Val Arg Lys Asp Phe Ser Leu Pro Ile
785                 790                 795                 800

Ser Thr Asn Glu Gly Lys Phe Leu Val Lys Arg Lys Thr Trp Asp Asn
                805                 810                 815

Asn Phe Ile Tyr Gln Ile Leu Asn Asp Ser Asp Ser Arg Val Asp Gly
            820                 825                 830

Thr Lys Pro Phe Ile Pro Ala Phe Asp Ile Ser Lys Asn Glu Ile Val
        835                 840                 845

Glu Ala Ile Ile Asp Ser Phe Thr Ser Lys Asn Ile Phe Trp Leu Pro
    850                 855                 860

Lys Asn Ile Glu Leu Gln Lys Val Asp Lys Ile Phe Leu Leu
865                 870                 875
```

<210> 439
<211> 292
<212> PRT
<213> Francisella tularensis

<400> 439

```
Met Leu Asn Asp Leu Ala Gly Val Leu Gln Val Ser Arg Asn Gln Leu
1               5                   10                  15
```

```
Leu Ser Ser Val Glu Glu Trp Phe Gln Gln Ala Gln Arg Val Gly Glu
            20                  25                  30

Ile Ser Lys Ser Gln Asp Glu Gln Ile Phe Glu Trp Leu Lys Ser Phe
        35                  40                  45

Lys Ile Ala Ser Tyr Cys Lys Ala Ala Val Glu Met Gln Lys Gln Tyr
    50                  55                  60

Arg Gly Thr Leu Lys Asn Ala Ile Gln Thr Ala Ile Phe Arg Gln Ser
65                  70                  75                  80

Glu Asn Ile Asn Lys Asn Lys Asn Lys Asn Thr Gly Asn Gln Gln Gln
                85                  90                  95

Ala Leu Ser Glu Asn Ser Lys Asp Val Lys Ser Leu Thr Ala Asp Glu
            100                 105                 110

Lys Lys Leu Leu Lys Leu Ile Glu Asn Ile Ala Lys Ala Ser Gln Lys
        115                 120                 125

Ile Gly Glu Ser Leu Gly Leu Asn Asp Lys Gln Ile Lys Lys Phe Asn
    130                 135                 140

Ser Ile Tyr Asn Phe Ala Gln Ile Gln Gln Ile Ala Phe Ala Glu Arg
145                 150                 155                 160

Lys Gly Asn Ala Asn Thr Cys Ala Val Tyr Ser Ala Asp Asn Ala His
                165                 170                 175

Arg Met Gln Gln Ile Lys Ile Thr Glu Leu Val Glu Asp Asn Lys Asp
            180                 185                 190

Asn Ile Ile Leu Ser Ala Lys Ala Gln Arg Leu Pro Ala Ile Pro Thr
        195                 200                 205
```

```
Arg Ile Val Asp Gly Ala Val Lys Lys Met Val Thr Ile Leu Ala Lys
    210                 215                 220

Asn Ile Val Asp Asp Asn Trp Gln Asn Ile Lys Gln Val Leu Ser Ala
225                 230                 235                 240

Lys His Gln Leu His Ile Pro Ile Ile Thr Glu Ser Asn Ala Phe Glu
                245                 250                 255

Phe Glu Pro Ala Leu Ala Asp Val Lys Gly Lys Ser Leu Lys Asp Arg
            260                 265                 270

Arg Lys Lys Ala Leu Glu Arg Ile Ser Pro Glu Asn Ile Phe Lys Asp
        275                 280                 285

Lys Asn Ile Cys
    290
```

<210> 440
<211> 53
<212> PRT
<213> Francisella tularensis

<400> 440

```
Met Asn His Ser Leu Leu Lys Ser Arg Tyr Pro Asp Lys Val Leu Glu
1               5                   10                  15

Ile Leu Lys Gln Ser Thr Ile Ile Glu Phe Glu Ser Ser Gly Phe Asn
            20                  25                  30

Lys Thr Ile Lys Glu Met Leu Gly Met Thr Leu Ala Gly Ile Tyr Asn
        35                  40                  45

Glu Thr Ser Asn Asn
    50
```

<210> 441
<211> 393
<212> PRT

<213> Francisella tularensis

<400> 441

```
Met Asn Val Lys Ile Leu Pro Ile Ala Ile Asp Leu Asp Val Lys Asn
1               5                  10                  15


Thr Gly Val Phe Ser Ala Phe Tyr Gln Lys Gly Thr Ser Leu Glu Lys
            20                  25                  30


Leu Asp Asn Lys Asn Gly Lys Val Tyr Glu Leu Ser Lys Asp Ser Tyr
        35                  40                  45


Thr Leu Leu Met Asn Asn Arg Thr Ala Gln Arg His Gln Arg Arg Gly
    50                  55                  60


Ile Asp Arg Lys Gln Leu Val Lys Arg Leu Phe Lys Leu Val Trp Thr
65                  70                  75                  80


Glu Gln Leu Asn Leu Glu Trp Asp Lys Asp Thr Gln Gln Ala Ile Ser
                85                  90                  95


Phe Leu Phe Asn Arg Arg Gly Phe Ser Phe Ile Thr Asp Gly Tyr Ser
            100                 105                 110


Thr Glu Tyr Leu Asn Ile Val Pro Glu Gln Val Lys Ala Ile Leu Met
        115                 120                 125


Asp Ile Phe Asp Asp Tyr Asn Gly Glu Asp Asp Leu Asp Ser Tyr Leu
    130                 135                 140


Lys Leu Ala Thr Glu Gln Glu Ser Lys Ile Ser Glu Ile Tyr Asn Lys
145                 150                 155                 160


Leu Met Gln Lys Ile Leu Glu Phe Lys Leu Arg Lys Leu Cys Thr Asp
                165                 170                 175


Ile Lys Asp Asp Lys Val Ser Thr Lys Thr Leu Lys Glu Ile Thr Ser
            180                 185                 190
```

```
Tyr Glu Phe Glu Leu Leu Ala Asp Tyr Leu Ala Asn Tyr Ser Glu Ser
        195                 200                 205

Leu Lys Thr Gln Lys Phe Ser Tyr Thr Asp Lys Gln Gly Asn Leu Lys
    210                 215                 220

Glu Leu Ser Tyr Tyr His His Asp Lys Tyr Asn Ile Gln Glu Phe Leu
225                 230                 235                 240

Lys Arg His Ala Thr Ile Asn Asp Glu Ile Leu Asp Thr Leu Leu Thr
                245                 250                 255

Asp Asp Phe Asp Ile Trp Asn Phe Asn Phe Glu Lys Phe Asp Phe Asp
            260                 265                 270

Lys Asn Glu Glu Lys Leu Gln Asn Gln Glu Asp Lys Asp His Thr Gln
        275                 280                 285

Ala Tyr Leu His His Phe Val Phe Ala Val Asn Lys Ile Lys Ser Glu
    290                 295                 300

Met Ala Ser Gly Gly Arg His Arg Ser Gln Tyr Phe Gln Glu Ile Thr
305                 310                 315                 320

Asn Val Leu Asp Glu Asn Asn His Gln Glu Gly Tyr Leu Lys Asn Phe
                325                 330                 335

Cys Glu Asn Leu His Asn Lys Lys Tyr Ser Asn Leu Ser Val Lys Asn
            340                 345                 350

Leu Val Asn Leu Val Gly Asn Leu Ser Asn Leu Glu Leu Lys Pro Leu
        355                 360                 365

Arg Lys Tyr Phe Asn Asp Lys Asn Leu Ile Ile Gly Met Ser Lys Ser
    370                 375                 380
```

```
Leu Gln Lys Leu Ile Ala Thr Gly Tyr
385                 390


<210>  442
<211>  1629
<212>  PRT
<213>  Francisella tularensis

<400>  442

Met Asn Val Lys Ile Leu Pro Ile Ala Ile Asp Leu Gly Val Lys Asn
1               5                   10                  15


Thr Gly Val Phe Ser Ala Phe Tyr Gln Lys Gly Thr Ser Leu Glu Arg
            20                  25                  30


Leu Asp Asn Lys Asn Gly Lys Val Tyr Glu Leu Ser Lys Asp Ser Tyr
        35                  40                  45


Thr Leu Leu Met Asn Asn Arg Thr Ala Arg Arg His Gln Arg Arg Gly
    50                  55                  60


Ile Asp Arg Lys Gln Leu Val Lys Arg Leu Phe Lys Leu Ile Trp Thr
65                  70                  75                  80


Glu Gln Leu Asn Leu Glu Trp Asp Lys Asp Thr Gln Gln Ala Ile Ser
                85                  90                  95


Phe Leu Phe Asn Arg Arg Gly Phe Ser Phe Ile Thr Asp Gly Tyr Ser
            100                 105                 110


Pro Glu Tyr Leu Asn Ile Val Pro Glu Gln Val Lys Ala Ile Leu Met
        115                 120                 125


Asp Ile Phe Asp Asp Tyr Asn Gly Glu Asp Asp Leu Asp Ser Tyr Leu
    130                 135                 140


Lys Leu Ala Thr Glu Gln Glu Ser Lys Ile Ser Glu Ile Tyr Asn Lys
145                 150                 155                 160
```

```
Leu Met Gln Lys Ile Leu Glu Phe Lys Leu Arg Lys Leu Cys Thr Asp
               165                 170                 175

Ile Lys Asp Asp Lys Val Ser Thr Lys Thr Leu Lys Glu Ile Thr Ser
            180                 185                 190

Tyr Glu Phe Glu Leu Leu Ala Asp Tyr Leu Ala Asn Tyr Ser Glu Ile
        195                 200                 205

Leu Lys Thr Gln Lys Phe Ser Tyr Thr Asp Lys Gln Gly Asn Leu Lys
    210                 215                 220

Glu Leu Ser Tyr Tyr His His Asp Lys Tyr Asn Ile Gln Glu Phe Leu
225                 230                 235                 240

Lys Arg His Ala Thr Ile Asn Asp Glu Ile Leu Asp Thr Leu Leu Thr
               245                 250                 255

Asp Asp Leu Asp Ile Trp Asn Phe Asn Phe Glu Lys Phe Asp Phe Asp
            260                 265                 270

Lys Asn Glu Glu Lys Leu Gln Asn Gln Glu Asp Lys Asp His Thr Gln
        275                 280                 285

Ala His Leu His His Phe Val Phe Ala Val Asn Lys Ile Lys Ser Glu
    290                 295                 300

Met Ala Ser Gly Gly Arg His Arg Gly Gln Tyr Phe Gln Glu Ile Thr
305                 310                 315                 320

Asn Val Leu Asp Glu Asn Asn His Gln Glu Gly Tyr Leu Lys Asn Phe
               325                 330                 335

Cys Glu Asn Leu His Asn Lys Lys Tyr Ser Asn Leu Ser Val Lys Asn
            340                 345                 350

Leu Val Asn Leu Ile Gly Asn Leu Ser Asn Leu Glu Leu Lys Pro Leu
```

```
        355                 360                 365

Arg Lys Tyr Phe Asn Asp Lys Ile His Ala Lys Ala Asp His Trp Asp
    370                 375                 380

Glu Gln Lys Phe Thr Glu Thr Tyr Cys His Trp Ile Leu Gly Glu Trp
385                 390                 395                 400

Arg Val Gly Val Lys Asp Gln Asp Lys Lys Asp Gly Ala Lys Tyr Ser
                405                 410                 415

Tyr Lys Asp Leu Cys Asn Glu Leu Lys Gln Lys Val Thr Lys Ala Gly
            420                 425                 430

Leu Val Asp Phe Leu Leu Glu Leu Asp Pro Cys Arg Thr Ile Pro Pro
        435                 440                 445

Tyr Leu Asp Asn Asn Asn Arg Lys Pro Pro Lys Cys Gln Ser Leu Ile
    450                 455                 460

Leu Asn Pro Lys Phe Leu Asp Asn Gln Tyr Pro Asn Trp Gln Gln Tyr
465                 470                 475                 480

Leu Gln Glu Leu Lys Lys Leu Gln Ser Ile Gln Asn Tyr Leu Glu Ser
                485                 490                 495

Phe Glu Thr Asp Leu Lys Val Leu Lys Ser Ser Lys Asp Gln Pro Tyr
            500                 505                 510

Phe Val Glu Tyr Lys Ser Ser Asn Gln Gln Ile Ala Ser Gly Gln Arg
        515                 520                 525

Asp Tyr Lys Asp Leu Asp Ala Arg Ile Leu Gln Phe Ile Phe Asp Arg
    530                 535                 540

Val Lys Ala Ser Asp Glu Leu Leu Leu Asn Glu Ile Tyr Phe Gln Ala
545                 550                 555                 560
```

```
Lys Lys Leu Lys Gln Lys Ala Ser Ser Glu Leu Glu Lys Leu Glu Ser
               565                 570                 575

Ser Lys Lys Leu Asp Glu Val Ile Ala Asn Ser Gln Leu Ser Gln Ile
            580                 585                 590

Leu Lys Ser Gln His Thr Asn Gly Ile Phe Glu Gln Gly Thr Phe Leu
        595                 600                 605

His Leu Val Cys Lys Tyr Tyr Lys Gln Arg Gln Arg Ala Arg Asp Ser
    610                 615                 620

Arg Leu Tyr Ile Met Pro Glu Tyr Arg Tyr Asp Lys Lys Leu Asp Lys
625                 630                 635                 640

Tyr Asn Asn Thr Gly Arg Phe Asp Asp Asp Asn Gln Leu Leu Thr Tyr
               645                 650                 655

Cys Asn His Lys Pro Arg Gln Lys Arg Tyr Gln Leu Leu Asn Asp Leu
            660                 665                 670

Ala Gly Val Leu Gln Val Ser Pro Asn Phe Leu Lys Asp Lys Ile Gly
        675                 680                 685

Ser Asp Asp Asp Leu Phe Ile Ser Lys Trp Leu Val Glu His Ile Arg
    690                 695                 700

Gly Phe Lys Lys Ala Cys Glu Asp Ser Leu Lys Ile Gln Lys Asp Asn
705                 710                 715                 720

Arg Gly Leu Leu Asn His Lys Ile Asn Ile Ala Arg Asn Thr Lys Gly
               725                 730                 735

Lys Cys Glu Lys Glu Ile Phe Asn Leu Ile Cys Lys Ile Glu Gly Ser
            740                 745                 750

Glu Asp Lys Lys Gly Asn Tyr Lys His Gly Leu Ala Tyr Glu Leu Gly
```

```
        755                 760                 765

Val Leu Leu Phe Gly Glu Pro Asn Glu Ala Ser Lys Pro Glu Phe Asp
    770                 775                 780

Arg Lys Ile Lys Lys Phe Asn Ser Ile Tyr Ser Phe Ala Gln Ile Gln
785                 790                 795                 800

Gln Ile Ala Phe Ala Glu Arg Lys Gly Asn Ala Asn Thr Cys Ala Val
                805                 810                 815

Cys Ser Ala Asp Asn Ala His Arg Met Gln Gln Ile Lys Ile Thr Glu
            820                 825                 830

Pro Val Glu Asp Asn Lys Asp Lys Ile Ile Leu Ser Ala Lys Ala Gln
        835                 840                 845

Arg Leu Pro Ala Ile Pro Thr Arg Ile Val Asp Gly Ala Val Lys Lys
    850                 855                 860

Met Ala Thr Ile Leu Ala Lys Asn Ile Val Asp Asp Asn Trp Gln Asn
865                 870                 875                 880

Ile Lys Gln Val Leu Ser Ala Lys His Gln Leu His Ile Pro Ile Ile
                885                 890                 895

Thr Glu Ser Asn Ala Phe Glu Phe Glu Pro Ala Leu Ala Asp Val Lys
            900                 905                 910

Gly Lys Ser Ile Lys Asp Arg Arg Lys Lys Ala Leu Glu Arg Ile Ser
        915                 920                 925

Pro Glu Asn Ile Phe Lys Asp Lys Asn Asn Arg Ile Lys Glu Phe Ala
    930                 935                 940

Lys Gly Ile Ser Ala Tyr Ser Gly Asp Asn Leu Ala Ser Gly Asp Phe
945                 950                 955                 960
```

```
Asp Gly Ala Lys Glu Glu Leu Asp His Ile Ile Pro Arg Ser His Lys
               965                 970                 975


Lys Tyr Gly Thr Leu Asn Asp Glu Ala Asn Leu Ile Cys Val Thr Arg
            980                 985                 990


Asp Asp Asn Lys Asn Lys Gly Asn  Arg Ile Phe Cys Leu  His Asp Leu
        995                 1000                1005


Ala Asn  Asn Tyr Lys Leu Lys  Gln Phe Glu Thr Thr  Asp Asp Leu
    1010                1015                1020


Glu Ile  Glu Lys Lys Ile Ala  Asp Thr Ile Trp Asp  Ala Ser Lys
    1025                1030                1035


Lys Asp  Phe Lys Phe Gly Asn  Tyr Arg Ser Phe Ile  Asn Leu Thr
    1040                1045                1050


Pro Gln  Glu Gln Lys Ala Phe  Arg His Ala Leu Phe  Leu Ala Asp
    1055                1060                1065


Glu Asn  Pro Ile Lys Gln Ala  Val Ile Arg Ala Ile  Asn Asn Arg
    1070                1075                1080


Asn Arg  Thr Phe Val Asn Gly  Thr Gln Arg Tyr Phe  Ala Glu Val
    1085                1090                1095


Leu Ala  Asn Asn Ile Tyr Leu  Arg Ala Lys Lys Glu  Asn Leu Asn
    1100                1105                1110


Thr Asp  Lys Ile Ser Phe Asp  Tyr Phe Gly Ile Pro  Thr Ile Gly
    1115                1120                1125


Asn Gly  Arg Gly Ile Val Glu  Ile Arg Gln Leu Tyr  Glu Lys Val
    1130                1135                1140


Asp Ser  Asp Ile Gln Ala Tyr  Ala Lys Gly Asp Lys  Pro Gln Ala
```

```
    1145                1150                1155

Ser Tyr  Ser His Leu Ile Asp  Ala Met Leu Ala Phe  Cys Ile Ala
    1160                1165                1170

Ala Asp  Glu His Arg Asn Asp  Gly Ser Ile Gly Leu  Glu Ile Asp
    1175                1180                1185

Lys Asn  Tyr Ser Leu Tyr Pro  Leu Asp Lys Asn Thr  Gly Glu Val
    1190                1195                1200

Phe Thr  Lys Asp Ile Phe Ser  Gln Ile Lys Ile Thr  Asn Asn Glu
    1205                1210                1215

Phe Ser  Asp Lys Lys Leu Val  Arg Lys Lys Ala Thr  Glu Gly Phe
    1220                1225                1230

Asn Thr  His Arg Gln Met Thr  Arg Asp Gly Ile Tyr  Ala Glu Asn
    1235                1240                1245

Tyr Leu  Pro Ile Leu Ile His  Lys Glu Leu Asp Glu  Val Arg Lys
    1250                1255                1260

Gly Tyr  Thr Trp Gly Asn Ser  Glu Glu Leu Lys Ile  His Lys Gly
    1265                1270                1275

Lys Lys  Tyr Asp Ile Gln Gln  Leu Asn Asn Leu Val  Tyr Cys Leu
    1280                1285                1290

Lys Phe  Ile Asp Lys Ser Ile  Ser Ile Asp Ile Gln  Ile Ser Thr
    1295                1300                1305

Leu Glu  Glu Leu Arg Asn Ile  Leu Thr Thr Asn Asn  Ile Ala Thr
    1310                1315                1320

Thr Ala  Glu Tyr Tyr Tyr Ile  Asn Leu Lys Thr Gln  Lys Leu His
    1325                1330                1335
```

```
Glu Tyr  Tyr Ile Glu Asn Tyr  Asn Thr Ala Leu Gly  Tyr Lys Lys
    1340                1345                1350

Tyr Thr  Lys Glu Met Glu Phe  Leu Arg Ser Leu Ala  Tyr Arg Ser
    1355                1360                1365

Glu Arg  Val Lys Ile Lys Ser  Ile Asp Asp Val Lys  Gln Val Leu
    1370                1375                1380

Asp Lys  Asp Ser Asn Phe Ile  Ile Gly Lys Ile Thr  Leu Pro Phe
    1385                1390                1395

Lys Lys  Glu Trp Gln Arg Leu  Tyr Arg Glu Trp Gln  Asn Thr Thr
    1400                1405                1410

Ile Lys  Asp Asp Tyr Glu Phe  Leu Lys Ser Phe Phe  Asn Val Lys
    1415                1420                1425

Ser Ile  Thr Lys Leu His Lys  Lys Val Arg Lys Asp  Phe Ser Leu
    1430                1435                1440

Pro Ile  Ser Thr Asn Glu Gly  Lys Phe Leu Val Lys  Arg Lys Thr
    1445                1450                1455

Trp Asp  Asn Asn Phe Ile Tyr  Gln Ile Leu Asn Asp  Ser Asp Ser
    1460                1465                1470

Arg Val  Asp Gly Thr Lys Pro  Phe Ile Pro Ala Phe  Asp Ile Ser
    1475                1480                1485

Lys Asn  Glu Ile Val Glu Ala  Ile Ile Asp Ser Phe  Thr Ser Lys
    1490                1495                1500

Asn Ile  Phe Trp Leu Pro Lys  Asn Ile Glu Leu Gln  Lys Val Asp
    1505                1510                1515

Asn Lys  Asn Ile Phe Ala Ile  Asp Thr Ser Lys Trp  Phe Glu Val
```

```
    1520                1525                1530

Glu Thr  Pro Ser Asp Leu Arg  Asp Ile Gly Val Ala  Thr Ile Gln
    1535                1540                1545

Tyr Lys  Ile Asp Asn Asn Ser  Arg Pro Lys Val Arg  Val Lys Leu
    1550                1555                1560

Asp Tyr  Val Ile Asp Asp Asp  Ser Lys Ile Asn Tyr  Phe Thr Asn
    1565                1570                1575

His Ser  Leu Leu Lys Ser Arg  Tyr Pro Asp Lys Val  Leu Glu Ile
    1580                1585                1590

Leu Lys  Gln Ser Thr Ile Ile  Glu Phe Glu Ser Ser  Gly Phe Asn
    1595                1600                1605

Lys Thr  Ile Lys Glu Met Leu  Gly Met Thr Leu Ala  Gly Ile Tyr
    1610                1615                1620

Asn Glu  Thr Ser Asn Asn
    1625
```

<210> 443
<211> 285
<212> PRT
<213> Francisella tularensis

<400> 443

```
Met Thr Arg Asp Gly Ile Tyr Ala Glu Asn Tyr Leu Pro Ile Leu Ile
1               5                   10                  15

His Lys Glu Leu Asp Glu Val Arg Lys Gly Tyr Thr Trp Gly Asn Ser
            20                  25                  30

Glu Glu Leu Lys Ile His Lys Gly Lys Lys Tyr Asn Ile Gln Gln Leu
        35                  40                  45
```

```
Asn Asn Ile Val Tyr Cys Leu Lys Phe Ile Asp Lys Ser Ile Ser Ile
    50                  55                  60

Asp Ile Gln Ile Ser Thr Leu Glu Glu Leu Arg Asn Ile Leu Thr Thr
65                  70                  75                  80

Asn Asn Ile Ala Ala Thr Ala Glu Tyr Tyr Tyr Ile Asn Leu Lys Asn
                85                  90                  95

Gln Lys Leu His Glu Tyr Tyr Ile Glu Asn Tyr Asn Thr Ala Leu Asp
            100                 105                 110

Tyr Lys Lys Tyr Ser Lys Glu Met Glu Phe Leu Arg Ser Leu Ala Tyr
        115                 120                 125

Arg Ser Glu Arg Val Lys Ile Lys Ser Ile Asp Asp Val Lys Gln Val
    130                 135                 140

Leu Asp Lys Asp Ser Asn Phe Ile Ile Gly Lys Ile Thr Leu Pro Phe
145                 150                 155                 160

Lys Lys Glu Trp Gln Arg Leu Tyr Leu Glu Trp Gln Asn Thr Thr Ile
                165                 170                 175

Lys Asp Asp Tyr Glu Phe Leu Lys Ser Phe Phe Asn Val Lys Ser Ile
            180                 185                 190

Thr Lys Leu His Lys Lys Val Arg Lys Asp Phe Ser Leu Pro Ile Ser
        195                 200                 205

Thr Asn Glu Gly Lys Phe Leu Val Lys Arg Lys Thr Trp Asp Asn Asn
    210                 215                 220

Phe Ile Tyr Gln Ile Leu Asn Asp Ser Asp Ser Arg Val Asp Gly Thr
225                 230                 235                 240

Lys Pro Phe Ile Pro Ala Phe Asp Ile Ser Lys Asn Glu Ile Val Glu
                245                 250                 255
```

```
Ala Ile Ile Asp Ser Phe Thr Ser Lys Asn Ile Phe Trp Leu Pro Lys
            260                 265                 270


Asn Ile Glu Leu Gln Lys Val Asp Lys Ile Phe Leu Leu
        275                 280                 285


<210>  444
<211>  1323
<212>  PRT
<213>  Fructobacillus fructosus

<400>  444

Met Val Tyr Asp Val Gly Leu Asp Ile Gly Thr Gly Ser Val Gly Trp
1               5                   10                  15


Val Ala Leu Asp Glu Asn Gly Lys Leu Ala Arg Ala Lys Gly Lys Asn
            20                  25                  30


Leu Val Gly Val Arg Leu Phe Asp Thr Ala Gln Thr Ala Ala Asp Arg
        35                  40                  45


Arg Gly Phe Arg Thr Thr Arg Arg Arg Leu Ser Arg Arg Lys Trp Arg
    50                  55                  60


Leu Arg Leu Leu Asp Glu Leu Phe Ser Ala Glu Ile Asn Glu Ile Asp
65                  70                  75                  80


Ser Ser Phe Phe Gln Arg Leu Lys Tyr Ser Tyr Val His Pro Lys Asp
                85                  90                  95


Glu Glu Asn Lys Ala His Tyr Tyr Gly Gly Tyr Leu Phe Pro Thr Glu
            100                 105                 110


Glu Glu Thr Lys Lys Phe His Arg Ser Tyr Pro Thr Ile Tyr His Leu
        115                 120                 125


Arg Gln Glu Leu Met Ala Gln Pro Asn Lys Arg Phe Asp Ile Arg Glu
```

```
    130                 135                 140

Ile Tyr Leu Ala Ile His His Leu Val Lys Tyr Arg Gly His Phe Leu
145                 150                 155                 160

Ser Ser Gln Glu Lys Ile Thr Ile Gly Ser Thr Tyr Asn Pro Glu Asp
                165                 170                 175

Leu Ala Asn Ala Ile Glu Val Tyr Ala Asp Glu Lys Gly Leu Ser Trp
            180                 185                 190

Glu Leu Asn Asn Pro Glu Gln Leu Thr Glu Ile Ile Ser Gly Glu Ala
        195                 200                 205

Gly Tyr Gly Leu Asn Lys Ser Met Lys Ala Asp Glu Ala Leu Lys Leu
    210                 215                 220

Phe Glu Phe Asp Asn Asn Gln Asp Lys Val Ala Ile Lys Thr Leu Leu
225                 230                 235                 240

Ala Gly Leu Thr Gly Asn Gln Ile Asp Phe Ala Lys Leu Phe Gly Lys
                245                 250                 255

Asp Ile Ser Asp Lys Asp Glu Ala Lys Leu Trp Lys Leu Lys Leu Asp
            260                 265                 270

Asp Glu Ala Leu Glu Glu Lys Ser Gln Thr Ile Leu Ser Gln Leu Thr
        275                 280                 285

Asp Glu Glu Ile Glu Leu Phe His Ala Val Val Gln Ala Tyr Asp Gly
    290                 295                 300

Phe Val Leu Ile Gly Leu Leu Asn Gly Ala Asp Ser Val Ser Ala Ala
305                 310                 315                 320

Met Val Gln Leu Tyr Asp Gln His Arg Glu Asp Arg Lys Leu Leu Lys
                325                 330                 335
```

```
Ser Leu Ala Gln Lys Ala Gly Leu Lys His Lys Arg Phe Ser Glu Ile
            340                 345                 350

Tyr Glu Gln Leu Ala Leu Ala Thr Asp Glu Ala Thr Ile Lys Asn Gly
        355                 360                 365

Ile Ser Thr Ala Arg Glu Leu Val Glu Glu Ser Asn Leu Ser Lys Glu
    370                 375                 380

Val Lys Glu Asp Thr Leu Arg Arg Leu Asp Glu Asn Glu Phe Leu Pro
385                 390                 395                 400

Lys Gln Arg Thr Lys Ala Asn Ser Val Ile Pro His Gln Leu His Leu
                405                 410                 415

Ala Glu Leu Gln Lys Ile Leu Gln Asn Gln Gly Gln Tyr Tyr Pro Phe
            420                 425                 430

Leu Leu Asp Thr Phe Glu Lys Glu Asp Gly Gln Asp Asn Lys Ile Glu
        435                 440                 445

Glu Leu Leu Arg Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Val Thr
    450                 455                 460

Lys Lys Asp Val Glu His Ala Gly Gly Asp Ala Asp Asn His Trp Val
465                 470                 475                 480

Glu Arg Asn Glu Gly Phe Glu Lys Ser Arg Val Thr Pro Trp Asn Phe
                485                 490                 495

Asp Lys Val Phe Asn Arg Asp Lys Ala Ala Arg Asp Phe Ile Glu Arg
            500                 505                 510

Leu Thr Gly Asn Asp Thr Tyr Leu Ile Gly Glu Lys Thr Leu Pro Gln
        515                 520                 525

Asn Ser Leu Arg Tyr Gln Leu Phe Thr Val Leu Asn Glu Leu Asn Asn
```

```
    530                 535                 540

Val Arg Val Asn Gly Lys Lys Phe Asp Ser Lys Thr Lys Ala Asp Leu
545                 550                 555                 560

Ile Asn Asp Leu Phe Lys Ala Arg Lys Thr Val Ser Leu Ser Ala Leu
                565                 570                 575

Lys Asp Tyr Leu Lys Ala Gln Gly Lys Gly Asp Val Thr Ile Thr Gly
            580                 585                 590

Leu Ala Asp Glu Ser Lys Phe Asn Ser Ser Leu Ser Ser Tyr Asn Asp
        595                 600                 605

Leu Lys Lys Thr Phe Asp Ala Glu Tyr Leu Glu Asn Glu Asp Asn Gln
    610                 615                 620

Glu Thr Leu Glu Lys Ile Ile Glu Ile Gln Thr Val Phe Glu Asp Ser
625                 630                 635                 640

Lys Ile Ala Ser Arg Glu Leu Ser Lys Leu Pro Leu Asp Asp Asp Gln
                645                 650                 655

Val Lys Lys Leu Ser Gln Thr His Tyr Thr Gly Trp Gly Arg Leu Ser
            660                 665                 670

Glu Lys Leu Leu Asp Ser Lys Ile Ile Asp Glu Arg Gly Gln Lys Val
        675                 680                 685

Ser Ile Leu Asp Lys Leu Lys Ser Thr Ser Gln Asn Phe Met Ser Ile
    690                 695                 700

Ile Asn Asn Asp Lys Tyr Gly Val Gln Ala Trp Ile Thr Glu Gln Asn
705                 710                 715                 720

Thr Gly Ser Ser Lys Leu Thr Phe Asp Glu Lys Val Asn Glu Leu Thr
                725                 730                 735
```

```
Thr Ser Pro Ala Asn Lys Arg Gly Ile Lys Gln Ser Phe Ala Val Leu
            740                 745                 750

Asn Asp Ile Lys Lys Ala Met Lys Glu Glu Pro Arg Arg Val Tyr Leu
        755                 760                 765

Glu Phe Ala Arg Glu Asp Gln Thr Ser Val Arg Ser Val Pro Arg Tyr
    770                 775                 780

Asn Gln Leu Lys Glu Lys Tyr Gln Ser Lys Ser Leu Ser Glu Glu Ala
785                 790                 795                 800

Lys Val Leu Lys Lys Thr Leu Asp Gly Asn Lys Asn Lys Met Ser Asp
                805                 810                 815

Asp Arg Tyr Phe Leu Tyr Phe Gln Gln Gln Gly Lys Asp Met Tyr Thr
            820                 825                 830

Gly Arg Pro Ile Asn Phe Glu Arg Leu Ser Gln Asp Tyr Asp Ile Asp
        835                 840                 845

His Ile Ile Pro Gln Ala Phe Thr Lys Asp Asp Ser Leu Asp Asn Arg
    850                 855                 860

Val Leu Val Ser Arg Pro Glu Asn Ala Arg Lys Ser Asp Ser Phe Ala
865                 870                 875                 880

Tyr Thr Asp Glu Val Gln Lys Gln Asp Gly Ser Leu Trp Thr Ser Leu
                885                 890                 895

Leu Lys Ser Gly Phe Ile Asn Arg Lys Lys Tyr Glu Arg Leu Thr Lys
            900                 905                 910

Ala Gly Lys Tyr Leu Asp Gly Gln Lys Thr Gly Phe Ile Ala Arg Gln
        915                 920                 925

Leu Val Glu Thr Arg Gln Ile Ile Lys Asn Val Ala Ser Leu Ile Glu
```

```
    930                 935                 940

Gly Glu Tyr Glu Asn Ser Lys Ala Val Ala Ile Arg Ser Glu Ile Thr
945                 950                 955                 960

Ala Asp Met Arg Leu Leu Val Gly Ile Lys Lys His Arg Glu Ile Asn
                965                 970                 975

Ser Phe His His Ala Phe Asp Ala Leu Leu Ile Thr Ala Ala Gly Gln
            980                 985                 990

Tyr Met Gln Asn Arg Tyr Pro Asp  Arg Asp Ser Thr Asn  Val Tyr Asn
        995                 1000                1005

Glu Phe  Asp Arg Tyr Thr Asn  Asp Tyr Leu Lys Asn  Leu Arg Gln
    1010                1015                1020

Leu Ser  Ser Arg Asp Glu Val  Arg Arg Leu Lys Ser  Phe Gly Phe
    1025                1030                1035

Val Val  Gly Thr Met Arg Lys  Gly Asn Glu Asp Trp  Ser Glu Glu
    1040                1045                1050

Asn Thr  Ser Tyr Leu Arg Lys  Val Met Met Phe Lys  Asn Ile Leu
    1055                1060                1065

Thr Thr  Lys Lys Thr Glu Lys  Asp Arg Gly Pro Leu  Asn Lys Glu
    1070                1075                1080

Thr Ile  Phe Ser Pro Lys Ser  Gly Lys Lys Leu Ile  Pro Leu Asn
    1085                1090                1095

Ser Lys  Arg Ser Asp Thr Ala  Leu Tyr Gly Gly Tyr  Ser Asn Val
    1100                1105                1110

Tyr Ser  Ala Tyr Met Thr Leu  Val Arg Ala Asn Gly  Lys Asn Leu
    1115                1120                1125
```

```
Leu Ile  Lys Ile Pro Ile Ser  Ile Ala Asn Gln Ile  Glu Val Gly
    1130                1135                1140

Asn Leu  Lys Ile Asn Asp Tyr  Ile Val Asn Asn Pro  Ala Ile Lys
    1145                1150                1155

Lys Phe  Glu Lys Ile Leu Ile  Ser Lys Leu Pro Leu  Gly Gln Leu
    1160                1165                1170

Val Asn  Glu Asp Gly Asn Leu  Ile Tyr Leu Ala Ser  Asn Glu Tyr
    1175                1180                1185

Arg His  Asn Ala Lys Gln Leu  Trp Leu Ser Thr Thr  Asp Ala Asp
    1190                1195                1200

Lys Ile  Ala Ser Ile Ser Glu  Asn Ser Ser Asp Glu  Glu Leu Leu
    1205                1210                1215

Glu Ala  Tyr Asp Ile Leu Thr  Ser Glu Asn Val Lys  Asn Arg Phe
    1220                1225                1230

Pro Phe  Phe Lys Lys Asp Ile  Asp Lys Leu Ser Gln  Val Arg Asp
    1235                1240                1245

Glu Phe  Leu Asp Ser Asp Lys  Arg Ile Ala Val Ile  Gln Thr Ile
    1250                1255                1260

Leu Arg  Gly Leu Gln Ile Asp  Ala Ala Tyr Gln Ala  Pro Val Lys
    1265                1270                1275

Ile Ile  Ser Lys Lys Val Ser  Asp Trp His Lys Leu  Gln Gln Ser
    1280                1285                1290

Gly Gly  Ile Lys Leu Ser Asp  Asn Ser Glu Met Ile  Tyr Gln Ser
    1295                1300                1305

Ala Thr  Gly Ile Phe Glu Thr  Arg Val Lys Ile Ser  Asp Leu Leu
```

1310 1315 1320

<210> 445
<211> 1367
<212> PRT
<213> Fusobacterium sp.

<400> 445

Met Lys Lys Gln Lys Phe Ser Asp Tyr Tyr Leu Gly Phe Asp Ile Gly
1 5 10 15

Thr Asn Ser Val Gly Trp Cys Val Thr Asp Leu Asp Tyr Asn Val Leu
20 25 30

Arg Phe Asn Lys Lys Asp Met Trp Gly Ser Arg Leu Phe Asp Glu Ala
35 40 45

Lys Thr Ala Ala Glu Arg Arg Val Gln Arg Asn Ser Arg Arg Arg Leu
50 55 60

Lys Arg Arg Lys Trp Arg Leu Asn Leu Leu Glu Glu Ile Phe Ser Asp
65 70 75 80

Glu Ile Met Lys Ile Asp Ser Asn Phe Phe Arg Arg Leu Lys Glu Ser
85 90 95

Ser Leu Trp Leu Glu Asp Lys Asn Ser Lys Glu Lys Phe Thr Leu Phe
100 105 110

Asn Asp Asp Asn Tyr Lys Asp Tyr Asp Phe Tyr Lys Gln Tyr Pro Thr
115 120 125

Ile Phe His Leu Arg Asp Glu Leu Ile Lys Asn Pro Glu Lys Lys Asp
130 135 140

Ile Arg Leu Ile Tyr Leu Ala Leu His Ser Ile Phe Lys Ser Arg Gly
145 150 155 160

```
His Phe Leu Phe Glu Gly Gln Asn Leu Lys Glu Ile Lys Asn Phe Glu
                165                 170                 175

Thr Leu Tyr Asn Asn Leu Ile Ser Phe Leu Glu Asp Asn Gly Ile Asn
            180                 185                 190

Lys Ser Ile Asp Lys Asp Asn Ile Lys Lys Leu Glu Lys Ile Ile Cys
        195                 200                 205

Asp Ser Gly Lys Gly Leu Lys Asp Lys Glu Lys Glu Phe Lys Glu Ile
    210                 215                 220

Phe Asn Ser Asp Lys Gln Leu Val Ala Ile Phe Lys Leu Ser Val Gly
225                 230                 235                 240

Ser Ser Val Ser Leu Asn Asp Leu Phe Asp Thr Asp Glu Tyr Lys Lys
                245                 250                 255

Glu Glu Val Glu Lys Glu Lys Ile Ser Phe Arg Glu Gln Ile Tyr Glu
            260                 265                 270

Asp Asp Lys Pro Ile Tyr Tyr Ser Ile Leu Gly Glu Lys Ile Glu Leu
        275                 280                 285

Leu Asp Ile Ala Lys Ser Phe Tyr Asp Phe Met Val Leu Asn Asn Ile
    290                 295                 300

Leu Ser Asp Ser Asn Tyr Ile Ser Glu Ala Lys Val Lys Leu Tyr Glu
305                 310                 315                 320

Glu His Lys Lys Asp Leu Lys Asn Leu Lys Tyr Ile Ile Arg Lys Tyr
                325                 330                 335

Asn Lys Glu Asn Tyr Asp Lys Leu Phe Lys Asp Lys Asn Glu Asn Asn
            340                 345                 350

Tyr Pro Ala Tyr Ile Gly Leu Asn Lys Glu Lys Gly Lys Lys Glu Val
        355                 360                 365
```

```
Val Glu Lys Ser Gly Leu Lys Ile Asp Asp Leu Ile Lys Val Ile Lys
    370                 375                 380

Gly Tyr Leu Pro Lys Pro Glu Arg Ile Glu Glu Lys Asp Lys Thr Ile
385                 390                 395                 400

Phe Asn Glu Ile Leu Asn Lys Ile Glu Leu Lys Thr Ile Leu Pro Lys
                405                 410                 415

Gln Arg Ile Ser Asp Asn Gly Thr Leu Pro Tyr Gln Ile His Glu Val
            420                 425                 430

Glu Leu Glu Lys Ile Leu Glu Asn Gln Ser Lys Tyr Tyr Asp Phe Leu
        435                 440                 445

Asn Tyr Glu Glu Asn Gly Val Ser Thr Lys Asp Lys Leu Leu Lys Thr
    450                 455                 460

Phe Lys Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Asn Ser Tyr His
465                 470                 475                 480

Lys Asp Lys Gly Gly Asn Ser Trp Ile Val Arg Lys Glu Glu Gly Lys
                485                 490                 495

Ile Leu Pro Trp Asn Phe Glu Gln Lys Val Asp Ile Glu Lys Ser Ala
            500                 505                 510

Glu Glu Phe Ile Lys Arg Met Thr Asn Lys Cys Thr Tyr Leu Asn Gly
        515                 520                 525

Glu Asp Val Ile Pro Lys Asp Ser Phe Leu Tyr Ser Glu Tyr Ile Ile
    530                 535                 540

Leu Asn Glu Leu Asn Lys Val Gln Val Asn Asp Glu Phe Leu Asn Glu
545                 550                 555                 560
```

```
Glu Asn Lys Arg Lys Ile Ile Asp Glu Leu Phe Lys Glu Asn Lys Lys
                565                 570                 575

Val Ser Glu Lys Lys Phe Lys Glu Tyr Leu Leu Val Asn Gln Ile Ala
            580                 585                 590

Asn Arg Thr Val Glu Leu Lys Gly Ile Lys Asp Ser Phe Asn Ser Asn
        595                 600                 605

Tyr Val Ser Tyr Ile Lys Phe Lys Asp Ile Phe Gly Glu Lys Leu Asn
    610                 615                 620

Leu Asp Ile Tyr Lys Glu Ile Ser Glu Lys Ser Ile Leu Trp Lys Cys
625                 630                 635                 640

Leu Tyr Gly Asp Asp Lys Lys Ile Phe Glu Lys Lys Ile Lys Asn Glu
                645                 650                 655

Tyr Gly Asp Ile Leu Asn Lys Asp Glu Ile Lys Lys Ile Asn Ser Phe
            660                 665                 670

Lys Phe Asn Thr Trp Gly Arg Leu Ser Glu Lys Leu Leu Thr Gly Ile
        675                 680                 685

Glu Phe Ile Asn Leu Glu Thr Gly Glu Cys Tyr Ser Ser Val Met Glu
    690                 695                 700

Ala Leu Arg Arg Thr Asn Tyr Asn Leu Met Glu Leu Leu Ser Ser Lys
705                 710                 715                 720

Phe Thr Leu Gln Glu Ser Ile Asp Asn Gly Asn Lys Glu Met Asn Glu
                725                 730                 735

Val Ser Tyr Arg Asp Leu Ile Glu Glu Ser Tyr Val Ser Pro Ser Leu
            740                 745                 750

Lys Arg Ala Ile Leu Gln Thr Leu Lys Ile Tyr Glu Glu Ile Lys Lys
        755                 760                 765
```

```
Ile Thr Gly Arg Val Pro Lys Lys Val Phe Ile Glu Met Ala Arg Gly
    770                 775                 780

Gly Asp Glu Thr Met Lys Asn Lys Lys Ile Pro Ala Arg Gln Glu Gln
785                 790                 795                 800

Leu Lys Lys Leu Tyr Asp Ser Cys Gly Asn Asp Ile Ala Asn Phe Ser
                805                 810                 815

Ile Asp Ile Lys Lys Met Lys Ser Ser Leu Ser Ser Tyr Asp Asn Asn
            820                 825                 830

Ser Leu Arg Gln Lys Lys Leu Tyr Leu Tyr Tyr Leu Gln Phe Gly Lys
        835                 840                 845

Cys Met Tyr Thr Gly Arg Glu Ile Asp Leu Asp Arg Leu Leu Gln Asn
    850                 855                 860

Asn Asp Thr Tyr Asp Ile Asp His Ile Tyr Pro Arg Ser Lys Val Ile
865                 870                 875                 880

Lys Asp Asp Ser Phe Asp Asn Leu Val Leu Val Leu Lys Asn Glu Asn
                885                 890                 895

Ala Glu Lys Ser Asn Glu Tyr Pro Val Lys Lys Glu Ile Gln Glu Lys
            900                 905                 910

Met Lys Ser Phe Trp Arg Phe Leu Lys Glu Lys Asn Phe Ile Ser Asp
        915                 920                 925

Glu Lys Tyr Lys Arg Leu Thr Gly Lys Asp Asp Phe Glu Leu Arg Gly
    930                 935                 940

Phe Met Ala Arg Gln Leu Val Asn Val Arg Gln Thr Thr Lys Glu Val
945                 950                 955                 960
```

```
Gly Lys Ile Leu Gln Gln Ile Glu Pro Glu Ile Lys Ile Val Tyr Ser
               965                 970                 975

Lys Ala Glu Ile Ala Ser Ser Phe Arg Glu Met Phe Asp Phe Ile Lys
           980                 985                 990

Val Arg Glu Leu Asn Asp Thr His  His Ala Lys Asp Ala  Tyr Leu Asn
        995                1000                1005

Ile Val  Ala Gly Asn Val Tyr  Asn Thr Lys Phe Thr  Glu Lys Pro
    1010                1015                1020

Tyr Arg  Tyr Leu Gln Glu Ile  Lys Glu Asn Tyr Asp  Val Lys Lys
    1025                1030                1035

Ile Tyr  Asn Tyr Asp Ile Lys  Asn Ala Trp Asp Lys  Glu Asn Ser
    1040                1045                1050

Leu Glu  Ile Val Lys Lys Asn  Met Lys Lys Asn Thr  Val Asn Ile
    1055                1060                1065

Thr Arg  Phe Ile Lys Glu Glu  Lys Gly Gln Leu Phe  Asp Leu Asn
    1070                1075                1080

Pro Ile  Lys Lys Gly Glu Thr  Ser Asn Glu Ile Ile  Ser Ile Lys
    1085                1090                1095

Pro Lys  Leu Tyr Asn Gly Lys  Glu Glu Lys Leu Asn  Glu Lys Tyr
    1100                1105                1110

Gly Tyr  Tyr Lys Ser Leu Asn  Pro Ala Tyr Phe Leu  Tyr Val Glu
    1115                1120                1125

His Lys  Glu Lys Asn Lys Arg  Ile Lys Ser Phe Glu  Arg Val Asn
    1130                1135                1140

Leu Val  Asp Val Asn Asn Ile  Lys Asp Glu Lys Ser  Leu Val Lys
    1145                1150                1155
```

```
Tyr Leu  Ile Glu Asn Lys Lys  Leu Val Glu Pro Arg  Leu Ile Lys
    1160                1165                1170

Lys Val  Tyr Lys Arg Gln Val  Ile Leu Ile Asn Asp  Tyr Pro Tyr
    1175                1180                1185

Ser Ile  Val Ala Leu Asp Ser  Asn Lys Leu Met Asp  Phe Glu Asn
    1190                1195                1200

Leu Lys  Pro Leu Phe Leu Glu  Asn Lys Tyr Glu Lys  Ile Leu Lys
    1205                1210                1215

Asn Val  Ile Lys Phe Leu Glu  Asp Asn Gln Gly Lys  Ser Glu Glu
    1220                1225                1230

Asn Tyr  Lys Phe Ile Tyr Leu  Lys Lys Lys Asp Arg  Tyr Glu Lys
    1235                1240                1245

Asn Glu  Thr Leu Glu Ser Val  Lys Asp Arg Tyr Asn  Leu Glu Phe
    1250                1255                1260

Asn Glu  Met Tyr Asp Lys Phe  Leu Glu Lys Leu Asp  Ser Lys Asp
    1265                1270                1275

Tyr Lys  Asn Tyr Ile Asn Asn  Lys Lys Tyr Lys Asn  Leu Leu Asp
    1280                1285                1290

Val Lys  Glu Lys Phe Ile Lys  Leu Asn Leu Phe Asp  Lys Ala Phe
    1295                1300                1305

Thr Leu  Lys Ser Phe Leu Asp  Leu Phe Asn Arg Lys  Thr Met Ala
    1310                1315                1320

Asp Phe  Ser Lys Val Gly Leu  Thr Lys Tyr Leu Gly  Lys Ile Gln
    1325                1330                1335
```

```
Lys Ile  Ser Ser Asn Val Leu  Ser Lys Asn Glu Leu  Tyr Leu Leu
    1340                1345                1350


Glu Glu  Ser Val Thr Gly Leu  Phe Val Lys Lys Ile  Lys Leu
    1355                1360                1365
```

<210> 446
<211> 1367
<212> PRT
<213> Fusobacterium sp.

<400> 446

```
Met Lys Lys Gln Lys Phe Ser Asp Tyr Tyr Leu Gly Phe Asp Ile Gly
1               5                   10                  15


Thr Asn Ser Val Gly Trp Cys Val Thr Asp Leu Asp Tyr Asn Val Leu
            20                  25                  30


Arg Phe Asn Lys Lys Asp Met Trp Gly Ser Arg Leu Phe Asp Glu Ala
        35                  40                  45


Lys Thr Ala Ala Glu Arg Arg Val Gln Arg Asn Ser Arg Arg Arg Leu
    50                  55                  60


Lys Arg Arg Lys Trp Arg Leu Asn Leu Leu Glu Glu Ile Phe Ser Asp
65                  70                  75                  80


Glu Ile Met Lys Ile Asp Ser Asn Phe Phe Arg Arg Leu Lys Glu Ser
                85                  90                  95


Ser Leu Trp Leu Glu Asp Lys Asn Ser Lys Glu Lys Phe Thr Leu Phe
            100                 105                 110


Asn Asp Asp Asn Tyr Lys Asp Tyr Asp Phe Tyr Lys Gln Tyr Pro Thr
        115                 120                 125


Ile Phe His Leu Arg Asp Glu Leu Ile Lys Asn Pro Glu Lys Lys Asp
    130                 135                 140
```

```
Ile Arg Leu Ile Tyr Leu Ala Leu His Ser Ile Phe Lys Ser Arg Gly
145                 150                 155                 160

His Phe Leu Phe Glu Gly Gln Asn Leu Lys Glu Ile Lys Asn Phe Glu
                165                 170                 175

Thr Leu Tyr Asn Asn Leu Ile Ser Phe Leu Glu Asp Asn Gly Ile Asn
            180                 185                 190

Lys Ser Ile Asp Lys Asp Asn Ile Lys Lys Leu Glu Lys Ile Ile Cys
        195                 200                 205

Asp Ser Gly Lys Gly Leu Lys Asp Lys Glu Lys Glu Phe Lys Glu Ile
    210                 215                 220

Phe Asn Ser Asp Lys Gln Leu Val Ala Ile Phe Lys Leu Ser Val Gly
225                 230                 235                 240

Ser Ser Val Ser Leu Asn Asp Leu Phe Asp Thr Asp Glu Tyr Lys Lys
                245                 250                 255

Glu Glu Val Glu Lys Glu Lys Ile Ser Phe Arg Glu Gln Ile Tyr Glu
            260                 265                 270

Asp Asp Lys Pro Ile Tyr Tyr Ser Ile Leu Gly Glu Lys Ile Glu Leu
        275                 280                 285

Leu Asp Ile Ala Lys Ser Phe Tyr Asp Phe Met Val Leu Asn Asn Ile
    290                 295                 300

Leu Ser Asp Ser Asn Tyr Ile Ser Glu Ala Lys Val Lys Leu Tyr Glu
305                 310                 315                 320

Glu His Lys Lys Asp Leu Lys Asn Leu Lys Tyr Ile Ile Arg Lys Tyr
                325                 330                 335

Asn Lys Glu Asn Tyr Asp Lys Leu Phe Lys Asp Lys Asn Glu Asn Asn
```

```
            340                 345                 350

Tyr Pro Ala Tyr Ile Gly Leu Asn Lys Glu Lys Gly Lys Lys Glu Val
        355                 360                 365

Val Glu Lys Ser Gly Leu Lys Ile Asp Asp Leu Ile Lys Val Ile Lys
    370                 375                 380

Gly Tyr Leu Pro Lys Pro Glu Arg Ile Glu Glu Lys Asp Lys Ile Ile
385                 390                 395                 400

Phe Asn Glu Ile Leu Asn Lys Ile Glu Leu Lys Thr Ile Leu Pro Lys
                405                 410                 415

Gln Arg Ile Ser Asp Asn Gly Thr Leu Pro Tyr Gln Ile His Glu Val
            420                 425                 430

Glu Leu Glu Lys Ile Leu Glu Asn Gln Ser Lys Tyr Tyr Asp Phe Leu
        435                 440                 445

Asn Tyr Glu Glu Asn Gly Val Ser Thr Lys Asp Lys Leu Leu Lys Thr
    450                 455                 460

Phe Lys Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Asn Ser Tyr His
465                 470                 475                 480

Lys Asp Lys Gly Gly Asn Ser Trp Ile Val Arg Lys Glu Glu Gly Lys
                485                 490                 495

Ile Leu Pro Trp Asn Phe Glu Gln Lys Val Asp Ile Glu Lys Ser Ala
            500                 505                 510

Glu Glu Phe Ile Lys Arg Met Thr Asn Lys Cys Thr Tyr Leu Asn Gly
        515                 520                 525

Glu Asp Val Ile Pro Lys Asp Ser Phe Leu Tyr Ser Glu Tyr Ile Ile
    530                 535                 540
```

```
Leu Asn Glu Leu Asn Lys Val Gln Val Asn Asp Glu Phe Leu Asn Glu
545                 550                 555                 560

Glu Asn Lys Arg Lys Ile Ile Asp Glu Leu Phe Lys Glu Asn Lys Lys
                565                 570                 575

Val Ser Glu Lys Lys Phe Lys Glu Tyr Leu Leu Val Asn Gln Ile Ala
            580                 585                 590

Asn Arg Thr Val Glu Leu Lys Gly Ile Lys Asp Ser Phe Asn Ser Asn
        595                 600                 605

Tyr Val Ser Tyr Ile Lys Phe Lys Asp Ile Phe Gly Glu Lys Leu Asn
    610                 615                 620

Leu Asp Ile Tyr Lys Glu Ile Ser Glu Lys Ser Ile Leu Trp Lys Cys
625                 630                 635                 640

Leu Tyr Gly Asp Asp Lys Lys Ile Phe Glu Lys Lys Ile Lys Asn Glu
                645                 650                 655

Tyr Gly Asp Ile Leu Asn Lys Asp Glu Ile Lys Lys Ile Asn Ser Phe
            660                 665                 670

Lys Phe Asn Thr Trp Gly Arg Leu Ser Glu Lys Leu Leu Thr Gly Ile
        675                 680                 685

Glu Phe Ile Asn Leu Glu Thr Gly Glu Cys Tyr Ser Ser Val Met Glu
    690                 695                 700

Ala Leu Arg Arg Thr Asn Tyr Asn Leu Met Glu Leu Leu Ser Ser Lys
705                 710                 715                 720

Phe Thr Leu Gln Glu Ser Ile Asp Asn Gly Asn Lys Glu Met Asn Glu
                725                 730                 735

Val Ser Tyr Arg Asp Leu Ile Glu Glu Ser Tyr Val Ser Pro Ser Leu
```

```
            740                 745                 750

Lys Arg Ala Ile Leu Gln Thr Leu Lys Ile Tyr Glu Glu Ile Lys Lys
        755                 760                 765

Ile Thr Gly Arg Val Pro Lys Lys Val Phe Ile Glu Met Ala Arg Gly
    770                 775                 780

Gly Asp Glu Thr Met Lys Asn Lys Lys Ile Pro Ala Arg Gln Glu Gln
785                 790                 795                 800

Leu Lys Lys Leu Tyr Asp Ser Cys Gly Asn Asp Ile Ala Asn Phe Ser
                805                 810                 815

Ile Asp Ile Lys Lys Met Lys Ser Ser Leu Ser Ser Tyr Asp Asn Asn
            820                 825                 830

Ser Leu Arg Gln Lys Lys Leu Tyr Leu Tyr Tyr Leu Gln Phe Gly Lys
        835                 840                 845

Cys Met Tyr Thr Gly Arg Glu Ile Asp Leu Asp Arg Leu Leu Gln Asn
    850                 855                 860

Asn Asp Thr Tyr Asp Ile Asp His Ile Tyr Pro Arg Ser Lys Val Ile
865                 870                 875                 880

Lys Asp Asp Ser Phe Asp Asn Leu Val Leu Val Leu Lys Asn Glu Asn
                885                 890                 895

Ala Glu Lys Ser Asn Glu Tyr Pro Val Lys Lys Glu Ile Gln Glu Lys
            900                 905                 910

Met Lys Ser Phe Trp Arg Phe Leu Lys Glu Lys Asn Phe Ile Ser Asp
        915                 920                 925

Glu Lys Tyr Lys Arg Leu Thr Gly Lys Asp Asp Phe Glu Leu Arg Gly
    930                 935                 940
```

```
Phe Met Ala Arg Gln Leu Val Asn Val Arg Gln Thr Thr Lys Glu Val
945                 950                 955                 960


Gly Lys Ile Leu Gln Gln Ile Glu Pro Glu Ile Lys Ile Val Tyr Ser
                965                 970                 975


Lys Ala Glu Ile Ala Ser Ser Phe Arg Glu Met Phe Asp Phe Ile Lys
            980                 985                 990


Val Arg Glu Leu Asn Asp Thr His  His Ala Lys Asp Ala  Tyr Leu Asn
        995                 1000                1005


Ile Val  Ala Gly Asn Val Tyr  Asn Thr Lys Phe Thr  Glu Lys Pro
    1010                1015                1020


Tyr Arg  Tyr Leu Gln Glu Ile  Lys Glu Asn Tyr Asp  Val Lys Lys
    1025                1030                1035


Ile Tyr  Asn Tyr Asp Ile Lys  Asn Ala Trp Asp Lys  Glu Asn Ser
    1040                1045                1050


Leu Glu  Ile Val Lys Lys Asn  Met Lys Lys Asn Thr  Val Asn Ile
    1055                1060                1065


Thr Arg  Phe Ile Lys Glu Glu  Lys Gly Gln Leu Phe  Asp Leu Asn
    1070                1075                1080


Pro Ile  Lys Lys Gly Glu Thr  Ser Asn Glu Ile Ile  Ser Ile Lys
    1085                1090                1095


Pro Lys  Leu Tyr Asn Gly Lys  Glu Glu Lys Leu Asn  Glu Lys Tyr
    1100                1105                1110


Gly Tyr  Tyr Lys Ser Leu Asn  Pro Ala Tyr Phe Leu  Tyr Val Glu
    1115                1120                1125


His Lys  Glu Lys Asn Lys Arg  Ile Lys Ser Phe Glu  Arg Val Asn
```

```
    1130                1135                1140

Leu Val  Asp Val Asn Asn Ile  Lys Asp Glu Lys Ser  Leu Val Lys
    1145                1150                1155

Tyr Leu  Ile Glu Asn Lys Lys  Leu Val Glu Pro Arg  Leu Ile Lys
    1160                1165                1170

Lys Val  Tyr Lys Arg Gln Val  Ile Leu Ile Asn Asp  Tyr Pro Tyr
    1175                1180                1185

Ser Ile  Val Ala Leu Asp Ser  Asn Lys Leu Met Asp  Phe Glu Asn
    1190                1195                1200

Leu Lys  Pro Leu Phe Leu Glu  Asn Lys Tyr Glu Lys  Ile Leu Lys
    1205                1210                1215

Asn Val  Ile Lys Phe Leu Glu  Asp Asn Gln Gly Lys  Ser Glu Glu
    1220                1225                1230

Asn Tyr  Lys Phe Ile Tyr Leu  Lys Lys Lys Asp Arg  Tyr Glu Lys
    1235                1240                1245

Asn Glu  Thr Leu Glu Ser Val  Lys Asp Arg Tyr Asn  Leu Glu Phe
    1250                1255                1260

Asn Glu  Met Tyr Asp Lys Phe  Leu Glu Lys Leu Asp  Ser Lys Asp
    1265                1270                1275

Tyr Lys  Asn Tyr Ile Asn Asn  Lys Lys Tyr Lys Asn  Leu Leu Asp
    1280                1285                1290

Val Lys  Glu Lys Phe Ile Lys  Leu Asn Leu Phe Asp  Lys Ala Phe
    1295                1300                1305

Thr Leu  Lys Ser Phe Leu Asp  Leu Phe Asn Arg Lys  Thr Met Ala
    1310                1315                1320
```

```
Asp Phe  Ser Lys Val Gly Leu  Thr Lys Tyr Leu Gly  Lys Ile Gln
    1325                1330                1335


Lys Ile  Ser Ser Asn Val Leu  Ser Lys Asn Glu Leu  Tyr Leu Leu
    1340                1345                1350


Glu Glu  Ser Val Thr Gly Leu  Phe Val Lys Lys Ile  Lys Leu
    1355                1360                1365
```

<210> 447
<211> 1367
<212> PRT
<213> Fusobacterium sp.

<400> 447

```
Met Lys Lys Gln Gln Phe Ser Asp Tyr Tyr Leu Gly Phe Asp Ile Gly
1               5                   10                  15


Thr Asn Ser Val Gly Trp Cys Val Thr Asp Phe Asn Tyr Asn Val Leu
            20                  25                  30


Arg Phe Asn Lys Lys Asp Met Trp Gly Ser Arg Leu Phe Asp Glu Ala
        35                  40                  45


Lys Thr Ala Ala Glu Arg Arg Val Gln Arg Asn Ser Arg Arg Arg Leu
    50                  55                  60


Lys Arg Arg Lys Trp Arg Leu Asn Leu Leu Glu Glu Ile Phe Ser Asp
65                  70                  75                  80


Glu Ile Leu Lys Ile Asp Ser Asn Phe Phe Arg Arg Leu Lys Glu Ser
                85                  90                  95


Ser Leu Trp Leu Glu Asp Lys Ser Ser Lys Glu Lys Phe Thr Leu Phe
            100                 105                 110


Asn Asp Asp Asn Tyr Lys Asp Tyr Asp Phe Tyr Lys Gln Tyr Pro Thr
        115                 120                 125
```

```
Ile Phe His Leu Arg Asn Glu Leu Ile Lys Asn Pro Glu Lys Lys Asp
    130                 135                 140

Ile Arg Leu Val Tyr Leu Ala Leu His Ser Ile Phe Lys Ser Arg Gly
145                 150                 155                 160

His Phe Leu Phe Glu Gly Gln Asn Leu Lys Asp Ile Lys Asn Phe Glu
                165                 170                 175

Thr Leu Tyr Asn Asn Leu Met Ala Phe Leu Glu Asp Asn Asp Ile Tyr
            180                 185                 190

Lys Asn Ile Asp Ser Ser Tyr Ile Gly Asn Leu Glu Asn Ile Ile Cys
        195                 200                 205

Asp Ser Lys Lys Gly Leu Lys Asp Lys Glu Lys Glu Phe Lys Glu Ile
    210                 215                 220

Phe Asn Ser Asp Lys Gln Leu Val Gly Phe Phe Lys Leu Ser Val Gly
225                 230                 235                 240

Ser Ser Val Ser Leu Asn Asp Leu Phe Asp Thr Asp Glu Tyr Lys Lys
                245                 250                 255

Gly Glu Val Glu Lys Glu Lys Ile Ser Phe Arg Glu Gln Ile Tyr Glu
            260                 265                 270

Asp Asp Lys Pro Ile Tyr Tyr Ser Ile Leu Gly Glu Lys Ile Glu Phe
        275                 280                 285

Leu Asp Ile Ala Lys Ser Phe Tyr Asp Phe Met Val Leu Asn Asn Ile
    290                 295                 300

Leu Ala Asp Ser Gln Tyr Ile Ser Glu Ala Lys Val Lys Leu Tyr Asp
305                 310                 315                 320
```

```
Glu His Lys Arg Asp Leu Lys Asn Leu Lys Tyr Ile Ile Arg Lys Tyr
                325                 330                 335

Asn Lys Glu Asn Tyr Asp Lys Leu Phe Lys Asp Lys Asn Glu Ser Asn
            340                 345                 350

Tyr Ser Ala Tyr Ile Gly Leu Asn Lys Glu Lys Gly Lys Lys Glu Val
        355                 360                 365

Ile Glu Lys Ser Arg Leu Lys Ile Asp Asp Phe Ala Lys Ile Ile Lys
    370                 375                 380

Gly Tyr Leu Pro Lys Ala Glu Lys Ile Asp Glu Lys Asp Arg Ser Ile
385                 390                 395                 400

Phe Asn Glu Ile Leu Asp Lys Ile Glu Leu Lys Thr Ile Leu Pro Lys
                405                 410                 415

Gln Arg Ile Ser Asp Asn Gly Thr Leu Pro Tyr Gln Ile His Glu Ala
            420                 425                 430

Glu Leu Glu Lys Ile Leu Glu Asn Gln Ala Lys Tyr Tyr Asp Phe Leu
        435                 440                 445

Asn His Glu Glu Asn Gly Ile Ser Thr Lys Asp Lys Leu Leu Met Thr
    450                 455                 460

Phe Lys Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Asn Ser Tyr His
465                 470                 475                 480

Lys Asn Lys Gly Gly Asn Ser Trp Ile Val Arg Lys Glu Glu Gly Lys
                485                 490                 495

Ile Leu Pro Trp Asn Phe Glu Gln Lys Val Asp Ile Glu Lys Ser Ala
            500                 505                 510

Glu Glu Phe Ile Lys Arg Met Thr Asn Lys Cys Thr Tyr Leu Asn Gly
        515                 520                 525
```

```
Glu Asp Val Ile Pro Lys Asp Ser Phe Leu Tyr Ser Glu Tyr Ile Ile
    530                 535                 540

Leu Asn Glu Leu Asn Lys Val Gln Val Asn Asp Glu Phe Leu Asn Lys
545                 550                 555                 560

Glu Ile Lys Lys Lys Ile Ile Glu Asp Leu Phe Lys Lys Ser Lys Lys
                565                 570                 575

Ile Ser Glu Lys Asn Phe Arg Glu Tyr Leu Leu Val Asn Gln Ile Thr
            580                 585                 590

Asn Lys Thr Val Glu Leu Lys Gly Val Lys Asp Ala Phe Asn Ser Asn
        595                 600                 605

Tyr Val Ser Tyr Ile Lys Phe Lys Asp Ile Phe Gly Asp Lys Leu Asn
    610                 615                 620

Leu Asp Ile Tyr Lys Glu Ile Ser Glu Lys Ser Ile Leu Trp Lys Cys
625                 630                 635                 640

Leu Tyr Gly Asp Asp Lys Lys Ile Phe Glu Lys Lys Ile Lys Ser Val
                645                 650                 655

Tyr Gly Asp Ile Leu Thr Lys Asp Glu Ile Lys Lys Ile Asn Ser Phe
            660                 665                 670

Lys Phe Asn Thr Trp Gly Arg Leu Ser Glu Lys Leu Leu Thr Glu Ile
        675                 680                 685

Glu Phe Ile Asp Leu Glu Thr Gly Glu Cys Tyr Ser Ser Val Met Asp
    690                 695                 700

Ala Leu Arg Arg Thr Asn Tyr Asn Leu Met Glu Leu Leu Ser Ser Lys
705                 710                 715                 720
```

```
Phe Thr Leu Gln Glu Asn Ile Asp Asn Glu Asn Lys Glu Val Ser Glu
                725                 730                 735

Phe Ser Tyr Arg Asp Leu Val Glu Glu Ser Tyr Val Ser Pro Ser Leu
            740                 745                 750

Lys Arg Ala Ile Leu Gln Thr Leu Lys Ile Tyr Glu Glu Ile Arg Lys
        755                 760                 765

Ile Thr Gly Arg Ile Pro Lys Lys Val Phe Ile Glu Met Ala Arg Gly
    770                 775                 780

Gly Asp Glu Thr Met Lys Asn Lys Lys Ile Pro Ala Arg Gln Glu Gln
785                 790                 795                 800

Leu Lys Lys Leu Tyr Asp Ser Cys Gly Lys Asp Ile Ser Asn Phe Ser
                805                 810                 815

Ile Asp Ile Lys Glu Met Lys Asn Ser Leu Asn Ser Tyr Asp Asn Asn
            820                 825                 830

Ser Leu Arg Gln Lys Lys Leu Tyr Leu Tyr Tyr Leu Gln Phe Gly Lys
        835                 840                 845

Cys Met Tyr Thr Gly Lys Glu Ile Asp Leu Asn Arg Leu Leu Gln Asn
    850                 855                 860

Asn Asp Thr Tyr Asp Ile Asp His Ile Tyr Pro Arg Ser Lys Val Ile
865                 870                 875                 880

Lys Asp Asp Ser Phe Asp Asn Leu Val Leu Val Leu Lys Asn Glu Asn
                885                 890                 895

Ala Glu Lys Ser Asn Glu Tyr Pro Leu Lys Lys Glu Ile Gln Glu Lys
            900                 905                 910

Met Lys Ser Phe Trp Lys Phe Leu Lys Glu Lys Asn Phe Ile Ser Asp
        915                 920                 925
```

```
Glu Lys Tyr Lys Arg Leu Thr Gly Lys Asp Glu Phe Glu Leu Arg Gly
    930                 935                 940

Phe Met Ala Arg Gln Leu Val Asn Val Arg Gln Thr Thr Lys Glu Ala
945                 950                 955                 960

Gly Lys Ile Leu Gln Gln Ile Glu Pro Glu Ile Lys Ile Val Tyr Ser
                965                 970                 975

Lys Ala Glu Ile Ala Ser Ser Phe Arg Glu Met Phe Asp Phe Ile Lys
            980                 985                 990

Val Arg Glu Leu Asn Asp Thr His  His Ala Lys Asp Ala  Tyr Leu Asn
        995                 1000                1005

Ile Val  Ala Gly Asn Val Tyr  Asn Thr Lys Phe Thr  Glu Lys Pro
    1010                1015                1020

Tyr Arg  Tyr Leu Gln Glu Ile  Lys Glu Asn Tyr Asp  Val Lys Lys
    1025                1030                1035

Ile Tyr  Asn Tyr Asp Ile Lys  Asn Ala Trp Asp Lys  Glu Lys Ser
    1040                1045                1050

Leu Glu  Ile Val Lys Lys Asn  Met Glu Lys Asn Thr  Val Asn Ile
    1055                1060                1065

Thr Arg  Phe Ile Lys Glu Glu  Lys Gly Gln Leu Phe  Asp Leu Asn
    1070                1075                1080

Pro Ile  Arg Lys Gly Glu Thr  Ser Asn Glu Ile Ile  Ala Ile Lys
    1085                1090                1095

Pro Lys  Phe Tyr Glu Gly Ser  Thr Glu Lys Leu Asn  Glu Lys Tyr
    1100                1105                1110
```

```
Gly Tyr  Tyr Lys Ser Leu Asn  Pro Ala Tyr Phe Ile  Tyr Val Glu
    1115                1120                1125

His Lys  Glu Lys Asn Lys Ile  Ile Arg Ser Phe Glu  Arg Val Asn
    1130                1135                1140

Leu Val  Asp Val Asn Lys Ile  Lys Asp Glu Lys Ser  Leu Ile Lys
    1145                1150                1155

Tyr Leu  Ile Glu Asn Lys Gly  Leu Ile Glu Pro Lys  Val Ile Lys
    1160                1165                1170

Lys Val  Tyr Lys Arg Gln Val  Ile Leu Ile Asn Asn  Phe Pro Tyr
    1175                1180                1185

Ser Ile  Val Ala Leu Asp Ser  Asn Lys Leu Met Asp  Phe Glu Asn
    1190                1195                1200

Leu Lys  Pro Leu Phe Leu Glu  Arg Lys Tyr Glu Lys  Ile Leu Lys
    1205                1210                1215

Asn Ala  Ile Lys Phe Leu Glu  Asp Asn Gln Gly Lys  Thr Glu Glu
    1220                1225                1230

Tyr Tyr  Lys Phe Leu Tyr Leu  Lys Lys Lys Asp Arg  Asn Glu Lys
    1235                1240                1245

Asn Glu  Thr Ile Asp Ser Val  Lys Glu Arg Tyr Asn  Ile Glu Phe
    1250                1255                1260

Asn Glu  Met Tyr Asp Lys Phe  Leu Glu Lys Leu Asp  Ser Lys Asp
    1265                1270                1275

Tyr Lys  Asn Tyr Ile Asn Asn  Lys Lys Tyr Ser Glu  Leu Val Asn
    1280                1285                1290

Val Lys  Glu Lys Phe Ile Lys  Leu Asn Leu Phe Asp  Lys Ala Phe
    1295                1300                1305
```

Thr Leu Lys Ser Phe Leu Asp Leu Phe Asn Arg Lys Thr Met Ala
    1310   1315   1320

Asp Phe Ser Lys Val Gly Leu Thr Lys Tyr Leu Gly Lys Ile Gln
    1325   1330   1335

Lys Ile Ser Ser Asn Val Leu Ser Lys Asn Glu Leu His Leu Leu
    1340   1345   1350

Glu Glu Ser Val Thr Gly Leu Phe Val Lys Lys Ile Lys Leu
    1355   1360   1365

<210> 448
<211> 1391
<212> PRT
<213> Galbibacter sp.

<400> 448

Met Lys Thr Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1   5   10   15

Ala Leu Val Lys Glu Ala Glu Asn Glu Asn Glu Val Ser Asp Ile Ile
            20   25   30

Lys Leu Gly Val Arg Val Asn Pro Leu Thr Val Asp Glu Leu Thr Asn
        35   40   45

Phe Glu Gly Gly Lys Ala Tyr Ser Asn Asn Ala Glu Arg Thr Leu Lys
    50   55   60

Arg Gly Ala Arg Arg Asn Leu Gln Arg Tyr Lys Leu Arg Arg Glu Asn
65   70   75   80

Leu Ile Glu Ile Leu Leu Lys Asn Gly Leu Ile Asn Lys Asp Thr Ala
                85   90   95

Leu Thr Glu Val Gly Lys Glu Thr Thr His Gln Thr Leu Lys Leu Arg

```
            100                 105                 110

Ser Lys Ser Ala Asn Glu Lys Val Ser Leu Glu Asp Leu Ala Lys Ile
        115                 120                 125

Leu Leu Ser Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Val
    130                 135                 140

Asn Ala Glu Asp Asp Gly Val Ala Ile Asp Gly Met Glu Val Ala Lys
145                 150                 155                 160

Leu Leu Tyr Asp Glu Asn Met Thr Pro Gly Glu Tyr Val Leu Arg Leu
                165                 170                 175

Leu Glu Ser Gly Lys Lys His Leu Pro Asp Phe Tyr Arg Ser Asp Leu
            180                 185                 190

Gln Glu Glu Phe Asn Leu Val Trp Lys Lys Gln Ser Glu Phe Tyr Pro
        195                 200                 205

Leu Ile Leu Thr Lys Glu Leu Phe Phe Glu Leu His Gly Lys Asn Lys
    210                 215                 220

Ser Gln Thr Trp Ala Ile Cys Lys Glu Pro Leu Gly Ile Val Gly Val
225                 230                 235                 240

Lys Leu Lys Gly Ser Ala Lys Glu Gln Lys Phe Ala Arg Tyr Arg Leu
                245                 250                 255

Arg Lys Glu Ala Leu Thr Gln Gln Ile Glu Leu Glu His Leu Ala Ile
            260                 265                 270

Val Leu Gln Asp Ile Asn Asn Asp Ser Asn Lys Ser Ser Gly Tyr Leu
        275                 280                 285

Gly Ala Ile Ser Asp Arg Ser Lys Glu Leu Phe Phe Asn Lys Glu Thr
    290                 295                 300
```

```
Val Gly Gln Tyr Gln Tyr Lys Gln Leu Gln Lys Asp Pro Asn Thr Ser
305                 310                 315                 320

Leu Lys Asn Gln Val Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe Glu
                325                 330                 335

Val Ile Trp Arg Asn Gln Ala Lys Phe Tyr Pro Gln Leu Thr Asn Glu
            340                 345                 350

Leu Lys Gln Glu Ile Arg Asp Val Val Ile Phe Tyr Gln Arg Lys Leu
        355                 360                 365

Lys Ser Gln Lys Asn Leu Ile Ser Phe Cys Gln Phe Glu Ser Thr Gln
    370                 375                 380

Gln Asn Tyr Val Glu Lys Glu Thr Gly Lys Thr Lys Ile Arg Thr Ile
385                 390                 395                 400

Gly Arg Arg Val Ile Pro Arg Ser Ser Pro Leu Phe Gln Glu Phe Lys
                405                 410                 415

Ile Trp Gln Ser Leu Asn Asn Leu Lys Phe Val Asn Ser Glu Ser Asn
            420                 425                 430

Gln Ile Ile Gln Phe Ile Glu Leu Glu Asp Asp Val Lys Lys Val Val
        435                 440                 445

Phe Asp Glu Leu Asn Leu Arg Gly Asp Leu Lys Pro Asn Gln Val Leu
    450                 455                 460

Lys Ile Leu Ser Lys Tyr Met Lys Ile Gly Lys Leu Thr Gln Trp Lys
465                 470                 475                 480

Cys Asn Leu Glu Glu Ile Glu Gly Asn Arg Thr Asn Ser Ala Leu Tyr
                485                 490                 495

Asn Val Phe Gln Met Ile Ala Glu Glu Glu Gly Tyr Gly Phe Asn Trp
```

```
            500                 505                 510

Gly Lys Lys Ser Ala Leu Glu Ile Lys Ser Glu Leu Lys Ala Ile Phe
        515                 520                 525

Ser Ser Ile Gly Ile Asn Asp Ser Ile Leu Asp Phe Asp Phe Ser Lys
    530                 535                 540

Lys Leu Asp Gln Gln Leu Ser Tyr Gln Leu Trp His Leu Leu Tyr Ser
545                 550                 555                 560

Ala Glu Glu Gly Asn Ser Lys Ile Thr Glu Glu Asp Lys Phe Thr Tyr
                565                 570                 575

Gly Asn Thr Gly Val Ala Leu Lys Lys Lys Leu His Leu Lys Phe Gly
            580                 585                 590

Phe Lys Pro Glu Tyr Ser Thr Leu Ile Ser Asn Leu Arg Phe Thr Ser
        595                 600                 605

Asp Tyr Gly Asn Leu Ser Ser Lys Ala Ile Ser Lys Ile Leu Pro Phe
    610                 615                 620

Leu Arg Asp Gly Ser Asp Tyr Ser Lys Ala Cys Gln Tyr Ala Gly Tyr
625                 630                 635                 640

Asn His Ser Asn Ser Leu Ser Ala Asp Glu Leu Asp Asn Arg Glu Leu
                645                 650                 655

Lys Pro Lys Leu Glu Leu Leu Lys Lys Asn Ser Leu Arg Asn Pro Val
            660                 665                 670

Val Glu Lys Ile Leu Asn Gln Met Val Asn Val Val Asn Gln Val Ile
        675                 680                 685

Asp Asn Tyr Gly Lys Pro Asp Glu Val Arg Ile Glu Leu Ala Arg Glu
    690                 695                 700
```

```
Leu Lys Lys Ser Ala Lys Glu Arg Ser Gln Met Thr Lys Asn Ile Ser
705                 710                 715                 720

Asp Ala Thr Arg Arg Asn Ala Glu Ile Lys Lys Tyr Leu Ser Lys Glu
                725                 730                 735

Phe Gly Ile Pro Asn Pro Thr Lys Gly Asp Val Ile Arg Tyr Arg Leu
            740                 745                 750

Trp Glu Glu Leu Ala Ser Asn Gly Tyr Lys Asp Leu Phe Arg Asp Lys
        755                 760                 765

Tyr Ile Pro Lys Glu Lys Leu Phe Ser Asn Glu Ile Asp Ile Glu His
    770                 775                 780

Ile Ile Pro Lys Ala Leu Leu Phe Asp Asp Ser Phe Ser Asn Lys Thr
785                 790                 795                 800

Leu Ala Phe Lys Val Asp Asn Leu Lys Lys Ala Asp Arg Thr Ala Phe
                805                 810                 815

Asp Phe Met Ser Thr Asp Phe Ser Lys Asp Val Asp Ser Tyr Ile Gly
            820                 825                 830

Arg Ile Glu Thr Leu His Lys Asp Gly Lys Ile Ser Ser Ser Lys Tyr
        835                 840                 845

Lys Lys Leu Met Ile Pro Lys Ser Lys Leu Val Asp Gly Phe Ile Glu
    850                 855                 860

Arg Asp Leu Arg Asn Thr Gln Tyr Ile Ala Lys Gln Ala Arg Lys Met
865                 870                 875                 880

Leu Leu Glu Val Phe Lys Thr Val Val Pro Thr Thr Gly Lys Ile Thr
                885                 890                 895

Asp Lys Leu Arg Glu Asp Trp Asp Leu Ile Asn Val Met Lys Glu Leu
```

```
            900                 905                 910

Asn Phe Pro Lys Tyr Lys Ala Leu Gly Leu Thr Lys Lys Ile Glu Arg
        915                 920                 925

Phe Asp Val Gly Ser Glu Lys Ile Lys Ser Ile Asn Val Ile Glu Gly
    930                 935                 940

Trp Ser Lys Arg Asn Asp His Arg His His Ala Met Asp Ala Leu Ala
945                 950                 955                 960

Val Ala Phe Thr Thr His Asn His Ile Gln Tyr Leu Asn Tyr Leu Asn
                965                 970                 975

Ala Arg Lys Asp Ile His His Glu Met His Gly Thr Ile Lys Ser Ile
            980                 985                 990

Glu Asn Gln Ile Ile Gly Lys Asp  Val Met Gly Lys Arg  Arg Phe Ile
        995                 1000                1005

Pro Pro  Ile Ser Asp Leu Arg  Met Lys Ala Lys Leu  Gln Ile Glu
    1010                1015                1020

Ser Ile  Leu Ile Ser Phe Lys  Asn Lys Asn Lys Val  Val Thr Trp
    1025                1030                1035

Ser Val  Asn Lys Thr Lys Leu  Lys Gly Lys Asp Asn  Tyr Asn Lys
    1040                1045                1050

Arg Arg  Gln Leu Thr Pro Arg  Gly Gln Leu His Lys  Glu Thr Val
    1055                1060                1065

Tyr Gly  Lys Ile Lys Leu Ile  Asp Pro Lys Pro Leu  Lys Leu Asn
    1070                1075                1080

Asn Lys  Phe Thr Leu Val Arg  Ala Ser Met Ile Val  Asp Lys Val
    1085                1090                1095
```

```
His Arg  Glu Ile Val Leu Gln  His Leu Ser Lys Tyr  Asp Asn Asn
    1100                1105                1110

Ser Glu  Val Ala Phe Asp Ser  Lys Thr Ile Lys Ile  Asp Pro Ile
    1115                1120                1125

Leu Ile  Glu Gly Ile Gly Leu  Lys Glu Val Val Cys  Tyr Glu Asp
    1130                1135                1140

Val Phe  Lys Ile Arg Lys Lys  Ile Ser Gly Asp Asn  Phe Lys Asn
    1145                1150                1155

Glu Lys  His Leu Glu Lys Val  Ile Asp Glu Lys Val  Lys Gln Ile
    1160                1165                1170

Leu Lys  Asp Arg Val Ile Lys  Phe Gln Gly Asn Phe  Lys Glu Ala
    1175                1180                1185

Phe Ser  Asn Leu Glu Glu Asn  Pro Ile Trp Leu Asn  Lys Ser Lys
    1190                1195                1200

Gly Ile  Ala Val Lys Ser Val  Ala Ile Lys Gly Val  Asn Asn Ala
    1205                1210                1215

Glu Ser  Leu His Glu Gly Lys  Asp His Phe Gly Asp  Gln Ile Leu
    1220                1225                1230

Asp Lys  Asn Lys Lys Gln Ile  Pro Val Asp Phe Val  Ser Thr Gly
    1235                1240                1245

Asn Asn  His His Val Gly Ile  Tyr Glu Asp Lys Asp  Gly Asn Leu
    1250                1255                1260

Gln Glu  Arg Val Val Ser Phe  Phe Glu Ala Val Thr  Arg Val Asn
    1265                1270                1275

Glu Gly  Leu Pro Ile Ile Asp  Lys Thr Tyr Asn Ser  Asp Ile Gly
```

```
    1280                1285                1290

Trp Lys  Phe Lys Phe Thr Met  Lys Gln Asn Glu Met  Phe Val Phe
    1295                1300                1305

Pro Ser  Asp Asp Phe Asp Pro  Asn Glu Phe Asp Leu  Thr Asp Gly
    1310                1315                1320

Lys Asn  Ala Ala Lys Ile Ser  Pro Asn Leu Tyr Arg  Val Gln Lys
    1325                1330                1335

Ile Ala  Thr Lys Asn Tyr Met  Phe Arg His His Leu  Glu Thr Val
    1340                1345                1350

Val Thr  Asn Asp Leu Glu Phe  Thr Tyr Lys Ser Ile  Arg Ser Thr
    1355                1360                1365

Gly Trp  Leu Arg Asn Leu Val  Lys Val Arg Ile Asn  His Leu Gly
    1370                1375                1380

Glu Ile  Val Tyr Val Gly Glu  Tyr
    1385                1390
```

<210> 449
<211> 1186
<212> PRT
<213> Gardnerella vaginalis

<400> 449

```
Met Glu Gly Asn Ile Ser Tyr Ala Ile Gly Ile Asp Val Gly Leu Asn
1               5                   10                  15

Ser Val Gly Leu Ala Ala Ile Arg Leu Asp Asp Tyr Gly Glu Pro Ile
            20                  25                  30

Arg Ile Leu Lys Ala Met Ser Val Ile His Asp Ala Gly Ile Asp Pro
        35                  40                  45
```

```
Asn Gly Ala Lys Glu Ser Asp Thr Arg Lys Ala Ile Ser Gly Val Ala
    50                  55                  60

Arg Arg Val Arg Arg Leu Tyr Arg Gln Arg Arg Arg Arg Leu Gln Lys
65                  70                  75                  80

Leu Asp Phe Leu Leu Gln Ser Leu Gly Trp Pro Val Val Glu Asn Lys
                85                  90                  95

Asp Leu Asp Phe Ser Asp Ser Phe Ile Pro Trp Ile Phe Arg Ala Lys
            100                 105                 110

Leu Ala Asp Glu Tyr Ile Ala Asp Glu Glu Gln Arg Lys Gln Met Leu
        115                 120                 125

Ser Val Ala Ile Arg His Ile Ala Arg His Arg Gly Trp Arg Asn Pro
    130                 135                 140

Tyr Gln Ser Ile Lys Ser Met Met Gln Glu Thr Glu Tyr Ser Glu Phe
145                 150                 155                 160

Tyr Asn Glu Leu Leu Lys Asn Ile Glu Lys Leu Ala Pro Gly Val Gly
                165                 170                 175

Cys Glu Gly Ser Thr Pro Ala Gln Leu Val Arg Asp Tyr Leu Leu Ser
            180                 185                 190

Gln Gln Gly Lys Ala Ser Arg Arg Leu Arg Ile Thr Thr Gly Gly Arg
        195                 200                 205

Arg Lys Asn His Pro His Ser Leu Asp Pro Val Leu Pro Arg Lys Leu
    210                 215                 220

Met Gln Ser Asp Asn Met Leu Glu Ile Leu Asn Ile Phe Asn Val Gln
225                 230                 235                 240

His Ile Asp Asp Lys Tyr Val Arg Glu Gln Ile Ile Asn Ala Val Phe
                245                 250                 255
```

```
Tyr Ala Glu Ser Pro Arg Gly Ser Ala Glu Asn Arg Val Gly Lys Asp
            260                 265                 270

Ala Ile Thr Gly Lys Gly Lys Arg Ala Leu Lys Ala Ser Leu Ala Phe
        275                 280                 285

Gln Lys Tyr Arg Ile Ile Ser Thr Ile Ser Asn Leu Arg Ile Arg Glu
    290                 295                 300

Asn Ser Lys Glu Arg Cys Leu Thr Ile Glu Glu Lys Gln Asn Val Tyr
305                 310                 315                 320

Lys Leu Leu Thr Thr Ser Ile Asp Lys Ser Ser Lys Arg Lys Ser Ala
                325                 330                 335

Glu Ala Pro Leu Tyr Thr Trp Ile Asp Val Ala Asp Cys Leu Gly Ile
            340                 345                 350

Glu Arg Tyr Lys Leu Arg Gly Val Gly Ser Gln Ile Gly Asp Gly Glu
        355                 360                 365

Ser Val Gly Asn Arg Pro Pro Met Leu Asn Ser Glu Leu Ala Ile Leu
    370                 375                 380

Tyr Ala Asn Asn Lys Ser Leu Gly Gln Ser Leu Ile Thr Trp Trp Leu
385                 390                 395                 400

Ala Ser Asn Arg Thr Gln Glu Asp Lys Glu Ala Leu Ile Glu Ile Leu
                405                 410                 415

Ser Asn Thr Val Asp Ile Glu Ala Ile His Asp Asn Pro Glu Tyr Gln
            420                 425                 430

Asp Lys Tyr Gly Ser Ala Ile Ala Phe Ile Asp Ser Met Asn Glu Thr
        435                 440                 445
```

```
Glu Ile Ala Ala Leu Glu Asn Ile Ser Leu Pro Asp Gly Arg Ala Ala
    450                 455                 460

Tyr Ser Leu Glu Thr Leu Asp Glu Leu Asn Lys Gln Met Leu Glu Thr
465                 470                 475                 480

Asp Asp Asp Leu Phe Glu Ala Arg Lys Lys Leu Phe Asn Leu Pro Asn
                485                 490                 495

Asn Trp Arg Pro Ala Glu Ala Pro Ile Ala Glu Pro Thr Gly Asn Pro
            500                 505                 510

Ser Val Asp Arg Val Leu Lys Ile Val His Arg Phe Leu Ile Ser Ala
        515                 520                 525

Lys Asn Arg Trp Gly Asn Pro Glu Arg Ile Asn Ile Glu His Val Arg
    530                 535                 540

Ser Gly Phe Gln Ser Lys Lys Met Ala Asn Ser Tyr Lys Glu Leu Leu
545                 550                 555                 560

Asp Lys Arg Thr Glu Gly Lys Glu Asn Leu Lys Ala Met Met Arg Asn
                565                 570                 575

Ser Leu His Leu Gly Thr Ser Asp Ser Ile Ser Asp Ala Asp Ile Arg
            580                 585                 590

Arg Tyr Glu Ala Val Gln Arg Gln Asn Gly Gln Cys Leu Tyr Cys Gly
        595                 600                 605

Ser Glu Ile Thr Tyr His Thr Cys Glu Leu Asp His Ile Val Pro Arg
    610                 615                 620

Lys Gly Pro Gly Ser Thr Asn Thr Arg Glu Asn Leu Val Ala Thr Cys
625                 630                 635                 640

Ser Ser Cys Asn Ala Gln Lys Cys Asn Thr Pro Phe Ala Thr Trp Cys
                645                 650                 655
```

```
Glu Gln Ser Thr Tyr Cys Lys Asn His Asp Ile Ser Ala Asp Ser Ala
            660                 665                 670

Ile Asn Arg Val Arg Ala Phe Ile Phe Pro Pro Asn Ser Tyr Asp Lys
        675                 680                 685

Arg Gly Ala Asn Gln Phe Lys Lys Glu Val Ile Ala Arg Leu Lys Gln
    690                 695                 700

Lys Val Gly Asp Glu Ala Phe Asp Asn Arg Ser Ile Glu Ser Val Ala
705                 710                 715                 720

Trp Met Ala Asn Glu Leu His Arg Arg Ile Asp Trp Tyr Tyr Asn Ser
                725                 730                 735

Gln Asn Tyr Gln Thr Asn Asn Gly Ile Ser Asp Ile Ser Asn Lys Ala
            740                 745                 750

Gln Thr Asn Val Gly Val Tyr Ala Gly Ser Leu Thr Ala Ile Ala Arg
        755                 760                 765

Arg Met Ser Gly Ile Asp Gly Lys Leu Glu Phe Phe Asp Gly Arg Arg
    770                 775                 780

Lys Thr Arg Phe Asp Arg Arg His His Ala Val Asp Ala Ser Val Ile
785                 790                 795                 800

Ala Met Met Thr Pro Gly Ile Ala Gln Ile Leu Ala Ile Lys Cys Asn
                805                 810                 815

Leu Arg Glu Thr Gln Leu Leu Gln Gly Asn Lys Val Val Pro Gly Gly
            820                 825                 830

Ile Asp Trp Lys Glu Tyr Pro Thr Ala Asn Asp Gln Gly Tyr Gln Gln
        835                 840                 845
```

```
Tyr Ala Asn Trp Ser Val Arg Met Asn Ala Leu Leu Lys Leu Leu Asn
    850                 855                 860

Glu Glu Met Arg Ala Asp Arg Ile Ala Val Val Asn Ser Ile Arg Leu
865                 870                 875                 880

Arg Tyr Ser Asn Ser Ser Val His Gln Tyr Glu Val Asn Ala Leu Leu
                885                 890                 895

Lys Leu His Val Gly Asp Glu Ile Asp Ser Glu Thr Ile Arg Arg Ser
            900                 905                 910

Ser Thr Pro Ala Leu Tyr Cys Ala Leu Thr Arg Asn Pro Asp Tyr Asp
        915                 920                 925

Val Asn Asn Gly Phe Pro Glu Asn Pro Gly Arg Thr Ile Leu Leu His
    930                 935                 940

Asn Lys Lys Leu Asn Ala Asp Asp Ser Ile Thr Phe Phe Lys Ala Gln
945                 950                 955                 960

Ala Val Gln Leu Phe Val Arg Glu Gly Ser Ala Lys Ile Gly Asn Ser
                965                 970                 975

Ile His His Leu Arg Ile Tyr Glu Tyr Phe Glu Lys Leu Lys Ser Gly
            980                 985                 990

Lys Ile Lys Lys Ser Tyr Gly Met  Ile Arg Val Phe Gln  Asn Asp Leu
        995                 1000                1005

His Arg  His Ile His Glu Asp  Leu Phe Ser Cys Asp  Leu Pro Glu
    1010                1015                1020

Gln Ser  Ile Ser Met Arg Tyr  Ala Asp Thr Lys Val  Ala His Ala
    1025                1030                1035

Val Gln  Thr Gly Asn Ala Asn  Tyr Leu Gly Tyr Leu  Val Pro Gly
    1040                1045                1050
```

```
Asp Glu  Ile Ile Val Asp Phe  Ser His Ile Thr Leu  Ser Glu Asn
    1055                1060                1065


Ile Gly  Lys Phe Val Glu Phe  Leu Asn Lys Ile Gly  Ala Asp Cys
    1070                1075                1080


Thr Ala  Tyr Arg His Trp Val  Val Val Gly Thr Asp  Thr Glu Lys
    1085                1090                1095


Val Leu  Ile Leu Lys Pro Ser  Met Ile Ser Ser Glu  Gly Ile Asp
    1100                1105                1110


Lys Leu  Tyr Ser Asn Cys Glu  Arg Asn Asn Phe Asp  Tyr Ser Ser
    1115                1120                1125


Tyr Glu  Lys Ser Ile Asn Glu  Ile Leu Ala Gly Lys  Gly Trp Arg
    1130                1135                1140


Val Ser  Val Asn Val Leu Ala  Gln Tyr Lys Ala Ala  Thr Ile Arg
    1145                1150                1155


Arg Asn  Ala Leu Gly Glu Val  Arg Trp Ala Ser Arg  Ser His Leu
    1160                1165                1170


Pro Ile  Ser Trp Ser Trp Asp  Thr Gly Glu Asn Arg  Glu
    1175                1180                1185


<210>  450
<211>  1186
<212>  PRT
<213>  Gardnerella vaginalis

<400>  450

Met Glu Gly Asn Ile Ser Tyr Ala Ile Gly Ile Asp Val Gly Leu Asn
1               5                   10                  15


Ser Val Gly Leu Ala Ala Ile Arg Leu Asp Asn Asn Gly Glu Pro Ile
```

```
            20                  25                  30

Arg Ile Leu Lys Ala Met Ser Val Ile His Asp Ala Gly Ile Asp Pro
        35                  40                  45

Asn Gly Ala Lys Glu Ser Asp Thr Arg Lys Ala Ile Ser Gly Val Ala
    50                  55                  60

Arg Arg Val Arg Arg Leu Tyr Arg Gln Arg Arg Arg Arg Leu Gln Lys
65                  70                  75                  80

Leu Asp Phe Leu Leu His Ser Leu Gly Phe Pro Val Val Glu Asn Lys
                85                  90                  95

Asp Leu Asp Phe Ser Asp Ser Phe Ile Pro Trp Ile Phe Arg Ala Lys
            100                 105                 110

Leu Ala Asp Glu Tyr Ile Ala Asp Glu Lys Gln Arg Lys Gln Met Leu
        115                 120                 125

Ser Val Ala Ile Arg His Ile Ala Arg His Arg Gly Trp Arg Asn Pro
    130                 135                 140

Tyr Gln Ser Ile Lys Ser Met Thr Gln Glu Thr Glu Tyr Ser Glu Phe
145                 150                 155                 160

Tyr Asn Glu Leu Leu Lys Asn Ile Glu Lys Phe Ala Pro Gly Val Gly
                165                 170                 175

Cys Glu Gly Ser Thr Pro Ala Gln Leu Val Arg Asp Tyr Leu Leu Leu
            180                 185                 190

Gln Gln Gly Lys Ala Ser Arg Arg Leu Arg Ile Thr Thr Asp Glu Lys
        195                 200                 205

Arg Lys Asn His Pro Asn Ser Leu Asn Pro Ile Leu Pro Arg Lys Leu
    210                 215                 220
```

```
Met Gln Ser Asp Asn Met Leu Glu Ile Leu Asn Ile Phe Asn Val Gln
225                 230                 235                 240

His Ile Asp Asp Lys Tyr Val Arg Glu Gln Ile Ile Asn Ala Val Phe
                245                 250                 255

Tyr Ala Lys Ser Pro Arg Gly Ser Ala Glu Asn Arg Val Gly Lys Asp
            260                 265                 270

Ala Ile Thr Gly Lys Gly Lys Arg Ala Leu Lys Ala Ser Leu Ala Phe
        275                 280                 285

Gln Lys Tyr Arg Ile Ile Ser Thr Ile Ser Asn Leu Arg Ile Arg Glu
    290                 295                 300

Asn Ser Lys Glu Arg Cys Leu Thr Ile Glu Glu Lys Gln Ser Val Tyr
305                 310                 315                 320

Lys Leu Leu Thr Thr Ser Thr Asp Glu Ser Ser Lys Glu Lys Ser Ala
                325                 330                 335

Glu Ala Pro Leu Tyr Thr Trp Ile Asp Val Ala Asp Cys Leu Gly Ile
            340                 345                 350

Glu Arg Tyr Lys Leu Arg Gly Val Gly Ser Gln Ile Gly Asp Gly Glu
        355                 360                 365

Ser Val Gly Asn Arg Pro Pro Met Leu Asn Ser Glu Leu Ala Ile Ile
    370                 375                 380

Tyr Ala Asn Asn Lys Ser Leu Gly Lys Ser Leu Leu Thr Trp Trp Leu
385                 390                 395                 400

Asp Ala Asn Arg Thr Gln Glu Asp Lys Glu Ala Leu Ile Glu Ile Leu
                405                 410                 415

Ser Asn Thr Val Asp Ile Glu Ala Ile His Asp Asn Pro Glu Tyr Gln
```

```
            420                 425                 430

Asp Lys Tyr Gly Ser Ala Ile Ala Phe Ile Asp Ser Met Asp Glu Thr
        435                 440                 445

Glu Ile Ala Ala Leu Glu Asn Ile Ser Leu Pro Asp Gly Arg Ala Ala
    450                 455                 460

Tyr Ser Leu Glu Thr Leu Asp Lys Leu Asn Lys Gln Met Leu Glu Thr
465                 470                 475                 480

Asp Asp Asp Leu Phe Glu Ala Arg Lys Lys Leu Phe Asn Leu Pro Asn
                485                 490                 495

Asn Trp Arg Pro Ser Glu Ala Pro Ile Ala Glu Pro Thr Gly Asn Pro
            500                 505                 510

Ser Val Asp Arg Val Leu Lys Ile Val His Arg Phe Leu Ile Ser Ala
        515                 520                 525

Lys Asn Arg Trp Gly Asn Pro Glu Arg Ile Asn Ile Glu His Val Arg
    530                 535                 540

Ser Gly Phe Lys Ser Lys Lys Met Ala Asn Ser Tyr Lys Glu Leu Leu
545                 550                 555                 560

Asp Lys Arg Thr Lys Gly Lys Glu Asn Leu Lys Ala Met Met Arg Asn
                565                 570                 575

Ser Leu His Leu Gly Met Ser Asp Ser Ile Ser Asp Ala Asp Ile Arg
            580                 585                 590

Arg Tyr Glu Ala Val Gln Arg Gln Asn Gly Gln Cys Leu Tyr Cys Gly
        595                 600                 605

Ser Glu Ile Thr Tyr His Thr Cys Glu Leu Asp His Ile Val Pro Arg
    610                 615                 620
```

```
Lys Gly Pro Gly Ser Thr Asn Thr Arg Glu Asn Leu Val Ala Thr Cys
625                 630                 635                 640


Ser Leu Cys Asn Ala Gln Lys Cys Asn Thr Pro Phe Ser Thr Trp Cys
                645                 650                 655


Glu Gln Ser Thr Tyr Cys Lys Asn His Asp Ile Ser Val Asp Ser Ala
            660                 665                 670


Ile Asn Arg Val Arg Ala Phe Ile Phe Pro Pro Asn Ser Tyr Asp Lys
        675                 680                 685


Arg Gly Ala Asn Gln Phe Lys Lys Glu Val Ile Ala Arg Leu Lys Gln
    690                 695                 700


Lys Val Gly Asp Glu Ala Phe Asp Asn Arg Ser Ile Glu Ser Val Ala
705                 710                 715                 720


Trp Met Ala Asn Glu Leu His Arg Arg Ile Asp Trp Tyr Tyr Asn Ser
                725                 730                 735


Gln Asn Tyr Gln Thr Asn Asn Gly Ile Ser Asp Ile Thr Asn Lys Ala
            740                 745                 750


Gln Thr Asn Val Gly Val Tyr Ala Gly Ser Leu Thr Ala Ile Ala Arg
        755                 760                 765


Arg Met Ser Gly Ile Asp Gly Lys Leu Glu Phe Phe Asp Gly Arg Arg
    770                 775                 780


Lys Thr Arg Phe Asp Arg Arg His His Ala Val Asp Ala Ser Val Ile
785                 790                 795                 800


Ala Met Met Thr Pro Gly Ile Ala Gln Ile Leu Ala Ile Lys Cys Asn
                805                 810                 815


Leu Arg Glu Thr Gln Leu Leu Gln Gly Asn Lys Val Val Pro Gly Gly
```

```
            820                 825                 830

Ile Asp Trp Lys Glu Tyr Pro Thr Ala Asn Asp Gln Gly Tyr Gln Gln
        835                 840                 845

Tyr Ala Asn Trp Ser Val Arg Met Asn Ala Leu Leu Lys Leu Leu Asn
    850                 855                 860

Glu Glu Met Arg Ala Asp Arg Ile Ala Val Val Asn Ser Ile Arg Leu
865                 870                 875                 880

Arg Tyr Asn Asn Ser Ser Val His Gln Tyr Lys Val Asn Ala Leu Leu
                885                 890                 895

Lys Leu His Val Gly Asp Glu Ile Asp Ser Gly Thr Ile Arg Arg Ser
            900                 905                 910

Ser Thr Pro Ala Leu Tyr Cys Ala Leu Thr Arg Asn Pro Asp Tyr Asp
        915                 920                 925

Val Asn Asn Gly Leu Pro Glu Asn Pro Asn Arg Ala Ile Leu Leu His
    930                 935                 940

Asp Lys Lys Leu Asn Ala Asp Asp Ser Ile Thr Phe Phe Lys Ala Gln
945                 950                 955                 960

Ala Val Gln Leu Phe Val Arg Glu Gly Ser Ala Glu Ile Gly Ser Ser
                965                 970                 975

Thr His His Leu Arg Ile Tyr Glu Tyr Phe Lys Lys Leu Lys Ser Gly
            980                 985                 990

Lys Ile Lys Lys Ser Tyr Gly Met  Ile Arg Val Phe Gln  Asn Asp Leu
        995                 1000                1005

His Arg  His Ile His Glu Asp  Leu Phe Ser Cys Asp  Leu Pro Glu
    1010                1015                1020
```

```
Gln Ser  Ile Ser Met Arg Tyr  Ala Asp Thr Glu Val  Ala His Ala
    1025                1030                1035

Val Gln  Thr Gly Asn Ser Asn  Tyr Leu Gly Tyr Leu  Val Pro Gly
    1040                1045                1050

Asp Glu  Ile Ile Val Asp Phe  Ser His Val Lys Leu  Ser Gly Asn
    1055                1060                1065

Ile Gly  Thr Phe Val Glu Phe  Leu Asn Lys Ile Gly  Ala Asn Cys
    1070                1075                1080

Ala Ala  Tyr Asn His Trp Val  Val Val Gly Thr Asp  Thr Glu Lys
    1085                1090                1095

Val Leu  Ile Leu Lys Pro Ser  Met Ile Ser Ser Glu  Gly Ile Asp
    1100                1105                1110

Lys Leu  Tyr Ser Asn Cys Lys  Arg Asn Asn Phe Asp  Tyr Ser Ser
    1115                1120                1125

Tyr Glu  Lys Ser Ile Asn Glu  Ile Leu Val Gly Lys  Gly Trp Arg
    1130                1135                1140

Val Ser  Val Asn Val Leu Ala  Lys Tyr Asn Ala Glu  Thr Ile Arg
    1145                1150                1155

Arg Asn  Ala Leu Gly Glu Val  Arg Trp Thr Ser Arg  Ser His Leu
    1160                1165                1170

Pro Ile  Ser Trp Ser Trp Asn  Thr Gly Glu Asn Arg  Glu
    1175                1180                1185
```

<210> 451
<211> 1258
<212> PRT
<213> Gemella haemolysans

<400> 451

```
Met Thr Glu Glu Asn Pro Asp Ile Arg Lys Val Phe Leu Ala Ile His
1               5                  10                  15

His Ile Leu Lys Asn Arg Gly His Phe Leu Leu Gln Gly Gln Ser Phe
            20                  25                  30

Lys Glu Gly Asn Leu Asn Asn Leu Ile Lys Glu Leu Leu Asn Leu Asp
        35                  40                  45

Ile Leu His Ile Ser Ile Glu Ile Thr Glu Glu Asn Ile Asn Lys Ile
    50                  55                  60

Thr Glu Ile Ala Leu Glu Lys Lys Thr Leu Thr Asp Lys Val Asn Asp
65                  70                  75                  80

Leu Lys Lys Ile Tyr Pro Lys Glu Lys Gln Leu Leu Glu Ala Phe Arg
                85                  90                  95

Leu Ile Phe Gly Gly Lys Thr Ser Leu Asp Lys Leu Phe Ala Ile Asp
            100                 105                 110

Glu Tyr Lys Glu Leu Asp Ala Ser Val Lys Ser Val Ser Phe Lys Glu
        115                 120                 125

Lys Ile Tyr Glu Glu Val Arg His Asp Tyr Glu Gln Val Leu Ser Asn
    130                 135                 140

Tyr Ile Glu Leu Leu Asp Leu Ala Lys Leu Val Tyr Asp Ser Ile Ile
145                 150                 155                 160

Leu Ser Asp Ile Lys Lys Glu Gly Lys Thr Leu Ser Glu Ser Lys Val
                165                 170                 175

Glu Leu Tyr His Lys His Arg Glu Asp Leu Thr Lys Leu Lys Thr Leu
            180                 185                 190
```

```
Val Lys Asn Asp Ser Lys Leu Ser Glu Asp Lys Lys Val Glu Leu Tyr
        195                 200                 205

Ser Ala Ile Phe Lys Glu Asp Lys Asp Lys Gly Thr Asn Tyr Val Asn
    210                 215                 220

Tyr Ile Arg Lys Ser Glu Glu Gly Lys Gly Cys Asn Tyr Glu Asp Phe
225                 230                 235                 240

Lys Lys Phe Leu Val Lys Glu Leu Ala Lys Leu Glu Glu Ser Ser Ala
                245                 250                 255

Lys Glu Glu Ile Leu Arg Asp Leu Glu Leu Glu Leu Phe Leu Pro Leu
            260                 265                 270

Gln Arg Thr Lys Asp Asn Ser Val Val Pro Tyr Gln Ile His Lys Glu
        275                 280                 285

Glu Leu Val Lys Ile Leu Asp Asn Ala Ala Lys Tyr His Lys Phe Leu
    290                 295                 300

Asn Glu Lys Asp Asp Ser Gly Tyr Ser Ile Ile Glu Lys Val Ile Gln
305                 310                 315                 320

Leu Leu Glu Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Asn Ser Ser
                325                 330                 335

Lys Lys Ala Lys Val Asp Gly Phe Ala Trp Ser Val Arg Asn Lys Gly
            340                 345                 350

Tyr Glu Asn Thr Pro Val Thr Pro Trp Asn Tyr Glu Lys Val Ile Asp
        355                 360                 365

Glu Ser Ala Ser Ala Glu Lys Phe Ile Thr Asn Leu Thr Asn Lys Cys
    370                 375                 380

Thr Tyr Leu Lys Gly Glu Asp Val Leu Pro Lys Ser Ser Leu Leu Tyr
385                 390                 395                 400
```

```
Ser Glu Phe Ala Leu Leu Asn Glu Leu Asn Ala Leu Lys Tyr Asp Gly
                405                 410                 415

Asn Arg Ile Ser Leu Glu Ala Arg Asn Val Ile Ile Glu Lys Leu Phe
            420                 425                 430

Lys Glu Gln Gly Lys Lys Val Thr Lys Thr Ser Ile Lys Asn Leu Leu
        435                 440                 445

Lys Ala Glu Gly Tyr Ile Asp Gly Lys Gly Glu Ile Thr Gly Ile Asp
    450                 455                 460

Ile Thr Val Lys Asn Asp Leu Lys Ser Tyr Arg Asp Phe Lys Lys Ile
465                 470                 475                 480

Leu Gly Asp Lys Phe Asn Thr Glu His Val Glu Asn Ile Ile Leu Trp
                485                 490                 495

Ile Thr Leu Tyr Gly Glu Ser Arg Lys Leu Ile Lys Ala Lys Ile Glu
            500                 505                 510

Ala Val Tyr Gly Asp Ile Tyr Ser Lys Glu Glu Ile Ala Lys Met Ser
        515                 520                 525

Arg Leu Val Tyr Lys Asp Trp Gly Arg Phe Ser Arg Lys Leu Leu Thr
    530                 535                 540

Glu Leu Val Ser Lys Lys Leu Tyr Asn Glu Glu Thr Gly Glu Cys Leu
545                 550                 555                 560

Asn Ile Ile Gly Ala Met Arg Gln Asn Asn Ile Leu Phe Met Glu Leu
                565                 570                 575

Leu Ala Asp Arg Phe Asp Tyr Ser Gln Gln Ile Ile Asp Tyr Asn Lys
            580                 585                 590
```

```
Glu Leu Gln Lys Glu Val Thr Glu Ile Thr Pro Glu Ile Leu Asp Asp
        595                 600                 605

Leu Tyr Val Ser Pro Ser Val Lys Arg Ser Ile Trp Gln Thr Val Arg
    610                 615                 620

Ile Val Glu Glu Leu Lys Lys Ile Ile Gly Cys Ala Pro Ala Lys Ile
625                 630                 635                 640

Phe Val Glu Thr Thr Arg Ser Asn Gln Asp Lys Lys Lys Pro Thr Asp
                645                 650                 655

Ser Arg Lys Lys Gln Leu Glu Leu Phe Tyr Lys Ala Val Lys Lys Asp
            660                 665                 670

Val Lys Asp Leu Glu Lys Glu Ile Gly Ser Leu Asn Phe Asp Lys Leu
        675                 680                 685

Asn Glu Arg Leu Ser Ser Val Glu Pro Ser Lys Leu Lys Ala Lys Lys
    690                 695                 700

Leu Tyr Leu Tyr Tyr Thr Gln Leu Gly Arg Cys Met Tyr Ser Gly Glu
705                 710                 715                 720

Thr Ile Asp Ile Thr Gln Leu Asn Thr Thr Ala Tyr Asp Ile Asp His
                725                 730                 735

Ile Tyr Pro Gln Ser Lys Val Lys Asp Asp Ser Phe Thr Asn Thr Val
            740                 745                 750

Leu Val Lys Arg Glu Tyr Asn Ala Ala Lys Thr Asp Arg Tyr Pro Leu
        755                 760                 765

Gly Ser Asp Ile Gln Thr Pro Ser Asn Arg Arg Phe Trp Lys Phe Leu
    770                 775                 780

Lys Glu Lys Gly Leu Ile Thr Asp Glu Lys Tyr Asn Arg Leu Val Arg
785                 790                 795                 800
```

```
Thr Glu Glu Phe Ser Asp Glu Glu Leu Thr Gly Phe Ile Ala Arg Gln
                805                 810                 815

Leu Val Glu Thr Ser Gln Ser Val Lys Ala Val Ala Gly Ile Leu Gly
            820                 825                 830

Glu Leu Asn Pro Lys Thr Ser Ile Cys Tyr Ser Lys Ala Glu Asn Val
        835                 840                 845

Ser Ser Phe Arg Gln Asn Phe Gly Lys Ile Lys Glu Gly Asn Arg Lys
    850                 855                 860

Ser Asp Asn Thr Glu Gln Leu Ile Lys Val Arg Glu Ile Asn Asp Tyr
865                 870                 875                 880

His His Ala Lys Asp Ala Tyr Leu Asn Val Val Val Gly Asn Val Tyr
                885                 890                 895

Asp Thr Lys Phe Thr Arg Asn Val Phe Asn Phe Ile Lys Asp Lys Lys
            900                 905                 910

Asp Gly Arg Lys Tyr Ser Leu Asn Asn Val Phe Tyr Glu Asn Val Ser
        915                 920                 925

Asn Ser Asn Asn Val Ala Trp Glu Leu Asn Lys Thr Val His Gln Val
    930                 935                 940

Glu Lys Val Met Asn Asn Asn Asn Ile Leu Val Thr Arg Arg Thr Ser
945                 950                 955                 960

Glu Gln Lys Gly Gly Leu Phe Asp Ala Thr Val Tyr Lys Ala Lys Val
                965                 970                 975

Ala Ala Lys Ala Lys Glu Gly Val Tyr Tyr Pro Leu Lys Thr Ser Asp
            980                 985                 990
```

```
Pro Val Val Asn Asp Val Thr Lys  Tyr Gly Gly Phe Thr  Lys Val Lys
        995                 1000                1005


Ile Ala  Tyr Tyr Ser Ile Phe  Glu Tyr Thr Leu Val  Asn Lys Lys
    1010                1015                1020


Gly Glu  Glu Lys Ile Thr Arg  Ile Ile Pro Ile Pro  Ile Tyr Val
    1025                1030                1035


Ser Gln  Asn Ile Lys Asp Asp  Ser Thr Leu Leu Glu  Phe Gly Lys
    1040                1045                1050


Thr Gln  Ile Asn Ile Lys Ser  Gly Glu Glu Val Lys  Asp Phe Lys
    1055                1060                1065


Leu Lys  Tyr Arg Lys Leu Cys  Ile Gly Asp Leu Val  Lys Ile Asn
    1070                1075                1080


Asn Phe  Phe Asn Phe Ile Gly  Gly Lys Thr Asn Asp  Ser Phe Val
    1085                1090                1095


Tyr Asp  Gly Ala Val Gln Val  Thr Leu Asp Thr Glu  Ser Glu Arg
    1100                1105                1110


Tyr Ile  Lys Thr Leu Ser Lys  Tyr Gln Asn Trp Lys  Lys Glu Asn
    1115                1120                1125


Lys Asp  Gly Glu Leu Trp Glu  Ser Ile Thr Lys Glu  Lys Asn Thr
    1130                1135                1140


Glu Leu  Tyr Asn Leu Leu Val  Glu Lys Met Asn Ser  Gly Ile Phe
    1145                1150                1155


Ile Lys  Lys Lys Pro Asn Lys  Phe Asn Glu Leu Asn  Ser Glu Glu
    1160                1165                1170


Ile Arg  Asn Asn Phe Ser Ser  Ile Ser Leu Glu Glu  Gln Ala Lys
    1175                1180                1185
```

```
Val Leu  Leu Glu Val Leu Asn  Leu Leu Thr Asn Lys  Lys Ser Ile
    1190                1195                1200


Phe Asp  Leu Lys Ser Ile Asn  Ile Thr Ala Ala Arg  Gly Lys Ile
    1205                1210                1215


Ser Phe  Asn Leu Ser Asn Leu  Ser Gln Phe Ser Ile  Ile Glu Gln
    1220                1225                1230


Ser Val  Ala Gly Phe Tyr Glu  Lys Glu Ile Thr Ile  Ile Gly Asp
    1235                1240                1245


Lys Glu  Asn Asp Met Glu Asn  Asn Asn Cys
    1250                1255
```

<210> 452
<211> 1054
<212> PRT
<213> Haemophilus parainfluenzae

<400> 452

```
Met Glu Asn Lys Asn Leu Asn Tyr Ile Leu Gly Leu Asp Leu Gly Ile
1               5                   10                  15


Ala Ser Val Gly Trp Ala Val Val Glu Ile Asp Glu Lys Glu Asn Pro
            20                  25                  30


Leu Arg Leu Ile Asp Val Gly Val Arg Thr Phe Glu Arg Ala Glu Val
        35                  40                  45


Pro Lys Thr Gly Glu Ser Leu Ala Leu Ser Arg Arg Leu Ala Arg Ser
    50                  55                  60


Ala Arg Arg Leu Thr Gln Arg Arg Val Ala Arg Leu Lys Lys Ala Lys
65                  70                  75                  80


Arg Leu Leu Lys Ser Glu Asn Ile Leu Leu Ser Thr Asp Glu Arg Leu
```

```
                85                  90                  95

Pro His Gln Val Trp Gln Leu Arg Val Glu Gly Leu Asp His Lys Leu
            100                 105                 110

Glu Arg Gln Glu Trp Ala Ala Val Leu Leu His Leu Ile Lys His Arg
        115                 120                 125

Gly Tyr Leu Ser Gln Arg Lys Asn Glu Ser Lys Ser Glu Asn Lys Glu
    130                 135                 140

Leu Gly Ala Leu Leu Ser Gly Val Asp Asn Asn His Lys Leu Leu Gln
145                 150                 155                 160

Gln Ala Thr Tyr Arg Ser Pro Ala Glu Leu Ala Val Lys Lys Phe Glu
                165                 170                 175

Val Glu Glu Gly His Ile Arg Asn Gln Gln Gly Ala Tyr Thr His Thr
            180                 185                 190

Phe Ser Arg Leu Asp Leu Leu Ala Glu Met Glu Leu Leu Phe Ser Arg
        195                 200                 205

Gln Gln His Phe Gly Asn Pro Phe Ala Ser Glu Lys Leu Leu Glu Asn
    210                 215                 220

Leu Thr Ala Leu Leu Met Trp Gln Lys Pro Ala Leu Ser Gly Glu Ala
225                 230                 235                 240

Ile Leu Lys Met Leu Gly Lys Cys Thr Phe Glu Asp Glu Tyr Lys Ala
                245                 250                 255

Ala Lys Asn Thr Tyr Ser Ala Glu Arg Phe Val Trp Ile Thr Lys Leu
            260                 265                 270

Asn Asn Leu Arg Ile Gln Glu Asn Gly Leu Glu Arg Ala Leu Asn Asp
        275                 280                 285
```

```
Asn Glu Arg Leu Ala Leu Met Glu Gln Pro Tyr Asp Lys Asn Arg Leu
    290                 295                 300

Phe Tyr Ser Gln Val Arg Ser Ile Leu Lys Leu Ser Asp Glu Ala Ile
305                 310                 315                 320

Phe Lys Gly Leu Arg Tyr Ser Gly Glu Asp Lys Lys Ala Ile Glu Thr
                325                 330                 335

Lys Ala Val Leu Met Glu Met Lys Ala Tyr His Gln Ile Arg Lys Val
            340                 345                 350

Leu Glu Gly Asn Asn Leu Lys Ala Glu Trp Ala Glu Leu Lys Ala Asn
        355                 360                 365

Pro Thr Leu Leu Asp Glu Ile Gly Thr Ala Phe Ser Leu Tyr Lys Thr
    370                 375                 380

Asp Glu Asp Ile Ser Ala Tyr Leu Ala Gly Lys Leu Ser Gln Pro Val
385                 390                 395                 400

Leu Asn Ala Leu Leu Glu Asn Leu Ser Phe Asp Lys Phe Ile Gln Leu
                405                 410                 415

Ser Leu Lys Ala Leu Tyr Lys Leu Leu Pro Leu Met Gln Gln Gly Leu
            420                 425                 430

Arg Tyr Asp Glu Ala Cys Arg Glu Ile Tyr Gly Asp His Tyr Gly Lys
        435                 440                 445

Lys Thr Glu Glu Asn His His Phe Leu Pro Gln Ile Pro Ala Asp Glu
    450                 455                 460

Ile Arg Asn Pro Val Val Leu Arg Thr Leu Thr Gln Ala Arg Lys Val
465                 470                 475                 480

Ile Asn Gly Val Val Arg Leu Tyr Gly Ser Pro Ala Arg Ile His Ile
```

```
                485                 490                 495

Glu Thr Gly Arg Glu Val Gly Lys Ser Tyr Lys Asp Arg Arg Glu Leu
            500                 505                 510

Glu Lys Arg Gln Glu Glu Asn Arg Lys Gln Arg Glu Asn Ala Ile Lys
        515                 520                 525

Glu Phe Lys Glu Tyr Phe Pro His Phe Ala Gly Glu Pro Lys Ala Lys
    530                 535                 540

Asp Ile Leu Lys Met Arg Leu Tyr Lys Gln Gln Asn Ala Lys Cys Leu
545                 550                 555                 560

Tyr Ser Gly Lys Pro Ile Glu Leu His Arg Leu Leu Glu Lys Gly Tyr
                565                 570                 575

Val Glu Val Asp His Ala Leu Pro Phe Ser Arg Thr Trp Asp Asp Ser
            580                 585                 590

Phe Asn Asn Lys Val Leu Val Leu Ala Asn Glu Asn Gln Asn Lys Gly
        595                 600                 605

Asn Leu Thr Pro Phe Glu Trp Leu Asp Gly Lys His Asn Ser Glu Arg
    610                 615                 620

Trp Arg Ala Phe Lys Ala Leu Val Glu Thr Ser Ala Phe Pro Tyr Ala
625                 630                 635                 640

Lys Lys Gln Arg Ile Leu Ser Gln Lys Leu Asp Glu Lys Gly Phe Ile
                645                 650                 655

Glu Arg Asn Leu Asn Asp Thr Arg Tyr Val Ala Arg Phe Leu Cys Asn
            660                 665                 670

Phe Ile Ala Asp Asn Met His Leu Thr Gly Glu Gly Lys Arg Lys Val
        675                 680                 685
```

```
Phe Ala Ser Asn Gly Gln Ile Thr Ala Leu Leu Arg Ser Arg Trp Gly
    690                 695                 700

Leu Ala Lys Ser Arg Glu Asp Asn Asp Arg His His Ala Leu Asp Ala
705                 710                 715                 720

Val Val Val Ala Cys Ser Thr Val Ala Met Gln Gln Lys Ile Thr Arg
                725                 730                 735

Phe Val Arg Phe Glu Ala Gly Asp Val Phe Thr Gly Glu Arg Ile Asp
            740                 745                 750

Arg Glu Thr Gly Glu Ile Ile Pro Leu His Phe Pro Thr Pro Trp Gln
        755                 760                 765

Phe Phe Lys Gln Glu Val Glu Ile Arg Ile Phe Ser Asp Asn Pro Lys
    770                 775                 780

Leu Glu Leu Glu Asn Arg Leu Pro Asp Arg Pro Gln Ala Asn His Glu
785                 790                 795                 800

Phe Val Gln Pro Leu Phe Val Ser Arg Met Pro Thr Arg Lys Met Thr
                805                 810                 815

Gly Gln Gly His Met Glu Thr Val Lys Ser Ala Lys Arg Leu Asn Glu
            820                 825                 830

Gly Ile Ser Val Ile Lys Met Pro Leu Thr Lys Leu Lys Leu Lys Asp
        835                 840                 845

Leu Glu Leu Met Val Asn Arg Glu Arg Glu Lys Asp Leu Tyr Asp Thr
    850                 855                 860

Leu Lys Ala Arg Leu Glu Ala Phe Asn Asp Asp Pro Ala Lys Ala Phe
865                 870                 875                 880

Ala Glu Pro Phe Ile Lys Lys Gly Gly Ala Ile Val Lys Ser Val Arg
```

```
               885                 890                 895

Val Glu Gln Ile Gln Lys Ser Gly Val Leu Val Arg Glu Gly Asn Gly
            900                 905                 910

Val Ala Asp Asn Ala Ser Met Val Arg Val Asp Val Phe Thr Lys Gly
        915                 920                 925

Gly Lys Tyr Phe Leu Val Pro Ile Tyr Thr Trp Gln Val Ala Lys Gly
    930                 935                 940

Ile Leu Pro Asn Lys Ala Ala Thr Gln Tyr Lys Asp Glu Glu Asp Trp
945                 950                 955                 960

Glu Val Met Asp Asn Ser Ala Thr Phe Lys Phe Ser Leu His Pro Asn
               965                 970                 975

Asp Leu Val Lys Leu Val Thr Lys Lys Lys Thr Ile Leu Gly Tyr Phe
            980                 985                 990

Asn Gly Leu Asn Arg Ala Thr Gly  Asn Ile Asp Ile Lys  Glu His Asp
        995                 1000                1005

Leu Asp  Lys Ser Lys Gly Lys  Gln Gly Ile Phe Glu  Gly Val Gly
    1010                1015                1020

Ile Lys  Leu Ala Leu Ser Phe  Glu Lys Tyr Gln Val  Asp Glu Leu
    1025                1030                1035

Gly Lys  Asn Ile Arg Leu Cys  Lys Pro Ser Lys Arg  Gln Pro Val
    1040                1045                1050

Arg
```

<210> 453
<211> 1052
<212> PRT

<213> Haemophilus parainfluenzae]

<400> 453

```
Met Lys Asn Thr Ser Leu Asn Tyr Val Leu Gly Leu Asp Leu Gly Ile
1               5                  10                  15


Ser Ser Val Gly Trp Ala Val Val Glu Ile Asp Glu Lys Glu Asn Pro
            20                  25                  30


Leu Ser Leu Ile Asp Val Gly Val Arg Thr Phe Glu Arg Ala Glu Thr
        35                  40                  45


Gln Lys Gly Glu Ser Leu Ala Leu Ala Arg Arg Leu Ala Arg Ser Ala
    50                  55                  60


Arg Arg Leu Thr Gln Arg Arg Val Ala Arg Leu Lys Lys Ala Lys Arg
65                  70                  75                  80


Leu Leu Lys Ser Glu Asn Ile Leu Leu Ser Thr Asp Glu Cys Leu Pro
                85                  90                  95


His Gln Val Trp Gln Leu Arg Val Glu Gly Leu Glu Arg Lys Leu Glu
            100                 105                 110


Arg Gln Glu Trp Ala Ala Val Leu Leu His Leu Ile Lys His Arg Gly
        115                 120                 125


Tyr Leu Ser Gln Arg Lys Asn Glu Ser Lys Ser Glu Asn Lys Glu Leu
    130                 135                 140


Gly Ala Leu Leu Ser Gly Val Ala Asn Asn His Lys Leu Leu Gln Gln
145                 150                 155                 160


Thr Thr Tyr Arg Thr Pro Ala Glu Leu Ala Val Lys Lys Phe Glu Val
                165                 170                 175


Glu Glu Gly His Ile Arg Asn Gln Gln Gly Ser Tyr Thr His Thr Phe
            180                 185                 190
```

```
Ser Arg Leu Asp Leu Leu Ser Glu Met Glu Leu Leu Phe Ser Arg Gln
        195                 200                 205

Gln His Phe Gly Asn Pro Phe Thr Ser Glu Lys Leu Leu Glu Asn Leu
    210                 215                 220

Thr Ala Leu Leu Met Trp Gln Lys Pro Ala Leu Ser Gly Asp Ala Ile
225                 230                 235                 240

Leu Lys Met Leu Gly Lys Cys Thr Phe Glu Asn Glu Tyr Lys Ala Ala
                245                 250                 255

Lys His Thr Tyr Ser Ala Glu Arg Phe Ile Trp Ile Thr Lys Leu Asn
            260                 265                 270

Asn Leu Arg Ile Gln Glu Asn Gly Leu Glu Arg Ala Leu Asn Asp Asn
        275                 280                 285

Glu Arg Leu Ala Leu Met Lys Gln Pro Tyr Glu Lys Ala Lys Leu Thr
    290                 295                 300

Tyr Ala Gln Val Arg Ser Ile Leu Asn Leu Ser Asp Glu Ala Ile Phe
305                 310                 315                 320

Lys Gly Leu Arg Tyr Ser Gly Glu Asp Lys Lys Thr Ser Glu Thr Lys
                325                 330                 335

Thr Val Leu Met Glu Met Lys Ala Tyr His Gln Ile Arg Leu Ala Leu
            340                 345                 350

Glu Lys Asn Asp Leu Lys Thr Glu Trp Ala Glu Leu Lys Val Asn Ser
        355                 360                 365

Ser Leu Leu Asp Glu Ile Gly Thr Ala Phe Ser Leu Tyr Lys Thr Asp
    370                 375                 380
```

```
Glu Asp Ile Ser Thr Cys Leu Ala Gly Lys Leu Ser Gln Pro Val Leu
385                 390                 395                 400

Asn Ala Leu Leu Glu Asn Leu Asn Phe Asp Lys Phe Ile Gln Leu Ser
                405                 410                 415

Leu Lys Ala Leu His Lys Ile Leu Pro Leu Met Gln Gln Gly Leu Arg
            420                 425                 430

Tyr Asp Glu Ala Cys Ala Glu Ile Tyr Gly Asp His Tyr Gly Lys Lys
        435                 440                 445

Thr Glu Glu Asn His Leu Leu Leu Pro Gln Ile Pro Ala Asp Glu Ile
    450                 455                 460

Arg Asn Pro Val Val Leu Arg Thr Leu Thr Gln Ala Arg Lys Val Ile
465                 470                 475                 480

Asn Gly Val Val Arg Leu Tyr Ser Ser Pro Ala Arg Ile His Ile Glu
                485                 490                 495

Thr Gly Arg Glu Val Gly Lys Ser Tyr Gln Asp Arg Arg Glu Leu Glu
            500                 505                 510

Lys Arg Gln Glu Glu Asn Arg Lys Gln Arg Glu Lys Ala Ile Ser Glu
        515                 520                 525

Ile Lys Thr Leu Phe Pro Asn Phe Ser Gly Glu Pro Lys Ala Lys Asp
    530                 535                 540

Ile Leu Lys Met Arg Leu Tyr Tyr Gln Gln Asn Ala Lys Cys Leu Tyr
545                 550                 555                 560

Ser Gly Lys Pro Leu Glu Leu His Arg Leu Leu Glu Gln Gly Tyr Val
                565                 570                 575

Glu Ile Asp His Ala Leu Pro Phe Ser Arg Thr Trp Asp Asp Ser Phe
            580                 585                 590
```

```
Asn Asn Lys Val Leu Val Leu Ala Asn Glu Asn Gln Asn Lys Gly Asn
        595                 600                 605

Leu Thr Pro Phe Glu Trp Leu Asp Gly Lys Asn Asn Ser Glu Arg Trp
    610                 615                 620

Lys Ala Phe Lys Ala Leu Val Glu Thr Ser Ala Phe Pro Tyr Thr Lys
625                 630                 635                 640

Lys Gln Arg Ile Leu Ser Gln Lys Leu Asp Glu Lys Gly Phe Ile Glu
                645                 650                 655

Arg Asn Leu Asn Asp Thr Arg Tyr Val Ala Arg Phe Leu Cys Asn Phe
            660                 665                 670

Ile Ala Asp Asn Met His Leu Thr Gly Glu Gly Lys Arg Lys Val Phe
        675                 680                 685

Ala Ser Asn Gly Gln Ile Thr Ala Leu Leu Arg Gly Arg Trp Gly Leu
    690                 695                 700

Ala Lys Ser Arg Glu Asp Asn Asp Arg His His Ala Leu Asp Ala Val
705                 710                 715                 720

Val Val Ala Cys Ser Thr Val Ser Met Gln Gln Lys Ile Thr Arg Phe
                725                 730                 735

Val Arg Phe Glu Glu Gly Asn Val Phe Thr Gly Glu Arg Ile Asp Arg
            740                 745                 750

Glu Thr Gly Glu Ile Ile Pro Leu His Phe Pro Ala Pro Trp Lys Phe
        755                 760                 765

Phe Arg Glu Glu Val Glu Ile Arg Ile Phe Ser Asp Asn Pro Lys Leu
    770                 775                 780
```

```
Glu Leu Glu Asn Arg Leu Ile Ala Arg Pro Gln Ala Asn His Glu Phe
785                 790                 795                 800


Val Gln Pro Leu Phe Val Ser Arg Met Pro Thr Arg Lys Met Ile Gly
                805                 810                 815


Gln Gly His Met Glu Thr Ile Lys Ser Ala Lys Arg Leu Asn Glu Gly
            820                 825                 830


Leu Ser Val Ile Lys Met Leu Leu Thr Lys Leu Arg Leu Lys Asp Leu
        835                 840                 845


Glu Ser Met Val Asn Arg Glu Arg Glu Lys Glu Leu Tyr Glu Ala Leu
    850                 855                 860


Lys Ala Arg Leu Glu Ala Phe Asn Asp Glu Pro Ala Lys Ala Phe Ala
865                 870                 875                 880


Glu Pro Phe Met Lys Lys Gly Gly Ala Ile Val Lys Ser Val Arg Val
                885                 890                 895


Glu Gln Val Gln Lys Ser Gly Val Leu Val Arg Asp Gly Asn Gly Val
            900                 905                 910


Ala Asp Asn Ala Ser Met Val Arg Val Asp Val Phe Thr Lys Gly Gly
        915                 920                 925


Lys Tyr Phe Leu Val Pro Ile Tyr Thr Trp Gln Val Ala Lys Gly Ile
    930                 935                 940


Leu Pro Asn Lys Ala Val Ile Gln Gly Lys Asn Glu Glu Asp Trp Glu
945                 950                 955                 960


Val Met Asp Asp Ala Thr Phe Arg Phe Ser Leu His Gln Asn Asp Leu
                965                 970                 975


Val Lys Leu Val Thr Lys Lys Lys Thr Ile Phe Gly Tyr Phe Asn Gly
            980                 985                 990
```

Leu Asn Arg Ala Thr Gly Asn Ile Asp Ile Lys Glu His Asp Leu Glu
        995   1000   1005

Lys Ser Lys Val Lys Asp Gly Ile His Gln Ser Ile Gly Ile Lys
    1010   1015   1020

Leu Ala Leu Ser Phe Glu Lys Tyr Gln Val Asp Glu Leu Gly Lys
    1025   1030   1035

Asn Ile Arg Leu Cys Lys Ser Ser Lys Arg Gln Ala Val Arg
    1040   1045   1050

<210> 454
<211> 121
<212> PRT
<213> Haemophilus pittmaniae

<400> 454

Met Leu Asn Arg Arg Tyr Ala Ala Lys Ile Thr Arg Phe Val Arg Phe
1   5   10   15

Glu Ala Gly Asp Val Phe Thr Gly Glu Arg Ile Asp Arg Glu Thr Gly
            20   25   30

Glu Ile Ile Pro Leu His Phe Pro Thr Pro Trp Gln Phe Phe Lys Gln
        35   40   45

Glu Val Glu Ile Arg Ile Phe Ser Asp Asn Pro Lys Leu Glu Leu Glu
    50   55   60

Asn Arg Leu Pro Asp Arg Pro Gln Ala Asn His Glu Phe Val Gln Pro
65   70   75   80

Leu Phe Val Ser Arg Met Pro Thr Arg Lys Met Thr Gly Gln Gly His
                85   90   95

Met Glu Thr Val Lys Ser Ala Lys Arg Leu Asn Glu Gly Ile Ser Val

```
            100                 105                 110


Ile Lys Met Pro Leu Thr Lys Leu Asn
        115                 120


<210>  455
<211>  203
<212>  PRT
<213>  Haemophilus pittmaniae

<400>  455

Met Val Asn Arg Glu Arg Glu Lys Asp Leu Tyr Asp Ala Leu Lys Ala
1               5                   10                  15


Arg Leu Glu Ala Phe Asn Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro
            20                  25                  30


Phe Ile Lys Lys Gly Gly Ala Ile Val Lys Ser Val Arg Val Glu Gln
        35                  40                  45


Val Gln Lys Ser Gly Val Leu Val Arg Glu Gly Asn Gly Val Ala Asp
    50                  55                  60


Asn Ala Ser Met Val Arg Val Asp Val Phe Thr Lys Asp Gly Lys Tyr
65                  70                  75                  80


Phe Leu Val Pro Ile Tyr Thr Trp Gln Val Ala Lys Gly Ile Leu Pro
                85                  90                  95


Asn Lys Ala Ala Thr Gln Tyr Lys Asp Glu Glu Asp Trp Glu Val Met
            100                 105                 110


Asp Asn Ser Ala Ile Phe Lys Phe Ser Leu His Pro Asn Asp Leu Val
        115                 120                 125


Lys Leu Val Thr Lys Lys Lys Thr Ile Leu Gly Tyr Phe Asn Gly Leu
    130                 135                 140
```

```
Asp Arg Ala Thr Gly Asn Ile Ala Ile Lys Glu His Asp Leu Glu Lys
145                 150                 155                 160


Ser Lys Ala Lys Gly Gly Ile His Gln Gly Val Gly Ile Lys Leu Ala
                165                 170                 175


Leu Ser Phe Glu Lys Tyr Gln Ile Asp Glu Leu Gly Lys Asn Ile Arg
            180                 185                 190


Leu Cys Asn Pro Ser Lys Cys Gln Ser Val Arg
        195                 200
```

<210> 456
<211> 1052
<212> PRT
<213> Haemophilus sputorum

<400> 456

```
Met Lys Asn Thr Ser Leu Asn Tyr Val Leu Gly Leu Asp Leu Gly Ile
1               5                   10                  15


Ser Ser Val Gly Trp Ala Val Val Glu Ile Asp Glu Lys Glu Asn Pro
            20                  25                  30


Leu Ser Leu Ile Asp Val Gly Val Arg Thr Phe Glu Arg Ala Glu Thr
        35                  40                  45


Gln Lys Gly Glu Ser Leu Ala Leu Ala Arg Arg Leu Ala Arg Ser Ala
    50                  55                  60


Arg Arg Leu Thr Gln Arg Arg Val Ala Arg Leu Lys Lys Ala Lys Arg
65                  70                  75                  80


Leu Leu Lys Ser Glu Asn Ile Leu Leu Ser Thr Asp Glu Cys Leu Pro
                85                  90                  95


His Gln Val Trp Gln Leu Arg Val Glu Gly Leu Glu Arg Lys Leu Glu
            100                 105                 110
```

```
Arg Gln Glu Trp Ala Ala Val Leu Leu His Leu Ile Lys His Arg Gly
        115                 120                 125

Tyr Leu Ser Gln Arg Lys Asn Glu Ser Lys Ser Glu Asn Lys Glu Leu
    130                 135                 140

Gly Ala Leu Leu Ser Gly Val Ala Asn Asn His Lys Leu Leu Gln Gln
145                 150                 155                 160

Thr Thr Tyr Arg Thr Pro Ala Glu Leu Ala Val Lys Lys Phe Glu Val
                165                 170                 175

Glu Glu Gly His Ile Arg Asn Gln Gln Gly Ser Tyr Thr His Thr Phe
            180                 185                 190

Ser Arg Leu Asp Leu Leu Ser Glu Met Glu Leu Leu Phe Ser Arg Gln
        195                 200                 205

Gln His Phe Gly Asn Pro Phe Thr Ser Glu Lys Leu Leu Glu Asn Leu
    210                 215                 220

Thr Ala Leu Leu Met Trp Gln Lys Pro Ala Leu Ser Gly Asp Ala Ile
225                 230                 235                 240

Leu Lys Met Leu Gly Lys Cys Thr Phe Glu Asn Glu Tyr Lys Ala Ala
                245                 250                 255

Lys His Thr Tyr Ser Ala Glu Arg Phe Ile Trp Ile Thr Lys Leu Asn
            260                 265                 270

Asn Leu Arg Ile Gln Glu Asn Gly Leu Glu Arg Ala Leu Asn Asp Asn
        275                 280                 285

Glu Arg Leu Ala Leu Met Lys Gln Pro Tyr Glu Lys Ala Lys Leu Thr
    290                 295                 300

Tyr Ala Gln Val Arg Ser Ile Leu Asn Leu Ser Asp Glu Ala Ile Phe
```

```
305                 310                 315                 320

Lys Gly Leu Arg Tyr Ser Gly Glu Asp Lys Lys Thr Ser Glu Thr Lys
                325                 330                 335

Thr Val Leu Met Glu Met Lys Ala Tyr His Gln Ile Arg Leu Ala Leu
            340                 345                 350

Glu Lys Asn Asp Leu Lys Thr Glu Trp Ala Glu Leu Lys Val Asn Ser
        355                 360                 365

Ser Leu Leu Asp Glu Ile Gly Thr Ala Phe Ser Leu Tyr Lys Thr Asp
    370                 375                 380

Glu Asp Ile Ser Thr Cys Leu Ala Gly Lys Leu Ser Gln Pro Val Leu
385                 390                 395                 400

Asn Ala Leu Leu Glu Asn Leu Asn Phe Asp Lys Phe Ile Gln Leu Ser
                405                 410                 415

Leu Lys Ala Leu His Lys Ile Leu Pro Leu Met Gln Gln Gly Leu Arg
            420                 425                 430

Tyr Asp Glu Ala Cys Ala Glu Ile Tyr Gly Asp His Tyr Gly Lys Lys
        435                 440                 445

Thr Glu Glu Asn His Leu Leu Leu Pro Gln Ile Pro Ala Asp Glu Ile
    450                 455                 460

Arg Asn Pro Val Val Leu Arg Thr Leu Thr Gln Ala Arg Lys Val Ile
465                 470                 475                 480

Asn Gly Val Val Arg Leu Tyr Ser Ser Pro Ala Arg Ile His Ile Glu
                485                 490                 495

Thr Gly Arg Glu Val Gly Lys Ser Tyr Gln Asp Arg Arg Glu Leu Glu
            500                 505                 510
```

```
Lys Arg Gln Glu Glu Asn Arg Lys Gln Arg Glu Lys Ala Ile Ser Glu
        515                 520                 525

Ile Lys Thr Leu Phe Pro Asn Phe Ser Gly Glu Pro Lys Ala Lys Asp
    530                 535                 540

Ile Leu Lys Met Arg Leu Tyr Tyr Gln Gln Asn Ala Lys Cys Leu Tyr
545                 550                 555                 560

Ser Gly Lys Pro Leu Glu Leu His Arg Leu Leu Glu Gln Gly Tyr Val
                565                 570                 575

Glu Ile Asp His Ala Leu Pro Phe Ser Arg Thr Trp Asp Asp Ser Phe
            580                 585                 590

Asn Asn Lys Val Leu Val Leu Ala Asn Glu Asn Gln Asn Lys Gly Asn
        595                 600                 605

Leu Thr Pro Phe Glu Trp Leu Asp Gly Lys Asn Asn Ser Glu Arg Trp
    610                 615                 620

Lys Ala Phe Lys Ala Leu Val Glu Thr Ser Ala Phe Pro Tyr Thr Lys
625                 630                 635                 640

Lys Gln Arg Ile Leu Ser Gln Lys Leu Asp Glu Lys Gly Phe Ile Glu
                645                 650                 655

Arg Asn Leu Asn Asp Thr Arg Tyr Val Ala Arg Phe Leu Cys Asn Phe
            660                 665                 670

Ile Ala Asp Asn Met His Leu Thr Gly Glu Gly Lys Arg Lys Val Phe
        675                 680                 685

Ala Ser Asn Gly Gln Ile Thr Ala Leu Leu Arg Gly Arg Trp Gly Leu
    690                 695                 700

Ala Lys Ser Arg Glu Asp Asn Asp Arg His His Ala Leu Asp Ala Val
```

```
705                 710                 715                 720

Val Val Ala Cys Ser Thr Val Ser Met Gln Gln Lys Ile Thr Arg Phe
                725                 730                 735

Val Arg Phe Glu Glu Gly Asn Val Phe Thr Gly Glu Arg Ile Asp Arg
            740                 745                 750

Glu Thr Gly Glu Ile Ile Pro Leu His Phe Pro Ala Pro Trp Lys Phe
        755                 760                 765

Phe Arg Glu Glu Val Glu Ile Arg Ile Phe Ser Asp Asn Pro Lys Leu
    770                 775                 780

Glu Leu Glu Asn Arg Leu Ile Ala Arg Pro Gln Ala Asn His Glu Phe
785                 790                 795                 800

Val Gln Pro Leu Phe Val Ser Arg Met Pro Thr Arg Lys Met Thr Gly
                805                 810                 815

Gln Gly His Met Glu Thr Ile Lys Ser Ala Lys Arg Leu Asn Glu Gly
            820                 825                 830

Leu Ser Val Ile Lys Met Leu Leu Thr Lys Leu Arg Leu Lys Asp Leu
        835                 840                 845

Glu Ser Met Val Asn Arg Glu Arg Glu Lys Glu Leu Tyr Glu Ala Leu
    850                 855                 860

Lys Ala Arg Leu Glu Ala Phe Asn Asp Glu Pro Ala Lys Ala Phe Ala
865                 870                 875                 880

Glu Pro Phe Met Lys Lys Gly Gly Ala Ile Val Lys Ser Val Arg Val
                885                 890                 895

Glu Gln Val Gln Lys Ser Gly Val Leu Val Arg Asp Gly Asn Gly Val
            900                 905                 910
```

```
Ala Asp Asn Ala Ser Met Val Arg Val Asp Val Phe Thr Lys Gly Gly
        915                 920                 925


Lys Tyr Phe Leu Val Pro Ile Tyr Thr Trp Gln Val Ala Lys Gly Ile
    930                 935                 940


Leu Pro Asn Lys Ala Val Ile Gln Gly Lys Asn Glu Glu Asp Trp Glu
945                 950                 955                 960


Val Met Asp Asp Ala Thr Phe Arg Phe Ser Leu His Gln Asn Asp Leu
                965                 970                 975


Val Lys Leu Val Thr Lys Lys Lys Thr Ile Phe Gly Tyr Phe Asn Gly
            980                 985                 990


Leu Asn Arg Ala Thr Gly Asn Ile  Asp Ile Lys Glu His  Asp Leu Glu
        995                 1000                1005


Lys Ser  Lys Val Lys Asp Gly  Ile His Gln Ser Ile  Gly Ile Lys
    1010                1015                1020


Leu Ala  Leu Ser Phe Glu Lys  Tyr Gln Val Asp Glu  Leu Gly Lys
    1025                1030                1035


Asn Ile  Arg Leu Cys Lys Ser  Ser Lys Arg Gln Ala  Val Arg
    1040                1045                1050


<210>  457
<211>  1338
<212>  PRT
<213>  Helcococcus kunzii

<400>  457

Met Gln Asp Tyr Tyr Leu Gly Leu Asp Ile Gly Thr Asn Ser Val Gly
1               5                   10                  15


Trp Ala Val Thr Asp Glu Asn Tyr Asn Leu Leu Arg Lys Lys Gly Lys
            20                  25                  30
```

```
Asp Leu Trp Gly Val Arg Leu Phe Lys Glu Ala Gln Pro Ala Thr Glu
        35                  40                  45

Arg Arg Gly His Arg Ser Ser Arg Arg Arg Thr Ile Arg Lys Ser Leu
    50                  55                  60

Arg Lys Gln Leu Leu Arg Glu Leu Phe Glu Glu Glu Ile Asn Ala Ile
65                  70                  75                  80

Asp Lys Asp Phe Phe Leu Arg Leu Asp Glu Ser Lys Tyr Trp Leu Glu
                85                  90                  95

Asp Lys Lys Ile Glu Gly Lys Tyr Ser Leu Phe Asn Asp Glu Asn Phe
            100                 105                 110

Thr Asp Lys Asp Tyr Tyr Glu Lys Phe Pro Thr Ile Phe His Leu Arg
        115                 120                 125

Lys Ala Leu Ile Glu Ser Asp Asp Lys Glu Asp Ile Arg Leu Tyr Phe
    130                 135                 140

Leu Ala Ile Asn Gln Met Met Lys Arg Arg Gly His Phe Leu Ile Asp
145                 150                 155                 160

Gly Lys Leu Ser Asn Val Glu Asp Ile Thr Pro Phe Lys Glu Cys Ile
                165                 170                 175

Gln Asn Leu Ile Asn Glu Glu Leu Asp Thr Glu Ile Glu Thr Glu Phe
            180                 185                 190

Tyr Asp Lys Ala Ile Lys Ile Val Ser Asp Tyr Ser Leu Lys Lys Thr
        195                 200                 205

Glu Lys Lys Asn Leu Ile Lys Asp Leu Val Lys Glu Thr Asp Ser Ile
    210                 215                 220
```

```
Glu Asp Ser Lys Lys Ile Ile Asn Ile Phe Asn Leu Leu Ile Ser Gly
225                 230                 235                 240

Lys Ser Lys Val Asn Gly Ile Phe Asp Asp Glu Glu Ile Leu Glu Lys
                245                 250                 255

Ile Lys Glu Asp Asn Lys Glu Asp Phe Tyr Leu Thr Ser Glu Lys Tyr
            260                 265                 270

Glu Glu Asn Leu Glu Tyr Phe Ser Gln Leu Leu Asp Tyr Arg Phe Glu
        275                 280                 285

Leu Ile Ser Ser Leu Lys Ser Ile Tyr Asp Tyr Ile Ile Leu Gln Glu
    290                 295                 300

Val Leu Lys Gly Lys Lys Tyr Leu Ser Tyr Ala Gln Val Glu Arg Tyr
305                 310                 315                 320

Lys Asn His Lys Glu Asp Leu Arg Lys Leu Lys Gln Leu Ile Lys Lys
                325                 330                 335

Tyr Asp Lys Asn Gly Lys Ile Tyr Tyr Gln Ile Phe Arg Asp Glu Asn
            340                 345                 350

Phe Lys Lys Gly Tyr Val Ala Tyr Leu Gly Tyr Tyr Lys Lys Asn Lys
        355                 360                 365

Lys Asn Val Pro Val Lys Lys Cys Asp Tyr Asp Thr Phe Ser Lys Asn
    370                 375                 380

Ile Lys Ser Thr Leu Asp Lys Ile Cys Asp Lys Glu Asp Pro Leu Tyr
385                 390                 395                 400

Ile Glu Leu Ile Asp Lys Ile Glu Lys Gly Gly Phe Leu Leu Lys Gln
                405                 410                 415

Ile Val Ser Thr Asn Ser Val Ile Pro His Gln Val His Glu Leu Glu
            420                 425                 430
```

```
Leu Asp Lys Ile Leu Glu Asn Leu Glu Lys Asn Tyr Pro Ser Phe Lys
        435                 440                 445

Glu Ile Ser Asp Gly Val Ser Lys Ile Asp Lys Ile Lys Met Ile Phe
    450                 455                 460

Asn Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Asn Asp Tyr His Lys
465                 470                 475                 480

Asp Lys Val Asn Ser Asn Thr Trp Ile Val Lys Asn Glu Gly Phe Glu
                485                 490                 495

Asn Glu Asn Ile Arg Pro Trp Asn Phe Ser Lys Ile Val Asp Glu His
            500                 505                 510

Ala Cys Glu Glu Glu Phe Ile Lys Arg Met Ile Asn Glu Cys Ser Tyr
        515                 520                 525

Ile Pro Gly Glu Lys Val Leu Pro Lys Ser Ser Leu Leu Tyr Ser Glu
    530                 535                 540

Tyr Met Val Leu Asn Glu Leu Asn Asn Leu Arg Val Asn Gly Asp Lys
545                 550                 555                 560

Leu Asn Pro Lys Ile Lys Lys Glu Ile Val Glu Asn Ile Tyr Lys Lys
                565                 570                 575

Glu Arg Lys Val Thr Leu Lys Lys Ile Arg Asn Phe Leu Ile Ile Asn
            580                 585                 590

Asn Tyr Val Asp Ser Lys Val Glu Phe Ser Gly Leu Ser Asp Gly Ile
        595                 600                 605

Lys Ala Asn Met Ser Ser Tyr Ile Asp Phe Ala Glu Ile Leu Asp Asp
    610                 615                 620
```

```
Asn Phe Asp Asn Asn Met Val Glu Asp Leu Ile Glu Gln Ile Thr Ile
625                 630                 635                 640

His Val Gly Asn Val Lys Leu Leu Thr Glu Lys Ile Ser Asn Lys Tyr
                645                 650                 655

Pro Asn Leu Glu Lys Lys Gln Ile Asn Lys Ile Val Asn Leu Lys Phe
            660                 665                 670

Lys Asp Trp Ala Arg Phe Ser Arg Lys Leu Leu Val Gly Ile Glu Gly
        675                 680                 685

Thr Glu Lys Glu Thr Gly Glu Ile Asn Thr Ile Ile Gly Phe Leu Arg
    690                 695                 700

Glu Thr Asn Glu Asn Phe Met Glu Leu Met Ser Asn Arg Tyr Thr Phe
705                 710                 715                 720

Ser Glu Glu Ile Ser Glu Ile Lys Lys Lys Tyr Ile Pro Asn Lys Leu
                725                 730                 735

Ser Lys Gln Ile Val Asp Asp Leu Tyr Val Ser Pro Ala Val Lys Lys
            740                 745                 750

Met Ile Trp Gln Val Leu Asn Ile Asn Asp Glu Leu Ile Lys Val Leu
        755                 760                 765

Gly Lys Gln Pro Lys Lys Ile Phe Ile Glu Met Ala Arg Gly Lys Glu
    770                 775                 780

Glu Lys Pro Glu Val Lys Asp Ser Arg Lys Asn Lys Leu Ile Glu Leu
785                 790                 795                 800

Tyr Lys Asn Leu Gly Lys Glu Gly Lys Glu Trp Leu Asn Arg Ile Glu
                805                 810                 815

Asp Lys Thr Glu Ala Asp Phe Arg Asn Arg Ala Leu Tyr Leu Tyr Tyr
            820                 825                 830
```

```
Thr Gln Met Gly Arg Cys Met Tyr Thr Gly Glu Ile Ile Asp Ile Glu
        835                 840                 845

Arg Leu Tyr Asp Lys Glu Leu Tyr Asp Leu Asp His Ile Ile Pro Arg
    850                 855                 860

Lys Met Lys Lys Asp Asp Ser Ile His Lys Asn Leu Val Leu Val Thr
865                 870                 875                 880

Arg Asn Ser Asn Gln Tyr Glu Lys Lys Asp Asn Tyr Pro Val Pro Glu
                885                 890                 895

Val Ile Lys Ser Arg Glu Asn Val Arg His Leu Trp Tyr Ala Leu Lys
            900                 905                 910

Lys Lys Gly Leu Ile Thr Glu Glu Lys Tyr Asn Arg Leu Thr Arg Ile
        915                 920                 925

Asn Pro Leu Ser Asp Lys Glu Leu Ser Glu Phe Ile Glu Arg Gln Leu
    930                 935                 940

Val Glu Thr Arg Gln Thr Thr Lys Val Val Lys Asp Leu Phe Glu Asn
945                 950                 955                 960

Tyr Tyr Thr Asp Ser Lys Ile Val Thr Val Lys Ala Gly Leu Val Ser
                965                 970                 975

Glu Leu Arg Arg Asp Phe Glu Val Leu Lys Cys Arg Glu Ile Asn Asp
            980                 985                 990

Leu Asn His Ala His Asp Ala Phe  Leu Asn Ile Ile Val  Gly Asp Val
        995                 1000                1005

Trp Ser  Lys Lys Phe Thr Ser  Asn Pro Tyr Asn Phe  Val Lys Lys
    1010                1015                1020
```

```
Asn Arg  Glu Lys Tyr Thr Leu  Asn Asn Ile Phe Thr  Lys Asn Gln
    1025                1030                1035

Lys Asp  Leu Arg Gly Asn Glu  Ile Trp Asn Cys Ala  Glu Gly Lys
    1040                1045                1050

Lys Arg  Ile Ile Lys Thr Leu  Asn Lys Pro Ser Val  Leu Phe Ser
    1055                1060                1065

Val Glu  Asn Phe Glu Gln Thr  Gly Gln Leu Phe Asp  Gln Asn Ile
    1070                1075                1080

Ile Gly  Lys Gln Asp Tyr Lys  Glu Lys Thr Ser Tyr  Val Pro Ile
    1085                1090                1095

Lys Gly  Asp Glu Arg Leu Gln  Asp Ile Ser Lys Tyr  Gly Gly Tyr
    1100                1105                1110

Arg Gly  Ile Ser Gly Ala Tyr  Phe Phe Ile Val Glu  His Thr Glu
    1115                1120                1125

Lys Asn  Lys Arg Val Lys Thr  Ile Glu Ser Leu Pro  Ile Tyr Met
    1130                1135                1140

Lys Ser  Tyr Val Glu Glu Asn  Gly Leu Leu Asp Phe  Cys Thr Asn
    1145                1150                1155

Glu Met  Lys Leu Val Asp Pro  Lys Ile Ile Val Lys  Lys Leu Asn
    1160                1165                1170

Tyr Lys  Ser Glu Ile Ile Val  Asp Gly Phe Lys Tyr  Leu Ile Ser
    1175                1180                1185

Gly Lys  Thr Glu Asn Arg Leu  Ser Leu Glu Thr Asn  Glu Tyr Leu
    1190                1195                1200

Tyr Trp  Asn His Thr Gln Thr  Thr Asp Ile Lys Lys  Ile Leu Asn
    1205                1210                1215
```

```
Ile Asn  Glu Lys Ile Glu Leu  Glu Lys Tyr Asn Gly  Asp Ile Glu
    1220                1225                1230


Ser Glu  Arg Glu Asn Ile Ile  Lys Tyr Ile Gln Ile  Ile Leu Glu
    1235                1240                1245


Lys Phe  Lys Leu Lys Pro Phe  Ile Lys Arg Arg Asn  Leu Pro Asn
    1250                1255                1260


Ile Glu  Ile Asn Phe Ala Asp  Tyr Glu Thr Glu Lys  Leu Leu Gln
    1265                1270                1275


Leu Leu  Val Asn Leu Ile Pro  Leu Thr Thr Lys Tyr  Val Ser Pro
    1280                1285                1290


Val Asp  Leu Thr Val Ile Ser  Gly Ser Lys Tyr Ala  Gly Lys Val
    1295                1300                1305


Leu Ile  Pro Lys Lys Ile Ser  Asn Leu Asn Glu Val  Ile Phe Ile
    1310                1315                1320


Ser Lys  Ser Ile Thr Gly Ile  Tyr Glu Ser Arg Arg  Arg Ile Ile
    1325                1330                1335


<210>  458
<211>  1023
<212>  PRT
<213>  Helicobacter cinaedi

<400>  458

Met Lys Ile Tyr Ser Phe Asp Ile Gly Val Ala Ser Ile Gly Trp Ala
1               5                  10                  15


Phe Ile Glu Asn Glu Val Leu Gln Asp Cys Gly Ile Arg Ile Phe Thr
            20                  25                  30


Lys Ala Glu Asn Pro Lys Asn Gly Ala Ser Leu Ala Leu Pro Arg Arg
```

```
        35                  40                  45

Glu Ala Arg Gly Val Arg Lys Arg Leu Ala Arg Arg Gly Arg Leu
    50                  55                  60

Asn Thr Ile Lys Gln Leu Leu Cys Lys Glu Phe Gly Leu Gln Leu Glu
65                  70                  75                  80

Asp Tyr Leu Ser Asn Asp Gly Glu Leu Pro Lys Ala Tyr Thr Ala Ser
                85                  90                  95

Lys Ala Asn Pro Leu Lys Ser Pro Tyr Glu Leu Arg Thr Leu Ala Leu
            100                 105                 110

Ser Gln Lys Leu Asp Ser Lys Asp Leu Val Arg Val Ile Leu His Ile
        115                 120                 125

Ala Lys His Arg Gly Tyr Gly Asn Lys His Ala Lys Asp Ser Lys Asp
    130                 135                 140

Thr Glu Ser Gly Lys Val Lys Lys Ala Ile Glu Phe Asn Arg Lys Thr
145                 150                 155                 160

Leu Ala Glu Lys Gly Tyr Arg Ser Val Gly Glu Tyr Leu Tyr Arg Glu
                165                 170                 175

Phe Phe Gln Gln Ser Arg Ile Ser Gln Asn Asn Gly Ala Thr Glu Phe
            180                 185                 190

Ile Asn Val Arg Asn Lys Ala Gly Asn Tyr Glu His Cys Val Ala Gln
        195                 200                 205

Asp Met Leu Lys Glu Glu Leu Glu Ser Ile Leu Asn Ala Gln Arg Gln
    210                 215                 220

Phe Gly Phe Ser Leu Lys Gln Asp Phe Glu Asn Lys Leu Leu Thr Lys
225                 230                 235                 240
```

```
Ile Phe Glu Gln Arg Pro Leu Lys Ser Phe Ala Asp Lys Val Gly Asn
                245                 250                 255

Cys Cys Phe Ile Ala Gly Glu Lys Arg Thr Pro Lys Asp Ser Leu Ser
            260                 265                 270

Ala Ile Glu Phe Ile Ala Leu Ser Arg Thr Ile Asn Thr Leu Ile Asn
        275                 280                 285

Leu Ser Lys Glu Ser Gly Glu Ile Tyr Asn Arg Ala Ile Ile Leu Gln
    290                 295                 300

Ile Val Glu Ser Thr Leu Lys Lys Gly Glu Ile Ser Tyr Lys Glu Leu
305                 310                 315                 320

Arg Glu Ile Ile Arg Leu Asp Glu Arg Leu Arg Phe Lys Asp Pro Arg
                325                 330                 335

Leu Asp Tyr Ser Arg Glu Ile Lys Glu Ala Glu Lys Val Lys Phe Leu
            340                 345                 350

Glu Phe Lys Gln Leu Lys Gly Phe Lys Lys Ala Leu Gly Glu Ser Phe
        355                 360                 365

Thr Thr Leu Ala Arg Ser Gln Leu Asp Glu Ile Ala Glu His Ile Ala
    370                 375                 380

Leu Ile Lys Asp Arg Val Lys Leu Asn Glu Lys Leu Glu Ser Tyr Ala
385                 390                 395                 400

Leu Thr Lys Glu Gln Arg Glu Ala Leu Ser Asn Leu Ser Phe Ser Ala
                405                 410                 415

His Ile Asn Leu Ser Leu Gln Ala Leu Lys Gln Ile Leu Pro Phe Met
            420                 425                 430

Arg Gly Asp Asn Gly Glu Gln Cys Leu Asp Tyr Asp Glu Ser Val Glu
```

```
        435                 440                 445

Lys Ala Gly Leu Lys Ala Leu Ser Lys Asp Thr Leu Lys Gly Gln Met
    450                 455                 460

Leu Pro Pro Leu Asn Glu Phe Glu Pro Tyr Leu Ser Asn Pro Val Val
465                 470                 475                 480

Ala Arg Ala Leu Ala Glu Tyr Arg Lys Val Leu Asn Ala Leu Leu Lys
                485                 490                 495

Gln Tyr Gly Ser Pro His Lys Ile His Ile Glu Tyr Ala Arg Glu Ala
            500                 505                 510

Lys Leu Ser Ser Thr Glu Arg Gln Lys Tyr Glu Lys Glu Gln Lys Asp
        515                 520                 525

Asn Tyr Ala Ala Asn Gln Ala Ala His Lys Lys Cys Gln Glu Leu Gly
    530                 535                 540

Leu Glu Pro Ser Ser Thr Asn Leu Leu Lys Leu Lys Leu Trp Gln Glu
545                 550                 555                 560

Gln Gly Gly Leu Cys Leu Tyr Ser Gly Ala Lys Ile Thr Ile Ser Tyr
                565                 570                 575

Leu Gln Asp Pro Thr Ala Leu Gln Val Asp His Ile Tyr Pro Tyr Ser
            580                 585                 590

Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Cys Leu Val Leu Thr Lys
        595                 600                 605

Ala Asn Gln Glu Lys Gly Asn Arg Thr Pro Phe Glu Ala Phe Gly Thr
    610                 615                 620

Asp Ser Ala Lys Trp Gly Val Ile Thr Thr Leu Ala Gln Lys Leu Pro
625                 630                 635                 640
```

```
His Lys Lys Arg Arg Arg Ile Leu Asn Thr Ala Phe Asn Asp Lys Glu
               645                 650                 655

Ala Gly Phe Lys Leu Arg Asn Leu Asn Asp Thr Ser Tyr Ile Ala Arg
            660                 665                 670

Leu Val Ala Asp Tyr Thr Glu Thr Tyr Leu Glu Phe Leu Pro Leu Val
        675                 680                 685

Glu Ser Glu Asn Thr Thr Leu Gly Lys Gly Gln Lys Gly Ser Lys Lys
    690                 695                 700

His Ile Ala Ile Val Asn Gly Ala Leu Thr Ser Thr Met Arg Tyr Tyr
705                 710                 715                 720

Leu Gly Phe Ala Ser Lys Asp Arg Asp Asn His Leu His His Ala Leu
               725                 730                 735

Asp Ala Val Ile Ile Gly Phe Met Asn Asp Ser Val Ile Lys Ala Phe
            740                 745                 750

Ser Asp Phe Lys Lys Thr Gln Glu Thr Ser Lys Ala Ala Tyr Tyr Ala
        755                 760                 765

His Thr Leu Ser Lys Gln Glu Tyr Lys Lys Gln Arg Ala Phe Ile Gln
    770                 775                 780

Leu Pro Ser Gly Glu Asn Phe Arg Ala Ser Val Leu Glu Lys Val Glu
785                 790                 795                 800

Ser Val Phe Val Ser Lys Pro Pro Arg Lys Arg Val Arg Gly Ala Leu
               805                 810                 815

His Glu Ala Thr Phe Tyr Ser Pro Asn Asp Pro Lys Leu Leu Lys Asn
            820                 825                 830

Tyr Gly Gly Thr Lys Gly Val Glu Arg Ala Leu Ala Leu Gly Lys Met
```

```
        835                 840                 845

Arg Lys Val Gly Ala Lys Ile Val Ser Asn Gly Ala Met Val Arg Val
    850                 855                 860

Asp Ile Phe Arg His Lys Ser Ser Gly Lys Phe Tyr Gly Val Pro Val
865                 870                 875                 880

Tyr Thr Met Asp Phe Ala Leu Gly Ile Leu Pro Asn Lys Ala Val Val
                885                 890                 895

Val Gly Lys Asp Lys Asn Gly Val Ile Lys Asp Trp Leu Glu Met Asp
            900                 905                 910

Ser Ser Tyr Glu Phe Ile Phe Ser Leu Tyr Lys Asp Asp Leu Leu Leu
        915                 920                 925

Val Gln Lys Lys Glu Met Ala Glu Pro Glu Leu Cys Tyr Phe Met Ser
    930                 935                 940

Phe Asn Ser Ser Ile Ala Gln Ile Ser Val Ala Lys His Asp Asn Asn
945                 950                 955                 960

Phe Ser Thr Leu Thr Lys Asn Gln Lys Leu Leu Phe Ser Asn Ala Thr
                965                 970                 975

Gln Glu Asp Val Ser Gly Lys Ser Ile Gly Ile Gln Asn Leu Gln Val
            980                 985                 990

Phe Glu Lys Trp Gln Val Ser Val  Leu Gly Glu Val Lys  Arg Thr Gln
        995                 1000                1005

Ser Tyr  Pro Arg Glu Asn Ile  Ser Leu Ala Ser Lys  Ala Lys Lys
    1010                1015                1020

<210>  459
<211>  1023
<212>  PRT
```

<213> Helicobacter cinaedi

<400> 459

```
Met Lys Ile Tyr Ser Phe Asp Ile Gly Val Ala Ser Ile Gly Trp Ala
1               5                   10                  15


Phe Ile Glu Asn Glu Val Leu Gln Asp Cys Gly Ile Arg Ile Phe Thr
            20                  25                  30


Lys Ala Glu Asn Pro Lys Asn Gly Ala Ser Leu Ala Leu Pro Arg Arg
        35                  40                  45


Glu Ala Arg Gly Val Arg Lys Arg Leu Ala Arg Arg Arg Gly Arg Leu
    50                  55                  60


Asn Thr Ile Lys Gln Leu Leu Cys Lys Glu Phe Gly Leu Gln Leu Glu
65                  70                  75                  80


Asp Tyr Leu Ser Asn Asp Gly Glu Leu Pro Lys Ala Tyr Thr Ala Ser
                85                  90                  95


Lys Ala Asn Pro Leu Lys Ser Pro Tyr Glu Leu Arg Thr Leu Ala Leu
            100                 105                 110


Ser Gln Lys Leu Asp Ser Lys Asp Leu Val Arg Val Ile Leu His Ile
        115                 120                 125


Ala Lys His Arg Gly Tyr Gly Asn Lys His Ala Lys Asp Ser Lys Asp
    130                 135                 140


Thr Glu Ser Gly Lys Val Lys Lys Ala Ile Glu Phe Asn Arg Lys Thr
145                 150                 155                 160


Leu Ala Glu Lys Gly Tyr Arg Ser Val Gly Glu Tyr Leu Tyr Arg Glu
                165                 170                 175


Phe Phe Gln Gln Ser Arg Ile Ser Gln Asn Asn Gly Ala Thr Glu Phe
            180                 185                 190
```

```
Ile Asn Val Arg Asn Lys Ala Gly Asn Tyr Glu His Cys Val Ala Gln
        195                 200                 205

Asp Met Leu Lys Glu Glu Leu Glu Ser Ile Leu Asn Ala Gln Arg Gln
    210                 215                 220

Phe Gly Phe Ser Leu Lys Gln Asp Phe Glu Ser Lys Leu Leu Thr Lys
225                 230                 235                 240

Ile Phe Glu Gln Arg Pro Leu Lys Ser Phe Ala Asp Lys Val Gly Asn
                245                 250                 255

Cys Cys Phe Ile Ala Gly Glu Lys Arg Ala Pro Lys Asp Ser Pro Ser
            260                 265                 270

Ala Ile Glu Phe Ile Ala Leu Ser Arg Thr Ile Asn Thr Leu Ile Asn
        275                 280                 285

Leu Ser Lys Glu Ser Gly Glu Ile Tyr Asn Arg Ala Ile Ile Leu Gln
    290                 295                 300

Ile Val Glu Ser Thr Leu Lys Lys Gly Glu Ile Ser Tyr Lys Glu Leu
305                 310                 315                 320

Arg Glu Ile Ile Arg Leu Asp Glu Arg Leu Arg Phe Lys Asp Pro Arg
                325                 330                 335

Leu Asp Tyr Ser Arg Glu Ile Lys Glu Ala Glu Lys Val Lys Phe Leu
            340                 345                 350

Glu Phe Lys Gln Leu Lys Gly Phe Lys Lys Ala Leu Gly Glu Ser Phe
        355                 360                 365

Thr Thr Leu Ala Ile Ser Gln Leu Asp Glu Ile Ala Glu His Ile Ala
    370                 375                 380
```

```
Leu Ile Lys Asp Arg Val Lys Leu Asn Glu Lys Leu Glu Ser Tyr Ala
385                 390                 395                 400

Leu Thr Lys Glu Gln Arg Glu Ala Leu Ser Asn Leu Ser Phe Ser Ala
                405                 410                 415

His Ile Asn Leu Ser Leu Gln Ala Leu Lys Gln Ile Leu Pro Phe Met
            420                 425                 430

Arg Gly Asp Asn Gly Glu Gln Cys Leu Asp Tyr Asp Glu Ser Val Glu
        435                 440                 445

Lys Ala Gly Leu Lys Ala Leu Ser Lys Asp Thr Leu Lys Gly Gln Met
    450                 455                 460

Leu Pro Pro Leu Asn Glu Phe Glu Pro Tyr Leu Ser Asn Pro Val Val
465                 470                 475                 480

Ala Arg Ala Leu Ala Glu Tyr Arg Lys Val Leu Asn Val Leu Leu Lys
                485                 490                 495

Gln Tyr Gly Ser Pro His Lys Ile His Ile Glu Tyr Ala Arg Glu Ala
            500                 505                 510

Lys Leu Ser Ser Thr Glu Arg Gln Lys Tyr Glu Lys Glu Gln Lys Asp
        515                 520                 525

Asn Tyr Ala Ala Asn Gln Ala Ala His Lys Lys Cys Gln Glu Leu Gly
    530                 535                 540

Leu Glu Pro Ser Ser Thr Asn Leu Leu Lys Leu Lys Leu Trp Gln Glu
545                 550                 555                 560

Gln Gly Gly Leu Cys Leu Tyr Ser Gly Ala Lys Ile Thr Ile Ser Tyr
                565                 570                 575

Leu Gln Asp Pro Thr Ala Leu Gln Val Asp His Ile Tyr Pro Tyr Ser
            580                 585                 590
```

```
Arg Ser Phe Asp Asp Ser Tyr Met Asn Lys Cys Leu Val Leu Thr Lys
        595                 600                 605

Ala Asn Gln Glu Lys Gly Asn Arg Thr Pro Phe Glu Ala Phe Gly Thr
    610                 615                 620

Asp Ser Ala Lys Trp Gly Val Ile Thr Thr Leu Ala Gln Lys Leu Pro
625                 630                 635                 640

His Lys Lys Arg Arg Arg Ile Leu Asn Thr Ala Phe Asn Asp Lys Glu
                645                 650                 655

Ala Gly Phe Lys Leu Arg Asn Leu Asn Asp Thr Ser Tyr Ile Ala Arg
            660                 665                 670

Leu Val Ala Asp Tyr Thr Glu Thr Tyr Leu Glu Phe Leu Pro Leu Val
        675                 680                 685

Glu Ser Glu Asn Thr Thr Leu Ser Lys Gly Gln Lys Gly Ser Lys Lys
    690                 695                 700

His Ile Ala Ile Val Asn Gly Val Leu Thr Ser Thr Met Arg Tyr Tyr
705                 710                 715                 720

Leu Gly Phe Ala Ser Lys Asp Arg Asp Asn His Leu His His Ala Leu
                725                 730                 735

Asp Ala Val Ile Ile Gly Phe Met Asn Asp Ser Val Ile Lys Ala Phe
            740                 745                 750

Ser Asp Phe Lys Lys Thr Gln Glu Thr Ser Lys Ala Ala Tyr Tyr Ala
        755                 760                 765

His Thr Leu Ser Lys Gln Glu Tyr Lys Lys Gln Arg Ala Phe Ile Gln
    770                 775                 780
```

```
Leu Pro Ser Gly Glu Asn Phe Arg Val Ser Val Leu Glu Lys Val Glu
785                 790                 795                 800

Ser Val Phe Val Ser Lys Pro Pro Arg Lys Arg Val Arg Gly Ala Leu
                805                 810                 815

His Glu Ala Thr Phe Tyr Ser Pro Asn Asp Pro Lys Leu Leu Lys Asn
            820                 825                 830

Tyr Gly Gly Thr Lys Gly Val Glu Arg Ala Leu Ala Leu Gly Lys Met
        835                 840                 845

Arg Lys Val Gly Ala Lys Ile Val Ser Asn Gly Ala Met Val Arg Val
    850                 855                 860

Asp Ile Phe Arg His Lys Ser Ser Gly Lys Phe Tyr Gly Val Pro Val
865                 870                 875                 880

Tyr Thr Met Asp Phe Ala Leu Gly Ile Leu Pro Asn Lys Ala Val Val
                885                 890                 895

Val Gly Lys Asp Gln Asn Gly Val Ile Lys Asp Trp Leu Glu Met Asp
            900                 905                 910

Ser Ser Tyr Glu Phe Ile Phe Ser Leu Tyr Lys Asp Asp Val Ile Leu
        915                 920                 925

Val Gln Lys Lys Glu Met Gln Arg Pro Glu Leu Cys Tyr Phe Val Ser
    930                 935                 940

Phe Asp Thr Ser Gly Ala Ser Ile Lys Val Ala Lys His Asp Asn Asn
945                 950                 955                 960

Phe Ser Thr Leu Thr Glu Asn Gln Lys Leu Leu Phe Ser Asn Ala Thr
                965                 970                 975

Lys Glu Glu Val Val Gly Lys Ser Ile Gly Ile Gln Asn Leu Lys Val
            980                 985                 990
```

```
Phe Glu Lys Trp Gln Val Ser Val  Leu Gly Glu Val Lys  Arg Thr Gln
        995                 1000                1005


Ser Tyr  Pro Arg Glu Asn Ile  Ser Leu Ala Ser Lys  Ala Lys Lys
    1010                1015                1020


<210>  460
<211>  344
<212>  PRT
<213>  Helicobacter pullorum

<400>  460

Met Lys Ile Leu Gly Phe Asp Ile Gly Ile Ala Ser Ile Gly Trp Ala
1               5                   10                  15


Phe Val Glu Asn Gly Glu Leu Lys Asp Cys Gly Val Arg Ile Phe Thr
            20                  25                  30


Lys Ala Glu Asn Pro Lys Thr Gly Asp Ser Leu Ala Met Pro Arg Arg
        35                  40                  45


Glu Ala Arg Ser Val Arg Arg Arg Leu Ala Arg Arg Lys Gly Arg Leu
    50                  55                  60


Glu Thr Leu Lys Arg Leu Leu Ala Lys Glu Trp Asp Leu Cys Tyr Glu
65                  70                  75                  80


Asp Tyr Ile Ala Ala Asp Gly Glu Leu Pro Lys Ala Phe Met Gly Lys
                85                  90                  95


Asn Leu Thr Asn Pro Tyr Val Leu Arg Tyr Glu Ala Leu Gln Arg Leu
            100                 105                 110


Leu Ser Lys Glu Glu Leu Val Arg Val Val Leu His Ile Ala Lys His
        115                 120                 125


Arg Gly Tyr Gly Asn Lys Asn Ala Lys Ile Thr Lys Ser Glu Glu Ser
```

```
    130                 135                 140

Lys Arg Glu Gln Gly Lys Ile Leu Ser Ala Leu Ala Thr Asn Ala Ser
145                 150                 155                 160

Val Ile Ala Arg Tyr Arg Thr Val Gly Glu Tyr Phe Tyr Lys Glu Phe
                165                 170                 175

Cys Glu Val Ile Lys Asn Pro Gln Gly Leu Asn Thr Asn Glu Asn Cys
            180                 185                 190

Thr Gln Pro Lys Val Arg Val Leu Lys Pro Ile Arg Asn Lys Gly Gly
        195                 200                 205

Glu Tyr Thr Asn Cys Ile Leu Gln Glu Asp Leu Gln Arg Glu Leu Arg
    210                 215                 220

Cys Ile Phe Glu His Gln Lys Gly Phe Gly Phe Ser Ile Thr Gln Glu
225                 230                 235                 240

Phe Gln Asp Lys Ile Leu Lys Ile Ala Phe Tyr Gln Arg Ser Leu Lys
                245                 250                 255

Asp Phe Ser His Leu Val Gly Lys Cys Thr Phe Tyr Pro Asp Glu Pro
            260                 265                 270

Arg Ala Pro Lys Phe Ser Leu Ser Ala Ile Glu Phe Ile Thr Lys Ala
        275                 280                 285

Lys Ala Ile Asn Leu Leu Ala Ser Ile Ala Lys Glu Ser Gly Glu Val
    290                 295                 300

Trp Asp Lys Glu Gln Trp Arg Glu Arg Leu Asp Ser Val Phe Ser Ala
305                 310                 315                 320

Val Cys Glu Arg Gly Ile Asn Thr Ile Pro Ser Ser Ser His Phe Leu
                325                 330                 335
```

Asn Ile Phe Asp Ile Leu Tyr Leu
340

<210> 461
<211> 1688
<212> PRT
<213> Ignavibacterium album

<400> 461

Met Glu Phe Lys Lys Val Leu Gly Leu Asp Ile Gly Thr Asn Ser Ile
1 5 10 15

Gly Cys Ala Leu Leu Ser Leu Pro Lys Ser Ile Gln Asp Tyr Gly Lys
20 25 30

Gly Gly Arg Leu Glu Trp Leu Thr Ser Arg Val Ile Pro Leu Asp Ala
35 40 45

Asp Tyr Met Lys Ala Phe Ile Asp Gly Lys Asn Gly Leu Pro Gln Val
50 55 60

Ile Thr Pro Ala Gly Lys Arg Arg Gln Lys Arg Gly Ser Arg Arg Leu
65 70 75 80

Lys His Arg Tyr Lys Leu Arg Arg Ser Arg Leu Ile Arg Val Phe Lys
85 90 95

Thr Leu Asn Trp Leu Pro Glu Asp Phe Pro Leu Asp Asn Pro Lys Arg
100 105 110

Ile Lys Glu Thr Ile Ser Thr Glu Gly Lys Phe Ser Phe Arg Ile Ser
115 120 125

Asp Tyr Val Pro Ile Ser Asp Glu Ser Tyr Arg Glu Phe Tyr Arg Glu
130 135 140

Phe Gly Tyr Pro Glu Asn Glu Ile Glu Gln Val Ile Glu Glu Ile Asn
145 150 155 160

```
Phe Arg Arg Lys Thr Lys Gly Lys Asn Lys Asn Pro Met Ile Lys Leu
                165                 170                 175

Leu Pro Glu Asp Trp Val Val Tyr Tyr Leu Arg Lys Lys Ala Leu Ile
            180                 185                 190

Lys Pro Thr Thr Lys Glu Glu Leu Ile Arg Ile Ile Tyr Leu Phe Asn
        195                 200                 205

Gln Arg Arg Gly Phe Lys Ser Ser Arg Lys Asp Leu Thr Glu Thr Ala
    210                 215                 220

Ile Leu Asp Tyr Asp Glu Phe Ala Lys Arg Leu Ala Glu Lys Glu Lys
225                 230                 235                 240

Tyr Ser Ala Glu Asn Tyr Glu Thr Lys Phe Val Ser Ile Thr Lys Val
                245                 250                 255

Lys Glu Val Val Glu Leu Lys Thr Asp Gly Arg Lys Gly Lys Lys Arg
            260                 265                 270

Phe Lys Val Ile Leu Glu Asp Ser Arg Ile Glu Pro Tyr Glu Ile Glu
        275                 280                 285

Arg Lys Glu Lys Pro Asp Trp Glu Gly Lys Glu Tyr Thr Phe Leu Val
    290                 295                 300

Thr Gln Lys Leu Glu Lys Gly Lys Phe Lys Gln Asn Lys Pro Asp Leu
305                 310                 315                 320

Pro Lys Glu Glu Asp Trp Ala Leu Cys Thr Thr Ala Leu Asp Asn Arg
                325                 330                 335

Met Gly Ser Lys His Pro Gly Glu Phe Phe Phe Asp Glu Leu Leu Lys
            340                 345                 350
```

```
Ala Phe Lys Glu Lys Arg Gly Tyr Lys Ile Arg Gln Tyr Pro Val Asn
        355                 360                 365

Arg Trp Arg Tyr Lys Lys Glu Leu Glu Phe Ile Trp Thr Lys Gln Cys
    370                 375                 380

Gln Leu Asn Pro Glu Leu Asn Asn Leu Asn Ile Asn Lys Glu Ile Leu
385                 390                 395                 400

Arg Lys Leu Ala Thr Val Leu Tyr Pro Ser Gln Ser Lys Phe Phe Gly
                405                 410                 415

Pro Lys Ile Lys Glu Phe Glu Asn Ser Asp Val Leu His Ile Ile Ser
            420                 425                 430

Glu Asp Ile Ile Tyr Tyr Gln Arg Asp Leu Lys Ser Gln Lys Ser Leu
        435                 440                 445

Ile Ser Glu Cys Arg Tyr Glu Lys Arg Lys Gly Ile Asp Gly Glu Ile
    450                 455                 460

Tyr Gly Leu Lys Cys Ile Pro Lys Ser Ser Pro Leu Tyr Gln Glu Phe
465                 470                 475                 480

Arg Ile Trp Gln Asp Ile His Asn Ile Lys Val Ile Arg Lys Glu Ser
                485                 490                 495

Glu Val Asn Gly Lys Lys Lys Ile Asn Ile Asp Glu Thr Gln Leu Tyr
            500                 505                 510

Ile Asn Glu Asn Ile Lys Glu Lys Leu Phe Glu Leu Phe Asn Ser Lys
        515                 520                 525

Asp Ser Leu Ser Glu Lys Asp Ile Leu Glu Leu Ile Ser Leu Asn Ile
    530                 535                 540

Ile Asn Ser Gly Ile Lys Ile Ser Lys Lys Glu Glu Glu Thr Thr His
545                 550                 555                 560
```

```
Arg Ile Asn Leu Phe Ala Asn Arg Lys Glu Leu Lys Gly Asn Glu Thr
                565                 570                 575

Lys Ser Arg Tyr Arg Lys Val Phe Lys Lys Leu Gly Phe Asp Gly Glu
            580                 585                 590

Tyr Ile Leu Asn His Pro Ser Lys Leu Asn Arg Leu Trp His Ser Asp
        595                 600                 605

Tyr Ser Asn Asp Tyr Ala Asp Lys Glu Lys Thr Glu Lys Ser Ile Leu
    610                 615                 620

Ser Ser Leu Gly Trp Lys Asn Arg Asn Gly Lys Trp Glu Lys Ser Lys
625                 630                 635                 640

Asn Tyr Asp Val Phe Asn Leu Pro Leu Glu Val Ala Lys Ala Ile Ala
                645                 650                 655

Asn Leu Pro Pro Leu Lys Lys Glu Tyr Gly Ser Tyr Ser Ala Leu Ala
            660                 665                 670

Ile Arg Lys Met Leu Val Val Met Arg Asp Gly Lys Tyr Trp Gln His
        675                 680                 685

Pro Asp Gln Ile Ala Lys Asp Gln Glu Asn Thr Ser Leu Met Leu Phe
    690                 695                 700

Asp Lys Asn Leu Ile Gln Leu Thr Asn Asn Gln Arg Lys Val Leu Asn
705                 710                 715                 720

Lys Tyr Leu Leu Thr Leu Ala Glu Val Gln Lys Arg Ser Thr Leu Ile
                725                 730                 735

Lys Gln Lys Leu Asn Glu Ile Glu His Asn Pro Tyr Lys Leu Glu Leu
            740                 745                 750
```

```
Val Ser Asp Gln Asp Leu Glu Lys Gln Val Leu Lys Ser Phe Leu Glu
        755                 760                 765

Lys Lys Asn Glu Ser Asp Tyr Leu Lys Gly Leu Lys Thr Tyr Gln Ala
    770                 775                 780

Gly Tyr Leu Ile Tyr Gly Lys His Ser Glu Lys Asp Val Pro Ile Val
785                 790                 795                 800

Asn Ser Pro Asp Glu Leu Gly Glu Tyr Ile Arg Lys Lys Leu Pro Asn
                805                 810                 815

Asn Ser Leu Arg Asn Pro Ile Val Glu Gln Val Ile Arg Glu Thr Ile
            820                 825                 830

Phe Ile Val Arg Asp Val Trp Lys Ser Phe Gly Ile Ile Asp Glu Ile
        835                 840                 845

His Ile Glu Leu Gly Arg Glu Leu Lys Asn Asn Ser Glu Glu Arg Lys
    850                 855                 860

Lys Thr Ser Glu Ser Gln Glu Lys Asn Phe Gln Glu Lys Glu Arg Ala
865                 870                 875                 880

Arg Lys Leu Leu Lys Glu Leu Leu Asn Ser Ser Asn Phe Glu His Tyr
                885                 890                 895

Asp Glu Asn Gly Asn Lys Ile Phe Ser Ser Phe Thr Val Asn Pro Asn
            900                 905                 910

Pro Asp Ser Pro Leu Asp Ile Glu Lys Phe Arg Ile Trp Lys Asn Gln
        915                 920                 925

Ser Gly Leu Thr Asp Glu Glu Leu Asn Lys Lys Leu Lys Asp Glu Lys
    930                 935                 940

Ile Pro Thr Glu Ile Glu Val Lys Lys Tyr Ile Leu Trp Leu Thr Gln
945                 950                 955                 960
```

```
Lys Cys Arg Ser Pro Tyr Thr Gly Lys Ile Ile Pro Leu Ser Lys Leu
               965                 970                 975

Phe Asp Ser Asn Val Tyr Glu Ile Glu His Ile Ile Pro Arg Ser Lys
           980                 985                 990

Met Lys Asn Asp Ser Thr Asn Asn  Leu Val Ile Cys Glu  Leu Gly Val
        995                 1000                1005

Asn Lys  Ala Lys Gly Asp Arg  Leu Ala Ala Asn Phe  Ile Ser Glu
    1010                1015                1020

Ser Asn  Gly Lys Cys Lys Phe  Gly Glu Val Glu Tyr  Thr Leu Leu
    1025                1030                1035

Lys Tyr  Gly Asp Tyr Leu Gln  Tyr Cys Lys Asp Thr  Phe Lys Tyr
    1040                1045                1050

Gln Lys  Ala Lys Tyr Lys Asn  Leu Leu Ala Thr Glu  Pro Pro Glu
    1055                1060                1065

Asp Phe  Ile Glu Arg Gln Ile  Asn Asp Thr Arg Tyr  Ile Gly Arg
    1070                1075                1080

Lys Leu  Ala Glu Leu Leu Thr  Pro Val Val Lys Asp  Ser Lys Asn
    1085                1090                1095

Ile Ile  Phe Thr Ile Gly Ser  Ile Thr Ser Glu Leu  Lys Ile Thr
    1100                1105                1110

Trp Gly  Leu Asn Gly Val Trp  Lys Asp Ile Leu Arg  Pro Arg Phe
    1115                1120                1125

Lys Arg  Leu Glu Ser Ile Ile  Asn Lys Lys Leu Ile  Phe Gln Asp
    1130                1135                1140
```

```
Glu Asp  Asp Pro Asn Lys Tyr  His Phe Asp Leu Ser  Ile Asn Pro
    1145                1150                1155

Gln Leu  Asp Lys Glu Gly Leu  Lys Arg Leu Asp His  Arg His His
    1160                1165                1170

Ala Leu  Asp Ala Thr Ile Ile  Ala Ala Thr Thr Arg  Glu His Val
    1175                1180                1185

Arg Tyr  Leu Asn Ser Leu Asn  Ala Ala Asp Asn Asp  Glu Glu Lys
    1190                1195                1200

Arg Glu  Tyr Phe Leu Ser Leu  Cys Asn His Lys Ile  Arg Asp Phe
    1205                1210                1215

Lys Leu  Pro Trp Glu Asn Phe  Thr Ser Glu Val Lys  Ser Lys Leu
    1220                1225                1230

Leu Ser  Cys Val Val Ser Tyr  Lys Glu Ser Lys Pro  Ile Leu Ser
    1235                1240                1245

Asp Pro  Phe Asn Lys Tyr Leu  Lys Trp Glu Tyr Lys  Asn Gly Lys
    1250                1255                1260

Trp Gln  Lys Val Phe Ala Ile  Gln Ile Lys Asn Asp  Arg Trp Lys
    1265                1270                1275

Ala Val  Arg Arg Ser Met Phe  Lys Glu Pro Ile Gly  Thr Val Trp
    1280                1285                1290

Ile Lys  Lys Ile Lys Glu Val  Ser Leu Lys Glu Ala  Ile Lys Ile
    1295                1300                1305

Gln Ala  Ile Trp Glu Glu Val  Lys Asn Asp Pro Val  Arg Lys Lys
    1310                1315                1320

Lys Glu  Lys Tyr Ile Tyr Asp  Asp Tyr Ala Gln Lys  Val Ile Ala
    1325                1330                1335
```

```
Lys Ile  Val Gln Glu Leu Gly  Leu Ser Ser Ser Met  Arg Lys Gln
    1340                1345                1350

Asp Asp  Glu Lys Leu Asn Lys  Phe Ile Asn Glu Ala  Lys Val Ser
    1355                1360                1365

Ala Gly  Val Asn Lys Asn Leu  Asn Thr Thr Asn Lys  Thr Ile Tyr
    1370                1375                1380

Asn Leu  Glu Gly Arg Phe Tyr  Glu Lys Ile Lys Val  Ala Glu Tyr
    1385                1390                1395

Val Leu  Tyr Lys Ala Lys Arg  Met Pro Leu Asn Lys  Lys Glu Tyr
    1400                1405                1410

Ile Glu  Lys Leu Ser Leu Gln  Lys Met Phe Asn Asp  Leu Pro Asn
    1415                1420                1425

Phe Ile  Leu Glu Lys Ser Ile  Leu Asp Asn Tyr Pro  Glu Ile Leu
    1430                1435                1440

Lys Glu  Leu Glu Ser Asp Asn  Lys Tyr Ile Ile Glu  Pro His Lys
    1445                1450                1455

Lys Asn  Asn Pro Val Asn Arg  Leu Leu Leu Glu His  Ile Leu Glu
    1460                1465                1470

Tyr His  Asn Asn Pro Lys Glu  Ala Phe Ser Thr Glu  Gly Leu Glu
    1475                1480                1485

Lys Leu  Asn Lys Lys Ala Ile  Asn Lys Ile Gly Lys  Pro Ile Lys
    1490                1495                1500

Tyr Ile  Thr Arg Leu Asp Gly  Asp Ile Asn Glu Glu  Glu Ile Phe
    1505                1510                1515
```

```
Arg Gly  Ala Val Phe Glu Thr  Asp Lys Gly Ser Asn  Val Tyr Phe
    1520                1525                1530

Val Met  Tyr Glu Asn Asn Gln  Thr Lys Asp Arg Glu  Phe Leu Lys
    1535                1540                1545

Pro Asn  Pro Ser Ile Ser Val  Leu Lys Ala Ile Glu  His Lys Asn
    1550                1555                1560

Lys Ile  Asp Phe Phe Ala Pro  Asn Arg Leu Gly Phe  Ser Arg Ile
    1565                1570                1575

Ile Leu  Ser Pro Gly Asp Leu  Val Tyr Val Pro Thr  Asn Asp Gln
    1580                1585                1590

Tyr Val  Leu Ile Lys Asp Asn  Ser Ser Asn Glu Thr  Ile Ile Asn
    1595                1600                1605

Trp Asp  Asp Asn Glu Phe Ile  Ser Asn Arg Ile Tyr  Gln Val Lys
    1610                1615                1620

Lys Phe  Thr Gly Asn Ser Cys  Tyr Phe Leu Lys Asn  Asp Ile Ala
    1625                1630                1635

Ser Leu  Ile Leu Ser Tyr Ser  Ala Ser Asn Gly Val  Gly Glu Phe
    1640                1645                1650

Gly Ser  Gln Asn Ile Ser Glu  Tyr Ser Val Asp Asp  Pro Pro Ile
    1655                1660                1665

Arg Ile  Lys Asp Val Cys Ile  Lys Ile Arg Val Asp  Arg Leu Gly
    1670                1675                1680

Asn Val  Arg Pro Leu
    1685
```

<210> 462
<211> 1354

<212> PRT
<213> Indibacter alkaliphilus

<400> 462

Met Lys Lys Ile Leu Gly Leu Asp Leu Gly Thr Thr Ser Ile Gly Trp
1 5 10 15

Ala Phe Ile Lys Glu Pro Glu Lys Asp Val Val Gly Ser Glu Ile Val
20 25 30

Asp Met Gly Val Arg Ile Val Pro Leu Ser Ser Asp Glu Glu Asn Asp
35 40 45

Phe Ala Lys Gly Asn Thr Ile Ser Ile Asn Ala Asp Arg Thr Leu Lys
50 55 60

Arg Gly Ala Arg Arg Asn Leu Gln Arg Phe Lys Gln Arg Arg Asn Ala
65 70 75 80

Leu Leu Glu Thr Phe Lys Glu Lys Asn Leu Ile Pro Ser Asn Phe Gln
85 90 95

Tyr Ala Glu Asp Gly Pro Ser Ser Thr Phe Ser Thr Leu Lys Leu Arg
100 105 110

Asp Lys Ala Ala Lys Glu Lys Ile Glu Leu Asp Asp Phe Val Lys Val
115 120 125

Leu Leu Gln Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Ala
130 135 140

Met Ser Glu Glu Asp Glu Gly Thr Ala Ile Asp Ser Met Gly Ile Ala
145 150 155 160

Lys Glu Leu Tyr Glu Asn Asp Leu Thr Pro Gly Gln Trp Val Tyr Glu
165 170 175

Ala Leu Lys Asn Gly Arg Lys Asn Val Pro Asp Phe Tyr Arg Ser Asp

```
            180                 185                 190

Leu Gln Glu Glu Phe Lys Lys Ile Val Asn Tyr Gln Ser Glu Phe Tyr
        195                 200                 205

Pro Asp Ile Leu Asn Thr Ser Phe Val Glu Asp Trp Met Gly Lys Ala
    210                 215                 220

Ser Thr Pro Thr Lys Gln Tyr Phe Asn Lys Arg Gly Val Gln Leu Ala
225                 230                 235                 240

Glu Asn Lys Gly Lys Arg Glu Glu Arg Arg Leu Gln Glu Tyr Lys Trp
                245                 250                 255

Arg Ala Glu Ala Val Asn Phe Lys Ile Asp Leu Ser Glu Ile Ala Leu
            260                 265                 270

Ile Leu Ser Gln Ile Asn Ser Gln Ile Ser Asn Ser Ser Gly Tyr Leu
        275                 280                 285

Gly Ala Ile Ser Asp Arg Ser Lys Glu Leu Tyr Phe Lys Asn Leu Thr
    290                 295                 300

Val Gly Gln Tyr Leu Tyr Gln Gln Val Lys Lys Asn Pro His Thr Arg
305                 310                 315                 320

Leu Lys Gly Gln Val Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe Glu
                325                 330                 335

Lys Ile Trp Ser Val Gln Ser Ser Phe Tyr Pro Gln Leu Asn Asp Glu
            340                 345                 350

Leu Lys Gln Glu Val Arg Asp Val Thr Ile Phe Phe Gln Arg Arg Leu
        355                 360                 365

Lys Ser Gln Lys His Leu Ile Ser Asn Cys Glu Phe Glu Glu His His
    370                 375                 380
```

```
Lys Val Val Pro Lys Ser His Pro Ile Phe Gln Glu Phe Arg Ile Trp
385                 390                 395                 400


Gln Asn Leu Asn Asn Leu Thr Leu Ile Lys Lys Asp Asn Leu Asn Glu
                405                 410                 415


Lys Cys Glu Leu Ala Leu Glu Asp Lys Thr Ala Leu Ala Asn Glu Leu
            420                 425                 430


Ala Phe Lys Lys Glu Leu Ser Val Lys Asp Ala Leu Lys Val Leu Gly
        435                 440                 445


Leu Lys Pro Ser Asp Trp Glu Phe Asn Phe Thr Lys Ile Glu Gly Asn
    450                 455                 460


Arg Thr Asn His Ala Phe Phe Glu Ala Phe Ala Lys Ile Ile Glu Leu
465                 470                 475                 480


Glu Asp Gly Glu Pro Ile Asp Leu Gly Asn Leu Lys Ala Asp Asp Ile
                485                 490                 495


Leu Asp Gln Phe Ser Glu Ala Phe Leu Arg Ile Gly Ile Asp Thr Glu
            500                 505                 510


Leu Leu Gln Val Asn Ser Asp Ile Glu Gly Ala Glu Tyr Glu Lys Gln
        515                 520                 525


Ser Tyr Ile Gln Phe Trp His Leu Leu Tyr Ser Ser Glu Asp Asp Gln
    530                 535                 540


Lys Leu Lys Gln Asn Leu Ile Arg Lys Phe Gly Phe Lys Pro Glu His
545                 550                 555                 560


Ala Lys Ile Leu Ala Ser Ile Ser Leu Gln Asp Asp His Ala Ser Leu
                565                 570                 575


Ser Ser Arg Ala Ile Lys Lys Ile Leu Pro His Leu Gln Ser Gly Leu
```

```
            580                 585                 590

Ile Tyr Asp Lys Ala Cys Thr Tyr Ala Gly Tyr Asn His Ser Ser Ser
        595                 600                 605

Phe Thr Lys Asp Glu Asn Glu Lys Arg Glu Leu Arg Ala Glu Leu Glu
    610                 615                 620

Leu Leu Lys Lys Asn Ser Leu Arg Asn Pro Val Val Glu Lys Ile Leu
625                 630                 635                 640

Asn Gln Met Ile Asn Val Val Asn Ala Ile Leu Lys Asp Pro Asn Leu
                645                 650                 655

Gly Arg Pro Asp Glu Ile Arg Val Glu Met Ala Arg Glu Leu Lys Ala
            660                 665                 670

Asn Ala Glu Gln Arg Lys Asn Met Thr Ser Asn Ile Ala Ser Ala Thr
        675                 680                 685

Arg Asp His Glu Lys Tyr Arg Glu Ile Leu Lys Lys Glu Phe Gly Leu
    690                 695                 700

Lys Arg Val Thr Lys Asn Asp Leu Leu Arg Tyr Lys Leu Trp Leu Glu
705                 710                 715                 720

Thr Asp Gly Ile Ser Leu Tyr Thr Gly Lys Pro Ile Glu Ala Ser Lys
                725                 730                 735

Leu Phe Ser Lys Glu Tyr Asp Ile Glu His Ile Ile Pro Lys Ala Arg
            740                 745                 750

Leu Phe Asp Asp Ser Phe Ser Asn Lys Thr Ile Cys Glu Arg Gln Leu
        755                 760                 765

Asn Ile Asp Lys Ala Asn Val Thr Ala Phe Ser Phe Leu Gln Asn Lys
    770                 775                 780
```

```
Leu Ser Ala Asp Glu Phe Glu Gln Tyr Gln Ser Arg Val Lys Ser Leu
785                 790                 795                 800

Tyr Gly Lys Leu Ser Lys Ala Lys Ile Gln Lys Leu Leu Met Ala Asn
                805                 810                 815

Asp Lys Ile Pro Glu Asp Phe Ile Ala Arg Gln Leu Gln Glu Thr Arg
            820                 825                 830

Tyr Ile Ser Lys Lys Ala Lys Glu Ile Leu Phe Glu Ile Thr Met Arg
        835                 840                 845

Val Ser Val Thr Thr Gly Thr Ile Thr Asp Lys Leu Arg Glu Asp Trp
    850                 855                 860

Gly Leu Val Glu Ile Met Lys Glu Leu Asn Trp Glu Lys Tyr Asp Lys
865                 870                 875                 880

Leu Gly Leu Thr Tyr Thr Ile Glu Gly Lys His Gly Glu Arg Leu Asn
                885                 890                 895

Lys Ile Lys Asp Trp Asn Lys Arg Asn Asp His Arg His His Ala Met
            900                 905                 910

Asp Ala Leu Thr Val Ala Leu Thr Lys Pro Ala Tyr Ile Gln Tyr Leu
        915                 920                 925

Asn Asn Leu Asn Ala Lys Ala Ile Gly Asn Lys Lys Gly Thr Glu Ile
    930                 935                 940

Phe Ala Ile Glu Gln Lys Tyr Leu Lys Arg Glu Asn Gly Lys Leu Cys
945                 950                 955                 960

Phe Ile Pro Pro Ile Glu Asn Ile Arg Ala Glu Ala Lys Lys His Leu
                965                 970                 975

Ser Lys Ile Leu Val Ser Tyr Lys Ala Lys Asn Lys Val Val Thr Ile
```

```
            980                 985                 990

Asn Lys Asn Lys Thr Lys Lys Lys  Ala Gly Phe Asn Glu  Gln Thr Ala
        995                 1000                1005

Leu Thr  Pro Arg Gly Gln Leu  His Lys Glu Thr Val  Tyr Gly Lys
    1010                1015                1020

Ser Phe  His Tyr Ser Thr Lys  Phe Glu Lys Ile Gly  Ala Ser Phe
    1025                1030                1035

Asp Ala  Gln Lys Ile Asn Thr  Val Ala Lys Lys Glu  Glu Arg Glu
    1040                1045                1050

Ala Leu  Leu Lys Arg Leu Ala  Glu Asn Gly Asn Asp  Pro Lys Lys
    1055                1060                1065

Ala Phe  Thr Gly Lys Asn Ser  Leu Asn Lys Met Pro  Ile Tyr Leu
    1070                1075                1080

Asp Leu  Gly Lys Asn Ile Lys  Leu Ser Glu Lys Val  Lys Thr Val
    1085                1090                1095

Val Leu  Glu Gln Asn Tyr Thr  Ile Arg Lys Asn Ile  Asp Pro Asp
    1100                1105                1110

Leu Lys  Val Asp Lys Val Ile  Asp Val Gly Ile Lys  Arg Ile Leu
    1115                1120                1125

Glu Ser  Arg Leu Glu Glu Phe  Gly Gly Asn Ala Lys  Leu Ala Phe
    1130                1135                1140

Ser Asn  Leu Glu Glu Asn Pro  Ile Trp Leu Asn Lys  Glu Lys Gly
    1145                1150                1155

Ile Pro  Ile Lys Arg Val Lys  Ile Ser Gly Val Ser  Asn Val Glu
    1160                1165                1170
```

```
Ser Leu  His Val Lys Lys Asp  His Phe Gly Glu Lys  Ile Leu Asp
    1175                1180                1185

Glu Glu  Gly Asn Glu Ile Pro  Val Asp Phe Val Ser  Thr Gly Asn
    1190                1195                1200

Asn His  His Val Ala Ile Tyr  Glu Asp Glu Asp Gly  Asn Leu Gln
    1205                1210                1215

Asp Glu  Val Val Asn Phe Tyr  Glu Ala Val Ile Arg  Arg Asn Gln
    1220                1225                1230

Gly Glu  Ser Ile Ile Lys Tyr  Arg His Glu Glu Gly  Trp Asn Phe
    1235                1240                1245

Leu Tyr  Ser Ile Lys Gln Asn  Glu Phe Phe Val Phe  Pro Ser Gln
    1250                1255                1260

Asp Phe  Asn Pro Asn Asp Phe  Asp Leu Leu Asp Pro  Lys Asn Tyr
    1265                1270                1275

Asp Leu  Ile Ser Pro Asn Leu  Tyr Arg Ala Gln Lys  Phe Ser Lys
    1280                1285                1290

Val Met  Tyr Gly Asn Ser Ala  Val Arg Asp Tyr Val  Phe Arg His
    1295                1300                1305

His Leu  Glu Thr Val Leu Asn  Asp Val Lys Glu Leu  Lys Asp Val
    1310                1315                1320

Ala Tyr  Lys Gln Leu Lys Ser  Leu Gln Tyr Leu Asn  Gly Ile Lys
    1325                1330                1335

Lys Val  Arg Leu Asn His Leu  Gly Gln Ile Ile Gln  Val Gly Glu
    1340                1345                1350

Tyr
```

<210> 463
<211> 1397
<212> PRT
<213> Joostella marina

<400> 463

```
Met Lys Lys Val Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Leu Val Asn Glu Ala Thr Lys Glu Glu Lys Lys Glu Gly Lys Ser
            20                  25                  30


Ser Glu Ile Ile Lys Leu Gly Val Arg Val Asn Pro Leu Thr Val Asp
        35                  40                  45


Glu Lys Thr Asn Phe Glu Lys Gly Arg Pro Leu Ser Thr Asn Ala Asp
    50                  55                  60


Arg Thr Leu Lys Arg Ser Ala Arg Arg Asn Leu Gln Arg Tyr Lys Leu
65                  70                  75                  80


Arg Arg Arg Asn Leu Ile Glu Ile Leu Ile Lys Asn Gly Phe Ile Thr
                85                  90                  95


Lys Asp Thr Pro Leu Thr Glu Thr Gly Lys Asp Thr Thr His Gln Thr
            100                 105                 110


Leu Lys Leu Arg Ala Lys Ser Ala Lys Glu Lys Val Asp Leu Lys Asp
        115                 120                 125


Phe Ala Lys Ile Leu Leu Thr Ile Asn Lys Lys Arg Gly Tyr Lys Ser
    130                 135                 140


Ser Arg Lys Val Asn Ser Asp Glu Asp Gly Leu Ala Ile Asp Gly Met
145                 150                 155                 160
```

```
Ala Val Ala Lys His Leu Tyr Glu Gln Asn Leu Thr Pro Gly Gln Tyr
                165                 170                 175

Val Leu Asn Leu Leu Gln Lys Asn Lys Lys Tyr Val Pro Asp Phe Tyr
            180                 185                 190

Arg Ser Asp Leu Gln Glu Glu Phe Lys Asn Ile Trp Asn Asn Gln Lys
        195                 200                 205

Thr Tyr Tyr Phe Asp Ile Leu Thr Asp Thr Leu Phe Glu Glu Leu Lys
    210                 215                 220

Asp Lys Asn Lys Ser Gln Thr Trp Ala Ile Cys Lys Lys Pro Phe Asp
225                 230                 235                 240

Ile Ala Gly Ile Lys Gln Ile Gly Lys Ala Ser Asp Lys Arg Leu Glu
                245                 250                 255

Arg Tyr Lys Trp Arg Thr Glu Gly Leu Thr Gln Lys Leu Asn Leu Glu
            260                 265                 270

Tyr Leu Ala Ile Ala Leu Gln Glu Ile Asn Asn Asp Ile Asn Lys Ser
        275                 280                 285

Ser Gly Tyr Leu Gly Ala Ile Ser Asp Arg Ser Lys Glu Leu Phe Phe
    290                 295                 300

Asn Lys Glu Thr Val Gly Glu Asn Leu Tyr Arg Gln Leu Val Lys Thr
305                 310                 315                 320

Pro His Thr Ser Leu Arg Asn Gln Val Phe Tyr Arg Gln Asp Tyr Leu
                325                 330                 335

Asp Glu Phe Glu Thr Ile Trp Glu Thr Gln Ala Lys Phe Tyr Pro Gln
            340                 345                 350

Leu Thr His Thr Leu Lys Glu Glu Ile Arg Asp Val Ile Ile Phe Tyr
        355                 360                 365
```

```
Gln Arg Lys Leu Lys Ser Gln Lys Ser Leu Ile Ser Phe Cys Gln Phe
    370                 375                 380

Glu Ser Trp Glu Gln Thr Tyr Ile Glu Lys Glu Thr Gly Lys Ser Lys
385                 390                 395                 400

Thr Arg Thr Val Gly Arg Lys Val Ile Pro Lys Ser Ser Pro Leu Phe
                405                 410                 415

Gln Glu Phe Lys Ile Trp Gln Asn Leu Asn Ser Leu Glu Phe Arg Asn
            420                 425                 430

Ser Asp Glu Gly Glu Ile Ile Glu Phe Ile Lys Leu Asp Glu Asp Ile
        435                 440                 445

Arg Gln Thr Val Phe Glu Glu Leu Asn Leu Arg Gly Asn Leu Lys Pro
    450                 455                 460

Asn Asp Val Leu Lys Ile Leu Gly Asn Tyr Ile Ser Leu Gly Lys Val
465                 470                 475                 480

Ser Gln Trp Lys Cys Asn Phe Glu Glu Ile Glu Gly Asn Arg Thr Asn
                485                 490                 495

Ala Ala Leu Tyr Asn Val Tyr Gln Ile Ile Ala Glu Asn Glu Gly Tyr
            500                 505                 510

Gly Phe Asp Trp Ala Lys Lys Thr Ala Ser Glu Ile Asn Lys Glu Leu
        515                 520                 525

Lys Asn Ile Phe Pro Gln Leu Gly Ile Asp Ala Ser Ile Leu Asp Phe
    530                 535                 540

Asp Phe Thr Gln Ala Asn Phe Asp Lys Gln Thr Ser Tyr Gln Leu Trp
545                 550                 555                 560
```

```
His Leu Leu Tyr Ser Ala Glu Glu Asp Phe Lys Ile Ser Glu Glu Asp
               565                 570                 575

Lys Val Leu Tyr Gly Asn Ser Ser Val Ser Leu Lys Lys Lys Leu His
            580                 585                 590

Gln Lys Tyr Gly Phe Lys Pro Glu Tyr Thr Lys Leu Leu Thr Asn Ile
        595                 600                 605

Ser Leu Gln Pro Asp Tyr Gly Asn Leu Ser Ala Lys Ala Ile Cys Asn
    610                 615                 620

Ile Leu Pro Tyr Leu Lys Glu Asn Asn Val Tyr Ser Glu Ala Cys Asp
625                 630                 635                 640

Leu Thr Gly Tyr Asn His Ser Asn Phe Leu Thr Ala Glu Glu Gln Ala
               645                 650                 655

Lys Arg Pro Leu Lys Pro Ile Leu Glu Leu Leu Lys Lys Asn Ser Leu
            660                 665                 670

Arg Asn Pro Val Val Glu Lys Ile Leu Asn Gln Met Val Asn Val Val
        675                 680                 685

Asn Gln Val Ile Glu Thr Tyr Gly Lys Pro Asp Glu Ile Arg Ile Glu
    690                 695                 700

Leu Thr Arg Glu Leu Lys Lys Ser Ala Lys Glu Arg Ala Asn Met Thr
705                 710                 715                 720

Lys Ser Ile Ala Asp Ala Thr Arg Arg Asn Asp Asp Tyr Arg Lys Thr
               725                 730                 735

Ile Ile Lys Glu Phe Gly Ile Pro Asn Pro Thr Lys Ser Asp Val Val
            740                 745                 750

Arg Tyr Arg Leu Trp Gln Glu Leu Ala Ser Arg Gly Tyr Lys Asp Ile
        755                 760                 765
```

```
Phe Thr Asp Thr Glu Ile Lys Pro Gln Glu Leu Phe Ser Asn Lys Ile
    770                 775                 780

Asp Ile Glu His Ile Ile Pro Lys Ala Leu Leu Phe Asp Asp Ser Phe
785                 790                 795                 800

Ser Asn Lys Thr Leu Ala Phe Lys Lys Asp Asn Leu Lys Lys Ala Asn
                805                 810                 815

Arg Thr Ala Tyr Asp Phe Ile Ala Asn Asp Tyr Ala Pro Asn Leu Glu
            820                 825                 830

Asn Tyr Ile Glu Arg Val Glu Ser Leu His Lys Asp Arg Lys Ile Thr
        835                 840                 845

Arg Ala Lys Arg Asn Lys Leu Leu Met Leu Gln Ser Lys Leu Pro Asp
    850                 855                 860

Gly Phe Ile Glu Arg Asp Leu Arg Asn Ser Gln Tyr Ile Thr Lys Glu
865                 870                 875                 880

Ala Lys Lys Met Leu Tyr Glu Val Cys Arg Thr Val Val Ser Thr Ser
                885                 890                 895

Gly Ser Ile Thr Asp Lys Leu Arg Glu Asp Trp Asp Leu Ile Asn Val
            900                 905                 910

Met Lys Glu Leu Asn Phe Pro Lys Tyr Lys Ala Leu Gly Leu Thr Glu
        915                 920                 925

Lys Ile Glu Arg Tyr Asp Ile Gly Ala Glu Lys Met Lys Glu Val Glu
    930                 935                 940

Ile Ile Glu Asp Trp Asn Lys Arg Asn Asp His Arg His His Ala Ile
945                 950                 955                 960
```

```
Asp Ala Leu Thr Val Ala Phe Ser Thr His Ser His Ile Gln Tyr Leu
                965                 970                 975


Asn His Leu Asn Ala Arg Arg Asp Glu Gly His Lys Lys His Ala Ala
            980                 985                 990


Ile Ile Ala Ile Glu Ser Thr Ile  Thr Glu Lys Glu Gly  Asn Lys Lys
        995                 1000                1005


Arg Arg  Phe Ile Ala Pro Leu  Pro Asn Phe Arg Leu  Gln Ala Lys
    1010                1015                1020


Glu His  Ile Glu Ser Ile Leu  Val Ser Phe Lys Asn  Lys Asn Lys
    1025                1030                1035


Val Val  Thr Asn Asn Ile Asn  Lys Thr Lys Arg Ile  Lys Lys Asp
    1040                1045                1050


Lys Phe  Asn Thr Lys Val Gln  Leu Thr Pro Arg Gly  Gln Leu His
    1055                1060                1065


Lys Glu  Thr Ile Tyr Gly Lys  Ile Lys Gln Pro Leu  Glu Lys His
    1070                1075                1080


Ile Lys  Leu Asn Lys Ser Phe  Thr Leu Glu Gln Ala  Lys Leu Ile
    1085                1090                1095


Ile Asp  Lys Arg Gln Arg Glu  Lys Val Leu Asn His  Leu Glu Lys
    1100                1105                1110


Tyr Ala  His Asn Ser Asp Ile  Ala Phe Asn Ser Lys  Thr Leu Lys
    1115                1120                1125


Lys Asn  Pro Leu Leu Ile Ser  Asp Glu Pro Leu Lys  Glu Val Leu
    1130                1135                1140


Cys Phe  Glu Glu Val Phe Thr  Ile Arg Lys Asp Ile  Ser Tyr Asp
    1145                1150                1155
```

```
Asn Phe  Lys Asn Glu Lys Gln  Leu Asp Lys Val Ile  Asp Glu Lys
    1160                1165                1170

Val Lys  Gln Ala Leu Lys Glu  Arg Ile Asn Gln Tyr  Asn Gly Asp
    1175                1180                1185

Phe Arg  Glu Ala Phe Ser Asp  Ile Glu Arg Asn Pro  Ile Trp Leu
    1190                1195                1200

Asn Lys  Ala Lys Gly Ile Cys  Val Lys Arg Ala Thr  Ile Lys Gly
    1205                1210                1215

Val Ser  Asn Ala Glu Pro Leu  His Thr Ala Lys Asn  His Leu Gly
    1220                1225                1230

Glu Glu  Val Leu Thr Glu Asn  Lys Glu Gln Ile Pro  Val Asp Tyr
    1235                1240                1245

Val Ser  Thr Gly Asn Asn His  His Val Ala Ile Tyr  Glu Asp Glu
    1250                1255                1260

Asp Gly  Asn Leu Gln Glu Lys  Val Val Ser Phe Tyr  Glu Ala Val
    1265                1270                1275

Ile Arg  Val Asn Glu Gly Leu  Pro Ile Ile Asp Lys  Glu Tyr Asn
    1280                1285                1290

Lys Ser  Leu Gly Trp Thr Phe  Lys Phe Thr Met Lys  Gln Asn Glu
    1295                1300                1305

Met Phe  Val Phe Pro Ser Glu  Asp Phe Asn Pro Thr  Glu Ile Asp
    1310                1315                1320

Leu Leu  Asp Gln Lys Asn Ala  Ser Leu Ile Ser Pro  Asn Leu Phe
    1325                1330                1335
```

```
Arg Val  Gln Lys Phe Thr Ile  Lys Asp Tyr Phe Phe  Arg His His
    1340                1345                1350


Leu Glu  Thr Thr Val Glu Asn  Asn Asn Thr Leu Lys  Asn Thr Thr
    1355                1360                1365


Trp Arg  Arg Glu Gly Leu Ser  Gly Ile Tyr Gly Ile  Ile Lys Ile
    1370                1375                1380


Arg Leu  Asn His Leu Gly Glu  Ile Val Gln Val Gly  Glu Tyr
    1385                1390                1395
```

<210> 464
<211> 1060
<212> PRT
<213> Kingella kingae

<400> 464

```
Met Ala Ala Lys Ser Leu Asn Tyr Ile Leu Gly Leu Asp Leu Gly Ile
1               5                   10                  15


Ala Ser Cys Gly Trp Ala Val Val Glu Met Asp Glu Gln Glu Asn Pro
            20                  25                  30


Leu Arg Leu Ile Asp Val Gly Val Arg Thr Phe Glu Glu Ala Glu Asn
        35                  40                  45


Pro Lys Asp Gly Ser Ser Leu Ala Glu Thr Arg Arg Leu Ala Arg Ala
    50                  55                  60


Gln Arg Arg Leu Ile Ser Arg Arg Ala Asn Arg Met Asn Lys Leu Cys
65                  70                  75                  80


Arg Leu Leu Lys Gln Glu Asn Val Leu Gln Ala Asn Asp Tyr Asp Glu
                85                  90                  95


Lys Gly Leu Ile Ile Gly Leu Pro Asn Gln Ala Trp Glu Leu Arg Ala
            100                 105                 110
```

```
Gln Gly Leu Asp Arg Lys Leu Glu Pro Lys Glu Trp Ala Ala Val Leu
        115                 120                 125

Ile His Leu Val Lys His Arg Gly Tyr Leu Ser Gln Arg Lys Asn Glu
    130                 135                 140

Ser Gln Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Ser Gly Met Asn
145                 150                 155                 160

His Asn His Gln Leu Leu Gln Ser Gln Ser Asn Gln Tyr Arg Thr Pro
                165                 170                 175

Ala Glu Leu Ala Ile Lys Gln Phe Ala Thr Gln Asp Gly His Ile Arg
            180                 185                 190

Asn Gln Arg Gly Ala Tyr Thr His Thr Phe Asn Arg Leu Asp Leu Gln
        195                 200                 205

Asn Glu Leu Asn Gln Leu Phe Asp Ala Gln Thr Arg Leu Gly Asn Pro
    210                 215                 220

His Val Ser Gly Ser Leu Lys Thr Ala Ile Asn Asp Leu Leu Met Asn
225                 230                 235                 240

Gln Lys Ala Ala Leu Ser Gly Asp Ala Ile Leu Glu Met Leu Gly Arg
                245                 250                 255

Cys Thr Phe Glu Pro Ser Glu Tyr Lys Ala Ala Lys Asn Thr Tyr Ser
            260                 265                 270

Ala Glu Arg Phe Val Trp Leu Gly Lys Leu Thr Asn Leu Arg Ile Gln
        275                 280                 285

Asp Asn Gly Leu Glu Ser Ala Leu Ser Arg Glu Gln Arg Glu Leu Leu
    290                 295                 300

Leu Asn Glu Pro Tyr Asn Lys Thr Lys Leu Thr Tyr Gln Gln Val Arg
```

```
305                 310                 315                 320

Lys Leu Leu Arg Leu Pro Glu Thr Ala Phe Phe Lys Gly Leu Arg Tyr
                325                 330                 335

Gly Lys Asp Asn Ala Glu Ser Ala Thr Phe Met Glu Met Lys Ser Tyr
            340                 345                 350

His Ala Ile Arg Lys Ser Leu Glu Asn Lys Ser Leu Lys Ser Glu Trp
        355                 360                 365

Glu Lys Leu Lys Thr Gln Pro Lys Leu Leu Asp Leu Ile Gly Thr Ala
    370                 375                 380

Phe Ser Ile Tyr Lys Thr Asp Asp Glu Ile Ala Gly Cys Leu Lys Asn
385                 390                 395                 400

Gln Leu Pro Glu Asn Val Ile Ile Ala Leu Gln Gly Gln Leu Asn Phe
                405                 410                 415

Ser Asn Phe Met Glu Leu Ser Leu Lys Ala Leu Glu Lys Leu Leu Pro
            420                 425                 430

Leu Met Glu Gln Gly Leu Arg Tyr Asp Glu Ala Cys Thr Gln Ile Tyr
        435                 440                 445

Gly Asn Arg His Glu Lys Ile Ala Asp Lys Thr Glu Lys Phe Leu Pro
    450                 455                 460

Asn Ile Pro Ala Asp Lys Leu Arg Asn Pro Val Val Leu Arg Thr Leu
465                 470                 475                 480

Thr Gln Ala Arg Lys Val Ile Asn Ala Ile Ile Arg Arg Tyr Gly Ser
                485                 490                 495

Pro Ala Arg Val His Ile Glu Thr Gly Arg Glu Val Gly Lys Ser Phe
            500                 505                 510
```

```
Ser Asp Arg Asp Lys Leu Lys Lys Gln Gln Glu Glu Asn Gln Glu Gln
        515                 520                 525

Arg Arg Arg Ala Ile Asp Glu Trp Lys Gln Phe Phe Pro Asn Ala Ala
    530                 535                 540

His Glu Pro Lys Ala Val Asp Ile Leu Lys Leu Arg Leu Tyr Gln Leu
545                 550                 555                 560

Gln Gln Gly Lys Cys Leu Tyr Ser Gly Leu Pro Ile Asp Val Arg Arg
                565                 570                 575

Leu Pro Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe Ser
            580                 585                 590

Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Ile Leu Val Leu Ala Ser
        595                 600                 605

Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Leu Arg Gly
    610                 615                 620

Ala Asp Asn Ser Glu Ser Trp Arg Leu Phe Val Glu Asn Val Gln Asn
625                 630                 635                 640

Cys Gln Phe Ser Pro Asn Lys Lys Gln Lys Ile Met Ala Lys Gln Leu
                645                 650                 655

Asp Glu Lys Gly Phe Leu Glu Arg Asn Leu Asn Asp Thr Arg Tyr Val
            660                 665                 670

Ser Arg Phe Leu Cys Gln Phe Ile Ser Glu His Leu His Leu Thr Gly
        675                 680                 685

Lys Gly Lys Lys Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Ala Leu
    690                 695                 700

Leu Arg Gly Arg Trp Gly Leu Ser Lys Asn Arg Glu Glu Asn Asp Arg
```

```
705                 710                 715                 720

His His Ala Val Asp Ala Val Val Val Ala Cys Ser Thr Val Ala Met
                725                 730                 735

Gln Gln Lys Ile Thr Gln Phe Val Arg Tyr Gln Lys Gly Asn Val Phe
            740                 745                 750

Thr Gly Glu Arg Ile Asp Lys Glu Thr Gly Glu Val Ile Ser Ile His
        755                 760                 765

Phe Pro Thr Pro Trp Glu His Phe Arg Glu Glu Val Met Ile Arg Val
    770                 775                 780

Phe Asp Asp Asn Pro Leu Arg Thr Leu Pro Glu Lys Leu Pro Asn Arg
785                 790                 795                 800

Pro Glu Ala Leu His Glu Tyr Val Met Pro Leu Phe Val Ser Arg Met
                805                 810                 815

Pro Thr Arg Lys Met Thr Gly Gln Gly His Lys Glu Thr Ile Lys Ser
            820                 825                 830

Ala Lys Arg Leu Asp Glu Lys Ile Ser Val Leu Arg Val Pro Leu Thr
        835                 840                 845

Gln Leu Lys Leu Asn Asp Leu Glu Asn Met Val Asn Arg Glu Arg Glu
    850                 855                 860

Pro Ala Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Gln Phe Lys Asn
865                 870                 875                 880

Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Phe Lys Gln Gly Gly Gln
                885                 890                 895

Gln Val Lys Ala Val Arg Val Glu Ile Val Gln Lys Ser Gly Met Leu
            900                 905                 910
```

```
Leu Arg Lys Ile Asn Gly Val Ala Asp Asn Gly Ser Met Val Arg Val
        915                 920                 925


Asp Val Phe Glu Lys Ser Gly Lys Phe Tyr Leu Val Pro Ile Tyr Ala
    930                 935                 940


Trp Gln Val Ala Glu Gly Ile Leu Pro Asn Tyr Ala Val Val Ala His
945                 950                 955                 960


Lys Asp Glu Ser Asp Trp Ile Leu Met Asp Glu Ser Tyr His Phe Lys
                965                 970                 975


Phe Ala Leu Tyr Lys Asn Asp Leu Leu Glu Val Gln Thr Lys Lys Gly
            980                 985                 990


Gly Ile Met Gly Tyr Phe Ala Ser  Leu Asp Arg Ala Thr  Gly Ala Ile
        995                 1000                1005


Thr Ile  Arg Glu His Asp Arg  Asp Lys Lys Lys Cys  Lys Asp Gly
    1010                1015                1020


Glu His  Arg Ser Ile Gly Val  Lys Met Ala Ser Ser  Phe Lys Lys
    1025                1030                1035


Leu Gln  Val Asp Glu Leu Gly  Lys Asn Ile His Glu  Thr Arg Ser
    1040                1045                1050


Arg Lys  Arg Pro Asn Ile Gly
    1055                1060


<210>  465
<211>  1314
<212>  PRT
<213>  Lactobacillus animalis

<400>  465

Met Leu Lys Lys Asp Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser
1               5                   10                  15
```

```
Val Gly His Ala Val Val Thr Asp Asp Tyr Lys Val Pro Thr Lys Lys
            20                  25                  30

Met Lys Val Phe Gly Asp Thr Ser Lys Lys Thr Ile Lys Lys Asn Met
        35                  40                  45

Leu Gly Val Leu Leu Phe Asn Glu Gly Gln Thr Ala Ala Asp Thr Arg
    50                  55                  60

Leu Lys Arg Gly Thr Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu
65                  70                  75                  80

Arg Tyr Leu Gln Glu Ile Phe Ala Pro Glu Leu Ala Lys Val Asp Pro
                85                  90                  95

Asn Phe Leu Tyr Arg Leu Glu Glu Ser Ser Leu Val Ala Glu Asp Lys
            100                 105                 110

Lys Tyr Asp Val Tyr Pro Ile Phe Gly Lys Arg Glu Glu Glu Leu Leu
        115                 120                 125

Tyr His Asp Thr Tyr Lys Thr Ile Tyr His Leu Arg Ser Ala Leu Ala
    130                 135                 140

Asn Asn Asp Gln Pro Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala
145                 150                 155                 160

His Ile Ile Lys Tyr Arg Gly Asn Phe Leu Leu Glu Gly Glu Ile Asp
                165                 170                 175

Leu Arg Thr Thr Asp Ile Asn Lys Val Phe Ala Glu Phe Ser Glu Thr
            180                 185                 190

Leu Asn Glu Asn Ser Asp Glu Asn Leu Gly Lys Leu Asp Val Ala Asp
        195                 200                 205
```

```
Ile Phe Lys Asn Asn Thr Phe Ser Lys Thr Lys Lys Ser Glu Glu Leu
    210                 215                 220

Leu Lys Leu Ser Gly Ala Lys Lys Asn Gln Leu Ala His Gln Leu Phe
225                 230                 235                 240

Lys Met Met Val Gly Asn Met Gly Ser Phe Lys Lys Val Leu Gly Thr
                245                 250                 255

Asp Glu Glu His Lys Leu Ser Phe Gly Lys Asp Thr Tyr Glu Asp Asp
            260                 265                 270

Leu Asn Asp Leu Leu Ala Glu Ala Gly Asp Gln Tyr Leu Asp Ile Phe
        275                 280                 285

Val Ala Ala Lys Lys Val Tyr Asp Ala Ala Ile Leu Ala Ser Ile Leu
    290                 295                 300

Asp Val Lys Asp Thr Gln Thr Lys Thr Val Phe Ser Gln Ala Met Ile
305                 310                 315                 320

Glu Arg Tyr Glu Glu His Gln Lys Asp Leu Ile Glu Leu Lys Arg Val
                325                 330                 335

Phe Lys Lys Tyr Leu Pro Glu Lys Cys His Asp Phe Phe Ser Glu Pro
            340                 345                 350

Lys Ile Ser Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Val Ser Glu Glu
        355                 360                 365

Asp Phe Tyr Lys Tyr Thr Lys Lys Thr Leu Lys Gly Ile Pro Glu Thr
    370                 375                 380

Glu Glu Ile Leu Gln Lys Ile Asp Ala Asn Asn Tyr Leu Arg Lys Gln
385                 390                 395                 400

Arg Thr Phe Asp Asn Gly Ala Ile Pro His Gln Val His Leu Lys Glu
                405                 410                 415
```

```
Leu Val Ala Ile Val Glu Asn Gln Gly Lys Tyr Tyr Pro Phe Leu Arg
            420                 425                 430

Glu Asn Lys Asp Lys Phe Glu Lys Ile Leu Asn Phe Arg Ile Pro Tyr
        435                 440                 445

Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Lys Phe Ala Trp Leu Thr
    450                 455                 460

Arg Ala Gly Glu Gly Lys Ile Thr Pro Tyr Asn Phe Asp Glu Met Ile
465                 470                 475                 480

Asp Lys Glu Thr Ser Ala Glu Asp Phe Ile Lys His Met Thr Ile Asn
                485                 490                 495

Asp Leu Tyr Leu Pro Thr Glu Pro Val Leu Pro Lys His Ser Leu Leu
            500                 505                 510

Tyr Glu Arg Tyr Thr Ile Phe Asn Glu Leu Ala Gly Val Arg Tyr Val
        515                 520                 525

Thr Glu Asn Gly Glu Ala Lys Tyr Phe Asp Ala Gln Thr Lys Arg Ser
    530                 535                 540

Ile Phe Glu Leu Phe Lys Leu Asp Arg Lys Val Ser Glu Lys Met Val
545                 550                 555                 560

Ile Lys His Leu Lys Val Val Met Pro Ala Ile Arg Ile Gln Ala Leu
                565                 570                 575

Lys Gly Leu Asp Asn Gly Lys Phe Asn Ala Ser Tyr Gly Thr Tyr Lys
            580                 585                 590

Asp Leu Val Asp Met Gly Val Ala Pro Glu Leu Leu Asn Asp Glu Val
        595                 600                 605
```

```
Asn Ser Glu Lys Trp Glu Asp Ile Ile Lys Thr Leu Thr Ile Phe Glu
    610                 615                 620

Gly Arg Lys Leu Ile Lys Arg Arg Leu Glu Asn Tyr Arg Asp Phe Leu
625                 630                 635                 640

Gly Glu Asp Ile Leu Arg Lys Leu Ser Arg Lys Lys Tyr Thr Gly Trp
                645                 650                 655

Gly Arg Leu Ser Ala Lys Leu Leu Asp Gly Ile Tyr Asp Lys Lys Thr
            660                 665                 670

His Lys Thr Ile Leu Asp Cys Leu Met Thr Glu Asp Tyr Ser Gln Asn
        675                 680                 685

Phe Met Gln Leu Ile Asn Asp Asp Asn Tyr Ser Phe Lys Glu Thr Ile
    690                 695                 700

Lys Asn Ala Gln Val Ile Glu Lys Glu Glu Thr Leu Ala Lys Thr Val
705                 710                 715                 720

Gln Glu Leu Pro Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Ser
                725                 730                 735

Leu Glu Ile Val Asp Glu Ile Ile Lys Val Met Gly Tyr Lys Pro Lys
            740                 745                 750

Ser Ile Val Val Glu Met Ala Arg Glu Thr Gln Lys Thr His Gly Thr
        755                 760                 765

Arg Lys Arg Glu Asp Arg Val Gln Gln Ile Val Glu Asn Leu Lys Asp
    770                 775                 780

Ala Asn Glu Leu Pro Glu Lys Leu Pro Ser Asn Ala Glu Leu Ser Asp
785                 790                 795                 800

Glu Arg Lys Tyr Leu Tyr Cys Leu Gln Asn Gly Arg Asp Met Tyr Thr
                805                 810                 815
```

```
Gly Ala Pro Leu Asp Tyr Asp His Leu Gln Phe Tyr Asp Val Asp His
            820                 825                 830

Ile Ile Pro Gln Ser Phe Leu Lys Asp Asp Ser Ile Glu Asn Lys Val
        835                 840                 845

Leu Thr Ile Lys Lys Glu Asn Val Arg Lys Thr Asn Gly Leu Pro Ser
    850                 855                 860

Glu Ala Val Ile Gln Lys Met Gly Ser Phe Trp Lys Lys Leu Leu Asp
865                 870                 875                 880

Ala Gly Ala Met Thr Asn Lys Lys Tyr Asp Asn Leu Arg Arg Asn Leu
                885                 890                 895

His Gly Gly Leu Asn Glu Lys Leu Lys Glu Arg Phe Ile Glu Arg Gln
            900                 905                 910

Leu Val Glu Thr Arg Gln Ile Thr Lys Tyr Val Ala Gln Leu Leu Asp
        915                 920                 925

Gln Arg Leu Asn Tyr Asp Gly Asn Gly Val Glu Leu Asp Glu Lys Ile
    930                 935                 940

Ala Ile Val Thr Leu Lys Ala Gln Leu Ala Ser Gln Phe Arg Ser Glu
945                 950                 955                 960

Phe Lys Leu Arg Lys Val Arg Ala Leu Asn Asn Leu His His Ala His
                965                 970                 975

Asp Ala Tyr Leu Asn Ala Ile Val Ala Asn Leu Ile Met Ala Lys Tyr
            980                 985                 990

Pro Glu Leu Glu Pro Glu Phe Val  Tyr Gly Lys Tyr Arg  Lys Ala Lys
        995                 1000                1005
```

```
Phe Lys  Gly Leu Gly Lys Ala  Thr Ala Lys Asn Thr  Leu Tyr Ala
    1010                1015                1020

Asn Val  Leu Tyr Phe Leu Lys  Glu Asn Glu Val Tyr  Pro Phe Trp
    1025                1030                1035

Asp Lys  Ala Arg Asp Leu Pro  Thr Ile Lys Arg Tyr  Leu Tyr Arg
    1040                1045                1050

Ala Gln  Val Asn Lys Val Arg  Lys Ala Glu Arg Gln  Ile Gly Gly
    1055                1060                1065

Phe Ser  Asp Glu Met Leu Val  Pro Lys Ser Asp Ser  Gly Lys Leu
    1070                1075                1080

Leu Pro  Arg Lys Glu Gly Leu  Asp Pro Val Lys Tyr  Gly Gly Tyr
    1085                1090                1095

Ala Lys  Ala Val Glu Ser Tyr  Ala Val Leu Ile Thr  Ala Asp Glu
    1100                1105                1110

Val Lys  Lys Gly Lys Thr Lys  Lys Val Lys Thr Leu  Val Asn Ile
    1115                1120                1125

Pro Ile  Ile Asp Ser Lys Lys  Tyr Glu Ala Asp Pro  Thr Ala Tyr
    1130                1135                1140

Leu Ala  Ser Arg Gly Tyr Thr  Asn Val Thr Asn Ser  Phe Ile Leu
    1145                1150                1155

Pro Lys  Tyr Ser Leu Leu Glu  Asp Pro Glu Gly Arg  Arg Arg Tyr
    1160                1165                1170

Leu Ala  Ser Phe Lys Glu Phe  Gln Lys Ala Asn Glu  Leu Ile Leu
    1175                1180                1185

Pro Gln  His Leu Val Glu Leu  Leu Tyr Trp Val Asn  Ala Lys Asp
    1190                1195                1200
```

```
Gly Glu  Gln Lys Leu Glu Asp  His Lys Ala Glu Phe  Lys Glu Leu
    1205                 1210                 1215


Phe Asp  Lys Ile Met Glu Phe  Ala Asp Lys Tyr Val  Val Ala Pro
    1220                 1225                 1230


Lys Asn  Ser Glu Lys Ile Arg  Arg Leu Tyr Glu Glu  Asn Gln Asp
    1235                 1240                 1245


Ala Thr  Pro Met Glu Leu Gly  Lys Asn Phe Val Glu  Leu Leu Arg
    1250                 1255                 1260


Tyr Thr  Ala Asp Gly Ala Ala  Ser Asp Phe Lys Phe  Phe Gly Glu
    1265                 1270                 1275


Asn Ile  Pro Arg Lys Arg Tyr  Asn Ser Ala Gly Ser  Leu Leu Asn
    1280                 1285                 1290


Gly Thr  Leu Ile Tyr Gln Ser  Lys Thr Gly Leu Tyr  Glu Thr Arg
    1295                 1300                 1305


Ile Asp  Leu Gly Lys Leu
    1310


<210>  466
<211>  1371
<212>  PRT
<213>  Lactobacillus buchneri

<400>  466

Met Lys Val Asn Asn Tyr His Ile Gly Leu Asp Ile Gly Thr Ser Ser
1               5                  10                  15


Ile Gly Trp Val Ala Ile Gly Lys Asp Gly Lys Pro Leu Arg Val Lys
            20                  25                  30


Gly Lys Thr Ala Ile Gly Ala Arg Leu Phe Gln Glu Gly Asn Pro Ala
```

```
        35                  40                  45

Ala Asp Arg Arg Met Phe Arg Thr Thr Arg Arg Arg Leu Ser Arg Arg
    50                  55                  60

Lys Trp Arg Leu Lys Leu Leu Glu Glu Ile Phe Asp Pro Tyr Ile Thr
65                  70                  75                  80

Pro Val Asp Ser Thr Phe Phe Ala Arg Leu Lys Gln Ser Asn Leu Ser
                85                  90                  95

Pro Lys Asp Ser Arg Lys Glu Phe Lys Gly Ser Met Leu Phe Pro Asp
            100                 105                 110

Leu Thr Asp Met Gln Tyr His Lys Asn Tyr Pro Thr Ile Tyr His Leu
        115                 120                 125

Arg His Ala Leu Met Thr Gln Asp Lys Lys Phe Asp Ile Arg Met Val
    130                 135                 140

Tyr Leu Ala Ile His His Ile Val Lys Tyr Arg Gly Asn Phe Leu Asn
145                 150                 155                 160

Ser Thr Pro Val Asp Ser Phe Lys Ala Ser Lys Val Asp Phe Val Asp
                165                 170                 175

Gln Phe Lys Lys Leu Asn Glu Leu Tyr Ala Ala Ile Asn Pro Glu Glu
            180                 185                 190

Ser Phe Lys Ile Asn Leu Ala Asn Ser Glu Asp Ile Gly His Gln Phe
        195                 200                 205

Leu Asp Pro Ser Ile Arg Lys Phe Asp Lys Lys Lys Gln Ile Pro Lys
    210                 215                 220

Ile Val Pro Val Met Met Asn Asp Lys Val Thr Asp Arg Leu Asn Gly
225                 230                 235                 240
```

```
Lys Ile Ala Ser Glu Ile Ile His Ala Ile Leu Gly Tyr Lys Ala Lys
                245                 250                 255

Leu Asp Val Val Leu Gln Cys Thr Pro Val Asp Ser Lys Pro Trp Ala
            260                 265                 270

Leu Lys Phe Asp Asp Glu Asp Ile Asp Ala Lys Leu Glu Lys Ile Leu
        275                 280                 285

Pro Glu Met Asp Glu Asn Gln Gln Ser Ile Val Ala Ile Leu Gln Asn
    290                 295                 300

Leu Tyr Ser Gln Val Thr Leu Asn Gln Ile Val Pro Asn Gly Met Ser
305                 310                 315                 320

Leu Ser Glu Ser Met Ile Glu Lys Tyr Asn Asp His His Asp His Leu
                325                 330                 335

Lys Leu Tyr Lys Lys Leu Ile Asp Gln Leu Ala Asp Pro Lys Lys Lys
            340                 345                 350

Ala Val Leu Lys Lys Ala Tyr Ser Gln Tyr Val Gly Asp Asp Gly Lys
        355                 360                 365

Val Ile Glu Gln Ala Glu Phe Trp Ser Ser Val Lys Lys Asn Leu Asp
    370                 375                 380

Asp Ser Glu Leu Ser Lys Gln Ile Met Asp Leu Ile Asp Ala Glu Lys
385                 390                 395                 400

Phe Met Pro Lys Gln Arg Thr Ser Gln Asn Gly Val Ile Pro His Gln
                405                 410                 415

Leu His Gln Arg Glu Leu Asp Glu Ile Ile Glu His Gln Ser Lys Tyr
            420                 425                 430

Tyr Pro Trp Leu Val Glu Ile Asn Pro Asn Lys His Asp Leu His Leu
```

```
        435                 440                 445

Ala Lys Tyr Lys Ile Glu Gln Leu Val Ala Phe Arg Val Pro Tyr Tyr
    450                 455                 460

Val Gly Pro Met Ile Thr Pro Lys Asp Gln Ala Glu Ser Ala Glu Thr
465                 470                 475                 480

Val Phe Ser Trp Met Glu Arg Lys Gly Thr Glu Thr Gly Gln Ile Thr
                485                 490                 495

Pro Trp Asn Phe Asp Glu Lys Val Asp Arg Lys Ala Ser Ala Asn Arg
            500                 505                 510

Phe Ile Lys Arg Met Thr Thr Lys Asp Thr Tyr Leu Ile Gly Glu Asp
        515                 520                 525

Val Leu Pro Asp Glu Ser Leu Leu Tyr Glu Lys Phe Lys Val Leu Asn
    530                 535                 540

Glu Leu Asn Met Val Arg Val Asn Gly Lys Leu Leu Lys Val Ala Asp
545                 550                 555                 560

Lys Gln Ala Ile Phe Gln Asp Leu Phe Glu Asn Tyr Lys His Val Ser
                565                 570                 575

Val Lys Lys Leu Gln Asn Tyr Ile Lys Ala Lys Thr Gly Leu Pro Ser
            580                 585                 590

Asp Pro Glu Ile Ser Gly Leu Ser Asp Pro Glu His Phe Asn Asn Ser
        595                 600                 605

Leu Gly Thr Tyr Asn Asp Phe Lys Lys Leu Phe Gly Ser Lys Val Asp
    610                 615                 620

Glu Pro Asp Leu Gln Asp Asp Phe Glu Lys Ile Val Glu Trp Ser Thr
625                 630                 635                 640
```

```
Val Phe Glu Asp Lys Lys Ile Leu Arg Glu Lys Leu Asn Glu Ile Thr
                645                 650                 655

Trp Leu Ser Asp Gln Gln Lys Asp Val Leu Glu Ser Ser Arg Tyr Gln
            660                 665                 670

Gly Trp Gly Arg Leu Ser Lys Lys Leu Leu Thr Gly Ile Val Asn Asp
        675                 680                 685

Gln Gly Glu Arg Ile Ile Asp Lys Leu Trp Asn Thr Asn Lys Asn Phe
    690                 695                 700

Met Gln Ile Gln Ser Asp Asp Asp Phe Ala Lys Arg Ile His Glu Ala
705                 710                 715                 720

Asn Ala Asp Gln Met Gln Ala Val Asp Val Glu Asp Val Leu Ala Asp
                725                 730                 735

Ala Tyr Thr Ser Pro Gln Asn Lys Lys Ala Ile Arg Gln Val Val Lys
            740                 745                 750

Val Val Asp Asp Ile Gln Lys Ala Met Gly Gly Val Ala Pro Lys Tyr
        755                 760                 765

Ile Ser Ile Glu Phe Thr Arg Ser Glu Asp Arg Asn Pro Arg Arg Thr
    770                 775                 780

Ile Ser Arg Gln Arg Gln Leu Glu Asn Thr Leu Lys Asp Thr Ala Lys
785                 790                 795                 800

Ser Leu Ala Lys Ser Ile Asn Pro Glu Leu Leu Ser Glu Leu Asp Asn
                805                 810                 815

Ala Ala Lys Ser Lys Lys Gly Leu Thr Asp Arg Leu Tyr Leu Tyr Phe
            820                 825                 830

Thr Gln Leu Gly Lys Asp Ile Tyr Thr Gly Glu Pro Ile Asn Ile Asp
```

```
        835                 840                 845

Glu Leu Asn Lys Tyr Asp Ile Asp His Ile Leu Pro Gln Ala Phe Ile
    850                 855                 860

Lys Asp Asn Ser Leu Asp Asn Arg Val Leu Val Leu Thr Ala Val Asn
865                 870                 875                 880

Asn Gly Lys Ser Asp Asn Val Pro Leu Arg Met Phe Gly Ala Lys Met
                885                 890                 895

Gly His Phe Trp Lys Gln Leu Ala Glu Ala Gly Leu Ile Ser Lys Arg
            900                 905                 910

Lys Leu Lys Asn Leu Gln Thr Asp Pro Asp Thr Ile Ser Lys Tyr Ala
        915                 920                 925

Met His Gly Phe Ile Arg Arg Gln Leu Val Glu Thr Ser Gln Val Ile
    930                 935                 940

Lys Leu Val Ala Asn Ile Leu Gly Asp Lys Tyr Arg Asn Asp Asp Thr
945                 950                 955                 960

Lys Ile Ile Glu Ile Thr Ala Arg Met Asn His Gln Met Arg Asp Glu
                965                 970                 975

Phe Gly Phe Ile Lys Asn Arg Glu Ile Asn Asp Tyr His His Ala Phe
            980                 985                 990

Asp Ala Tyr Leu Thr Ala Phe Leu  Gly Arg Tyr Leu Tyr  His Arg Tyr
        995                 1000                1005

Ile Lys  Leu Arg Pro Tyr Phe  Val Tyr Gly Asp Phe  Lys Lys Phe
    1010                1015                1020

Arg Glu  Asp Lys Val Thr Met  Arg Asn Phe Asn Phe  Leu His Asp
    1025                1030                1035
```

```
Leu Thr  Asp Asp Thr Gln Glu  Lys Ile Ala Asp Ala  Glu Thr Gly
    1040                1045                1050

Glu Val  Ile Trp Asp Arg Glu  Asn Ser Ile Gln Gln  Leu Lys Asp
    1055                1060                1065

Val Tyr  His Tyr Lys Phe Met  Leu Ile Ser His Glu  Val Tyr Thr
    1070                1075                1080

Leu Arg  Gly Ala Met Phe Asn  Gln Thr Val Tyr Pro  Ala Ser Asp
    1085                1090                1095

Ala Gly  Lys Arg Lys Leu Ile  Pro Val Lys Ala Asp  Arg Pro Val
    1100                1105                1110

Asn Val  Tyr Gly Gly Tyr Ser  Gly Ser Ala Asp Ala  Tyr Met Ala
    1115                1120                1125

Ile Val  Arg Ile His Asn Lys  Lys Gly Asp Lys Tyr  Arg Val Val
    1130                1135                1140

Gly Val  Pro Met Arg Ala Leu  Asp Arg Leu Asp Ala  Ala Lys Asn
    1145                1150                1155

Val Ser  Asp Ala Asp Phe Asp  Arg Ala Leu Lys Asp  Val Leu Ala
    1160                1165                1170

Pro Gln  Leu Thr Lys Thr Lys  Lys Ser Arg Lys Thr  Gly Glu Ile
    1175                1180                1185

Thr Gln  Val Ile Glu Asp Phe  Glu Ile Val Leu Gly  Lys Val Met
    1190                1195                1200

Tyr Arg  Gln Leu Met Ile Asp  Gly Asp Lys Lys Phe  Met Leu Gly
    1205                1210                1215

Ser Ser  Thr Tyr Gln Tyr Asn  Ala Lys Gln Leu Val  Leu Ser Asp
```

```
    1220                1225                1230

Gln Ser  Val Lys Thr Leu Ala  Ser Lys Gly Arg Leu  Asp Pro Leu
    1235                1240                1245

Gln Glu  Ser Met Asp Tyr Asn  Asn Val Tyr Thr Glu  Ile Leu Asp
    1250                1255                1260

Lys Val  Asn Gln Tyr Phe Ser  Leu Tyr Asp Met Asn  Lys Phe Arg
    1265                1270                1275

His Lys  Leu Asn Leu Gly Phe  Ser Lys Phe Ile Ser  Phe Pro Asn
    1280                1285                1290

His Asn  Val Leu Asp Gly Asn  Thr Lys Val Ser Ser  Gly Lys Arg
    1295                1300                1305

Glu Ile  Leu Gln Glu Ile Leu  Asn Gly Leu His Ala  Asn Pro Thr
    1310                1315                1320

Phe Gly  Asn Leu Lys Asp Val  Gly Ile Thr Thr Pro  Phe Gly Gln
    1325                1330                1335

Leu Gln  Gln Pro Asn Gly Ile  Leu Leu Ser Asp Glu  Thr Lys Ile
    1340                1345                1350

Arg Tyr  Gln Ser Pro Thr Gly  Leu Phe Glu Arg Thr  Val Ser Leu
    1355                1360                1365

Lys Asp  Leu
    1370
```

<210> 467
<211> 315
<212> PRT
<213> Lactobacillus casei

<400> 467

```
Met Phe Lys Asp Tyr Leu Lys Gln Leu Glu Asp Asp Gly Thr Ala Lys
1               5                  10                  15

Ala Ile Arg Gln Leu Tyr Asp Arg Tyr Ile Asp Gly Asp Asp Ala Lys
            20                  25                  30

Pro Phe Val Arg Glu Asp Phe Val Lys Ala Leu Thr Lys Glu Val Thr
        35                  40                  45

Ala His Pro Asn Ala Lys Ser Pro Glu Leu Leu Glu Arg Leu Ala Gln
    50                  55                  60

Pro Asp Phe Met Leu Lys Gln Arg Asn Lys Ala Asn Gly Ala Ile Pro
65                  70                  75                  80

Val Gln Met Gln Gln Arg Glu Leu Asp Gln Ile Ile Lys Asn Gln Ser
                85                  90                  95

Val Tyr Tyr Asp Trp Leu Ala Ala Pro Asn Pro Val Glu Lys His Arg
            100                 105                 110

Lys Ser Met Pro Tyr Gln Leu Asp Glu Leu Leu Asn Phe Arg Ile Pro
        115                 120                 125

Tyr Tyr Val Gly Pro Leu Val Thr Ala Lys Glu Gln Lys Ala Ala Arg
    130                 135                 140

Gly Gly Val Phe Ala Trp Met Val Arg Lys Asp Pro Asp Gly Asn Ile
145                 150                 155                 160

Thr Pro Tyr Asn Phe Asp Glu Lys Val Asp Arg Glu Ala Ser Ala Asn
                165                 170                 175

Thr Phe Ile Gln Arg Met Lys Thr Thr Asp Thr Tyr Leu Ile Gly Glu
            180                 185                 190

Asp Val Leu Pro Lys Gln Ser Leu Leu Tyr Gln Ser Tyr Glu Val Leu
        195                 200                 205
```

```
Asn Glu Leu Asn Asn Val Arg Val Asn Asp Asn Lys Leu Ser Phe Asp
    210                 215                 220

Gln Lys Gln Gln Val Leu Gly Glu Leu Phe Glu Arg His Asn Thr Val
225                 230                 235                 240

Thr Ile Lys Gln Phe Val Asp Asn Leu Leu Ala His Gly Asp Tyr Asp
                245                 250                 255

Arg Ile Pro Glu Val Arg Gly Leu Ala Asp Glu Lys Arg Phe Leu Ser
            260                 265                 270

Ser Leu Ser Thr Tyr Asn Gln Leu Lys Gly Ile Leu His Glu Ala Ile
        275                 280                 285

Asp Asp Ser Asp Lys Gln Thr Asp Met Val Asp Cys Lys Ile Asn Pro
    290                 295                 300

Asn Ala Val Arg Thr Lys Lys Ile Ser Phe Leu
305                 310                 315
```

<210> 468
<211> 236
<212> PRT
<213> Lactobacillus casei

<400> 468

```
Met Phe Lys Asp Tyr Leu Lys Gln Leu Glu Asp Asp Gly Thr Ala Lys
1               5                   10                  15

Ala Ile Arg Gln Leu Tyr Asp Arg Tyr Ile Asp Gly Asp Asp Ala Lys
            20                  25                  30

Pro Phe Val Arg Glu Asp Phe Val Lys Ala Leu Thr Lys Glu Val Thr
        35                  40                  45

Ala His Pro Asn Ala Lys Ser Pro Glu Leu Leu Glu Arg Leu Ala Gln
```

```
    50                  55                  60

Pro Asp Phe Met Leu Lys Gln Arg Asn Lys Ala Asn Gly Ala Ile Pro
65                  70                  75                  80

Val Gln Met Gln Gln Arg Glu Leu Asp Gln Ile Ile Lys Asn Gln Ser
                85                  90                  95

Val Tyr Tyr Asp Trp Leu Ala Ala Pro Asn Pro Val Glu Lys His Arg
            100                 105                 110

Lys Ser Met Pro Tyr Gln Leu Asp Glu Leu Leu Asn Phe Arg Ile Pro
        115                 120                 125

Tyr Tyr Val Gly Pro Leu Val Thr Ala Lys Glu Gln Lys Ala Ala Arg
    130                 135                 140

Gly Gly Val Phe Ala Trp Met Val Arg Lys Asp Pro Asp Gly Asn Ile
145                 150                 155                 160

Thr Pro Tyr Asn Phe Asp Glu Lys Val Asp Arg Glu Ala Ser Ala Asn
                165                 170                 175

Thr Phe Ile Gln Arg Met Lys Thr Thr Asp Thr Tyr Leu Ile Gly Glu
            180                 185                 190

Asp Val Leu Pro Lys Gln Ser Leu Leu Tyr Gln Ser Tyr Glu Val Leu
        195                 200                 205

Asn Glu Leu Asn Asn Val Arg Val Asn Asp Asn Lys Leu Ser Ser Ser
    210                 215                 220

Ile Phe Lys Ser Ser Ala Thr Met Ile Thr Asn Ser
225                 230                 235


<210>  469
<211>  1389
<212>  PRT
```

<213> Lactobacillus casei

<400> 469

```
Met Ile Ile Arg Thr Tyr Glu Leu Lys Thr Ile Thr Thr Ile Ala Ile
1               5                  10                  15


Leu Lys Met Phe Gln Leu Leu Thr Gly Gly Leu Ser Met Thr Lys Leu
            20                  25                  30


Gly Lys Pro Tyr Gly Ile Gly Val Asp Ile Gly Ser Asn Ser Ile Gly
        35                  40                  45


Phe Ala Ala Val Asp Glu Asn Ser His Leu Ile Arg Leu Lys Gly Lys
    50                  55                  60


Thr Val Ile Gly Ala Arg Leu Phe Glu Glu Gly Lys Ala Ala Ala Asp
65                  70                  75                  80


Arg Arg Ala Ser Arg Thr Thr Arg Arg Arg Leu Ser Arg Asn Arg Trp
                85                  90                  95


Arg Leu Ser Phe Leu Arg Asp Phe Phe Glu Ser His Ile Thr Pro Thr
            100                 105                 110


Gly Pro Asn Phe Phe Met Arg Gln Lys Tyr Ser Glu Ile Ser Pro Lys
        115                 120                 125


Asp Lys Ala Arg Tyr Lys Tyr Glu Lys Arg Leu Phe Asn Asp Arg Thr
    130                 135                 140


Asp Ala Glu Phe Tyr Gln Gln Tyr Pro Thr Met Tyr His Leu Arg Asn
145                 150                 155                 160


Arg Leu Leu Thr Asp Pro Ser Lys Ala Asp Val Arg Glu Ile Tyr Phe
                165                 170                 175


Ala Ile His His Ile Leu Lys Ser Arg Gly His Phe Leu Thr Ser Gly
            180                 185                 190
```

```
Tyr Ala Lys Asp Phe Asn Thr Asn Lys Val Ala Leu Asn Glu Ile Phe
        195                 200                 205

Pro Ala Leu Gln Asp Ala Tyr Ala Gln Val Tyr Pro Asp Leu Asp Ile
    210                 215                 220

Thr Phe Asp Glu Asn Lys Val Asn Glu Phe Lys Thr Val Leu Leu Asn
225                 230                 235                 240

Glu Lys Ala Thr Pro Ser Asp Thr Gln Arg Ala Leu Val Asn Leu Leu
                245                 250                 255

Leu Ala Glu Asp Gly Asp Lys Asp Ile Leu Lys Gln Gln Lys Gln Val
            260                 265                 270

Leu Thr Glu Phe Ala Lys Ala Val Val Gly Leu Lys Thr Lys Leu Asn
        275                 280                 285

Val Ala Leu Gly Thr Glu Val Asp Ser Ser Glu Ala Thr Val Trp Asn
    290                 295                 300

Phe Ser Leu Gly Gln Leu Asp Asp Lys Trp Ala Gly Ile Glu Ser Ala
305                 310                 315                 320

Met Thr Asp Glu Gly Thr Glu Ile Leu Asp Gln Ile Arg Asp Leu Tyr
                325                 330                 335

Arg Ala Arg Leu Leu Asn Gly Ile Val Pro Ala Gly Lys Thr Leu Ser
            340                 345                 350

Gln Ala Lys Val Asp Asp Tyr Ala Gln His His Glu Asp Leu Glu Leu
        355                 360                 365

Phe Lys Asp Tyr Leu Lys Gln Leu Glu Asp Asp Gly Thr Ala Lys Ala
    370                 375                 380
```

```
Ile Arg Gln Leu Tyr Asp Arg Tyr Ile Asp Gly Asp Asp Ala Lys Pro
385                 390                 395                 400

Phe Val Arg Glu Asp Phe Val Lys Ala Leu Thr Lys Glu Val Thr Ala
                405                 410                 415

His Pro Asn Ala Lys Ser Pro Glu Leu Leu Glu Arg Leu Ala Gln Pro
            420                 425                 430

Asp Phe Met Leu Lys Gln Arg Asn Lys Ala Asn Gly Ala Ile Pro Val
        435                 440                 445

Gln Met Gln Gln Arg Glu Leu Asp Gln Ile Ile Lys Asn Gln Ser Val
    450                 455                 460

Tyr Tyr Asp Trp Leu Ala Ala Pro Asn Pro Val Glu Lys His Arg Lys
465                 470                 475                 480

Ser Met Pro Tyr Gln Leu Asp Glu Leu Leu Asn Phe Arg Ile Pro Tyr
                485                 490                 495

Tyr Val Gly Pro Leu Val Thr Ala Lys Glu Gln Lys Ala Ala Gln Gly
            500                 505                 510

Gly Val Phe Ala Trp Met Val Arg Lys Asp Pro Asp Gly Asn Ile Thr
        515                 520                 525

Pro Tyr Asn Phe Asp Glu Lys Val Asp Arg Glu Ala Ser Ala Asn Thr
    530                 535                 540

Phe Ile Gln Arg Met Lys Thr Thr Asp Thr Tyr Leu Ile Gly Glu Asp
545                 550                 555                 560

Val Leu Pro Lys Gln Ser Leu Leu Tyr Gln Arg Tyr Glu Val Leu Asn
                565                 570                 575

Glu Leu Asn Asn Val Arg Val Asn Asn Glu Lys Leu Ser Ile Glu Gln
            580                 585                 590
```

```
Lys Gln Gln Val Ile Arg Glu Leu Phe Glu Arg His Asn Ser Val Thr
        595                 600                 605

Ile Lys Gln Phe Ala Glu Asn Leu Arg Ala His Gly Asp Tyr Ala His
    610                 615                 620

Ile Pro Glu Ile Arg Gly Leu Ala Asp Glu Lys Arg Phe Leu Ser Ser
625                 630                 635                 640

Leu Ser Thr Tyr Arg Gln Leu Lys Ser Leu Leu Pro Asp Ala Ile Asp
                645                 650                 655

Asp Pro Ala Lys Gln Ala Asp Ile Glu Asn Ile Ile Ala Trp Ser Thr
            660                 665                 670

Val Phe Glu Asp Ala Ala Ile Phe Lys Thr Lys Leu Lys Glu Ile Asn
        675                 680                 685

Trp Leu Asp Ser Gln Thr Ile Thr Lys Leu Ser Asn Ile Arg Tyr Arg
    690                 695                 700

Gly Trp Gly Gln Phe Ser His Lys Phe Leu Asn Gly Leu Thr Leu Gly
705                 710                 715                 720

Asn Gly His Thr Ile Ile Gln Glu Leu Phe Leu Ser Asn Asn Asn Leu
                725                 730                 735

Met Gln Ile Leu Thr Asp Glu Thr Leu Gln Lys Lys Met Thr Glu Leu
            740                 745                 750

Asn Ala Asp Lys Leu Lys Ala Ala Asn Ile Asn Asp Ala Ile Asp Asp
        755                 760                 765

Ala Tyr Thr Ser Pro Ser Asn Lys Lys Ala Leu Arg Gln Val Leu Arg
    770                 775                 780
```

```
Val Ile Glu Asp Ile Lys Arg Ala Ala Asp Gly Gln Asp Pro Ser Trp
785                 790                 795                 800

Leu Tyr Val Glu Thr Ala Asp Gly Gly Gly Thr Pro Gly Lys Arg Thr
                805                 810                 815

Arg Ala Arg Gln His Gln Leu Gln Glu Ile Tyr Ala Asn Ala Ala His
            820                 825                 830

Glu Leu Ile Asp Ser Ala Val Arg Gly Glu Leu Glu Asp Lys Ile Ala
        835                 840                 845

Asp Lys Ala Asp Phe Asn Asp Arg Leu Val Leu Tyr Phe Met Gln Gly
    850                 855                 860

Gly Arg Asp Ile Tyr Thr Gly Thr Pro Leu Asn Ile Asp Gln Leu Ser
865                 870                 875                 880

Ser Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Leu Ile Lys Asp Asn
                885                 890                 895

Ser Leu Asp Asn Arg Val Leu Val His Ala Ile Ile Asn Arg Glu Lys
            900                 905                 910

Asn Ala Thr Phe Ala Ser Thr Ile Tyr Ala Gln Lys Met Asn Ala Thr
        915                 920                 925

Trp Arg Gln Trp His Glu Ala Gly Leu Ile Ser Gly Arg Lys Leu Arg
    930                 935                 940

Asn Leu Gln Met Arg Pro Asp Gln Ile Asp Lys Tyr Ala Ser Gly Phe
945                 950                 955                 960

Val Ala Arg Gln Leu Val Glu Thr Arg Gln Ile Ile Lys Leu Thr Glu
                965                 970                 975

Gln Ile Val Ala Ala Gln Tyr Pro Glu Thr Lys Ile Ile Ala Val Lys
            980                 985                 990
```

```
Ala Gly Leu Ser His Gln Leu Arg  Glu Glu Leu Glu Phe  Pro Lys Asn
        995                 1000                1005


Arg Asp  Val Asn His Tyr His  His Ala Phe Asp Ala  Phe Leu Ala
    1010                1015                1020


Ala Arg  Ile Gly Thr Tyr Leu  Leu Lys Arg Phe Pro  Asn Leu Gln
    1025                1030                1035


Ala Phe  Phe Thr Tyr Gly Lys  Phe Lys Lys Ala Asp  Val Lys Lys
    1040                1045                1050


Leu Arg  Gly Phe Asn Phe Ile  Arg Asp Ile Thr His  Ala Glu Asp
    1055                1060                1065


Lys Ile  Val Val Lys Asp Thr  Gly Glu Val Ile Trp  Asp Lys Lys
    1070                1075                1080


Arg Asp  Val Asp Glu Leu Asp  Arg Ile Tyr Asn Phe  Lys Arg Met
    1085                1090                1095


Leu Ile  Thr His Glu Val His  Phe Glu Lys Ala Asp  Leu Phe Lys
    1100                1105                1110


Gln Thr  Val Tyr Gly Ala Lys  Asp Ser Lys Glu Ala  Gly Gly Lys
    1115                1120                1125


Lys Gln  Leu Ile Ser Lys Lys  Lys Gly Tyr Pro Val  Asp Ile Tyr
    1130                1135                1140


Gly Gly  Tyr Thr Gln Glu Thr  Gly Ser Tyr Leu Ser  Val Val Arg
    1145                1150                1155


Leu Thr  Lys Lys Ala Met Tyr  Ala Val Val Lys Val  Ser Thr Arg
    1160                1165                1170
```

```
Asp Ala  Ala Lys Leu Ala Val  Ala Lys Ser Ile Ser  Glu Gln Lys
    1175                1180                1185

Glu Asn  Glu Thr Leu Asn Asp  Ile Ile Asp Glu Lys  Leu Ser Lys
    1190                1195                1200

Ile Ser  Lys Asn Gly Lys Ile  Thr His Glu Leu Phe  Glu Val Val
    1205                1210                1215

Leu Pro  Arg Val Gly Gln Lys  Thr Leu Phe Lys Asn  Ser Lys Tyr
    1220                1225                1230

Asn Leu  Phe Leu Val Asn Ser  Asp Thr Tyr Met His  Asn Tyr Gln
    1235                1240                1245

Glu Leu  Trp Met Pro Arg Glu  Tyr Gln Lys Met Trp  Lys Asp Ile
    1250                1255                1260

Ser Leu  Ser Lys Tyr Gly Asp  Ala Gln Thr Glu Asp  Gln Leu Asp
    1265                1270                1275

Gln Ile  Phe Gly Phe Ile Val  Ser Gln Val Asn Ser  Tyr Phe Asn
    1280                1285                1290

Leu Tyr  Asp Ile Asn Gln Phe  Arg Lys Lys Leu Asn  Asp Ala Ala
    1295                1300                1305

Asp Lys  Phe Ala Thr Leu Pro  Met Arg Asp Thr Asp  Asp Met Gln
    1310                1315                1320

Gly Lys  Ile Ala Thr Ile Gly  Gln Leu Leu Ile Gly  Leu Gln Ala
    1325                1330                1335

Asn Ala  Ala Arg Ser Asp Leu  Arg Asn Leu Asp Ile  Lys Thr Pro
    1340                1345                1350

Leu Gly  Leu Leu Gln Ile Pro  Asn Gly Ile Ser Leu  Asp Ser Asp
    1355                1360                1365
```

Thr Ser Val Val Tyr Gln Ser Pro Thr Gly Leu Leu Glu Arg Glu
    1370   1375   1380

Val His Leu Ser Asp Leu
    1385

<210> 470
<211> 412
<212> PRT
<213> Lactobacillus casei

<400> 470

Met Ile Lys Asp Asn Ser Leu Asp Asn Arg Val Leu Val His Pro Leu
1   5   10   15

Val Asn Arg Glu Lys Asp Thr Ile Phe Ala Ser Thr Arg Phe Ala Lys
            20   25   30

Gln Thr Asn Gly Met Trp Arg Gln Trp His Ala Ala Gly Leu Ile Ser
        35   40   45

Ser Arg Lys Leu Arg Asn Leu Gln Met Arg Pro Asp Glu Ile Asp Lys
    50   55   60

Tyr Ala Ser Gly Phe Val Ala Arg Gln Leu Val Glu Thr Arg Gln Ile
65   70   75   80

Ile Lys Leu Thr Glu Gln Ile Val Ala Asp Gln Tyr Pro Asp Thr Lys
                85   90   95

Ile Ile Ala Val Lys Ala Gly Leu Ser Ser Gln Leu Arg Lys Glu Leu
            100   105   110

Asp Phe Pro Lys Asn Arg Glu Val Asn His Tyr His His Ala Phe Asp
        115   120   125

Ala Phe Leu Ala Ala Arg Ile Gly Thr Tyr Leu Leu Lys Arg Tyr Pro

```
    130                 135                 140

Asn Leu Glu Pro Phe Phe Thr Tyr Gly Lys Phe Lys Lys Thr Glu Val
145                 150                 155                 160

Lys Lys Leu Lys Ser Phe Asn Phe Ile Arg Asp Met Thr His Ala Lys
                165                 170                 175

Asp Lys Ile Val Ala Lys Glu Thr Gly Glu Ile Val Trp Asp Asn Ala
            180                 185                 190

Ser Asp Ile Asn Glu Leu Asp Arg Ile Tyr Asn Phe Lys Arg Met Leu
        195                 200                 205

Ile Thr His Glu Val Arg Phe Glu Thr Ala Ser Leu Phe Lys Gln Thr
    210                 215                 220

Leu Tyr Ala Ala Lys Asn Pro Lys Asn Arg Gly Gly Ser Arg Gln Leu
225                 230                 235                 240

Ile Pro Lys Lys Lys Gly Tyr Leu Val Asp Ile Tyr Gly Gly Tyr Thr
                245                 250                 255

Gln Glu Thr Gly Ser Tyr Leu Ser Val Val Arg Leu Thr Lys Lys Ala
            260                 265                 270

Met Tyr Ala Val Val Lys Val Ser Thr Arg Asp Ala Ala Lys Leu Ala
        275                 280                 285

Val Ala Lys Ser Ile Ser Glu Gln Lys Glu Asn Glu Thr Leu Lys Lys
    290                 295                 300

Ile Ile Asp Gly Lys Leu Ser Lys Thr Ser Lys Lys Gly Lys Thr Thr
305                 310                 315                 320

His Gln Leu Phe Glu Ile Val Leu Pro Arg Val Gly Gln Lys Thr Leu
                325                 330                 335
```

```
Phe Lys Asn Ser Lys Tyr Asn Gln Phe Leu Val Asn Ser Asp Thr Tyr
            340                 345                 350

Met His Asn Tyr Gln Glu Leu Trp Met Pro Arg Glu Tyr Gln Arg Met
        355                 360                 365

Trp Lys Asp Ile Leu Leu Ser Asn His Gly Asp Ala Gln Ile Glu Gly
    370                 375                 380

Gln Leu Asp Gln Ile Phe Lys Phe Ile Val Ser Gln Val Asn Ser Tyr
385                 390                 395                 400

Phe Asn Leu Tyr Asp Ile Asn Gln Phe Arg Lys Lys
                405                 410
```

<210> 471
<211> 234
<212> PRT
<213> Lactobacillus casei

<400> 471

```
Met Lys Val Thr Lys Lys Thr Glu Thr Ile Phe Lys Val Val Lys Ile
1               5                   10                  15

Ala Thr Ser Gln Val Ala Ala Leu Asn Lys Ala Arg Ser Arg Ser Thr
            20                  25                  30

Ala Glu Glu Leu Ser Val Leu Thr Glu Leu Leu Lys Pro Lys Phe Ser
        35                  40                  45

Lys Val Gly Lys Asn Gly Lys Ile Thr Asp Thr Pro Phe Glu Val Val
    50                  55                  60

Leu Pro Arg Val Pro Arg Glu Gln Leu Phe Tyr Asn Ala Lys Tyr Gly
65                  70                  75                  80

Phe Phe Met Val Asn Ser Asp Thr Met Phe His Asn Phe Gln Glu Ile
                85                  90                  95
```

```
Trp Val Ser Arg Ser Asp Gln Lys Ile Leu Gln Gln Ile Arg Lys Ala
            100                 105                 110

Lys Ile Asp Tyr Pro Asn Val Asp Gln Asp Leu Asp Asn Leu Phe His
        115                 120                 125

Asn Leu Ala Asp Gln Ile Val Lys Tyr Phe Asp Leu Tyr Ser Ile Ala
    130                 135                 140

Gly Phe Lys Glu Lys Ile Ser Gln Ser Gln Asn Thr Phe Asn Asp Leu
145                 150                 155                 160

Ala Val Asp Asp Thr Asp Gln Ser Val Gly Lys Ile Thr Val Ile Asn
                165                 170                 175

Glu Leu Leu Lys Gly Ala Gln Ala Asn Gly Met Thr Gly Ser Leu Lys
            180                 185                 190

Val Leu Lys Ile Ser Thr Pro Phe Gly Phe Thr Gln Asp Lys Ser Gly
        195                 200                 205

Val Leu Thr Lys Asp Ser Ser Ile Ile Tyr Gln Ser Pro Thr Gly Leu
    210                 215                 220

Phe Glu Arg Ser Val Arg Leu Thr Asp Leu
225                 230
```

<210> 472
<211> 566
<212> PRT
<213> Lactobacillus casei

<400> 472

```
Met Gln Ile Leu Thr Asp Glu Val Leu Lys Gln Lys Ile Ala Glu Leu
1               5                   10                  15

Asn Ala His Glu Leu Lys Ala Ser Gly Ile Tyr Ala Ala Ile Asp Asp
```

```
            20                  25                  30

Ala Tyr Thr Ser Pro Ser Asn Lys Lys Ala Leu Arg Gln Val Leu Ser
        35                  40                  45

Val Ile Asp Asp Ile Thr Asn Ala Ala Gly Gln Ala Pro Asn Trp Leu
    50                  55                  60

Tyr Ile Glu Thr Ala Asp Gly Asp Gly Val Pro Gly Lys Arg Thr Asn
65                  70                  75                  80

Ser Arg Gln Arg Lys Ile Gln Glu Ile Tyr Val Asn Ala Ala Gln Glu
                85                  90                  95

Leu Ile Thr Ser Ser Val Arg Gly Glu Leu Glu Asp Lys Ile Ala Ser
            100                 105                 110

Arg Ala Asp Phe Thr Asp Arg Leu Val Leu Tyr Phe Met Gln Gly Gly
        115                 120                 125

Arg Asp Ile Tyr Thr Gly Glu Pro Leu Asn Ile Asp Asn Leu Ser Ser
    130                 135                 140

Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Leu Ile Lys Asp Asn Ser
145                 150                 155                 160

Leu Asp Asn Arg Val Leu Val His Pro Leu Val Asn Arg Glu Lys Asp
                165                 170                 175

Thr Ile Phe Ala Ser Thr Arg Phe Ala Lys Gln Met Asn Gly Met Trp
            180                 185                 190

Arg Gln Trp His Ala Ala Gly Leu Ile Ser Ser Arg Lys Leu Arg Asn
        195                 200                 205

Leu Gln Met Arg Pro Asp Glu Ile Asp Lys Tyr Ala Ser Gly Phe Val
    210                 215                 220
```

```
Ala Arg Gln Leu Val Glu Thr Arg Gln Ile Ile Lys Leu Thr Glu Gln
225                 230                 235                 240

Ile Val Ala Asp Gln Tyr Pro Asp Ala Lys Ile Ile Ala Val Lys Ala
                245                 250                 255

Gly Leu Ser Ser Gln Leu Arg Lys Glu Leu Asp Phe Pro Lys Asn Arg
            260                 265                 270

Glu Val Asn His Tyr His His Ala Phe Asp Ala Phe Leu Ala Ala Arg
        275                 280                 285

Ile Gly Thr Tyr Leu Leu Lys Arg Tyr Pro Asn Leu Glu Pro Phe Phe
    290                 295                 300

Thr Tyr Gly Lys Phe Lys Lys Thr Glu Val Lys Lys Leu Lys Ser Phe
305                 310                 315                 320

Asn Phe Ile Arg Asp Met Thr His Ala Lys Asp Lys Ile Val Ala Lys
                325                 330                 335

Glu Thr Gly Glu Ile Val Trp Asp Asn Ala Ser Asp Ile Asn Glu Leu
            340                 345                 350

Asp Arg Ile Tyr Asn Phe Lys Arg Met Leu Ile Thr His Glu Val Arg
        355                 360                 365

Phe Glu Thr Ala Ser Leu Phe Lys Gln Thr Leu Tyr Ala Ala Lys Asn
    370                 375                 380

Ser Lys Asn Arg Gly Gly Ser Arg Gln Leu Ile Pro Lys Lys Lys Gly
385                 390                 395                 400

Tyr Leu Val Asp Ile Tyr Gly Gly Tyr Thr Gln Glu Thr Gly Ser Tyr
                405                 410                 415

Leu Ser Val Val Arg Leu Thr Lys Lys Ala Met Tyr Ala Val Val Lys
```

```
            420                 425                 430

Val Ser Thr Arg Asp Ala Ala Lys Leu Ala Val Ala Lys Ser Ile Ser
        435                 440                 445

Glu Gln Lys Glu Asn Glu Thr Leu Lys Lys Ile Ile Asp Gly Lys Leu
    450                 455                 460

Ser Lys Thr Ser Lys Lys Gly Lys Thr Thr His Gln Leu Phe Glu Ile
465                 470                 475                 480

Val Leu Pro Arg Val Gly Gln Lys Thr Leu Phe Lys Asn Ser Lys Tyr
                485                 490                 495

Asn Gln Phe Leu Val Asn Ser Asp Thr Tyr Met His Asn Tyr Gln Glu
            500                 505                 510

Leu Trp Met Pro Arg Glu Tyr Gln Arg Met Trp Lys Asp Ile Leu Leu
        515                 520                 525

Ser Asn His Gly Asp Ala Gln Leu Glu Gly Gln Leu Asp Gln Ile Phe
    530                 535                 540

Lys Phe Ile Val Ser Gln Val Asn Ser Tyr Phe Asn Leu Tyr Asp Ile
545                 550                 555                 560

Asn Gln Phe Arg Lys Lys
                565
```

<210> 473
<211> 1363
<212> PRT
<213> Lactobacillus casei

<400> 473

```
Met Thr Lys Leu Gly Lys Pro Tyr Gly Ile Gly Val Asp Ile Gly Ser
1               5                   10                  15
```

```
Asn Ser Ile Gly Phe Ala Ala Val Asp Glu Asn Ser His Leu Ile Arg
            20                  25                  30

Leu Lys Gly Lys Thr Val Ile Gly Ala Arg Leu Phe Glu Glu Gly Lys
        35                  40                  45

Ala Ala Ala Asp Arg Arg Ala Ser Arg Thr Thr Arg Arg Arg Leu Ser
    50                  55                  60

Arg Asn Arg Trp Arg Leu Ser Phe Leu Arg Asp Phe Phe Glu Ser His
65                  70                  75                  80

Ile Thr Pro Thr Asp Pro Asn Phe Phe Met Arg Gln Lys Tyr Ser Glu
                85                  90                  95

Ile Ser Pro Lys Asp Lys Ala Arg Tyr Lys Tyr Glu Lys Arg Leu Phe
            100                 105                 110

Asn Asp Arg Thr Asp Ala Glu Phe Tyr Gln Gln Tyr Pro Thr Met Tyr
        115                 120                 125

His Leu Arg Asn Arg Leu Leu Thr Asp Pro Ser Lys Ala Asp Val Arg
    130                 135                 140

Glu Ile Tyr Phe Ala Ile His His Ile Leu Lys Ser Arg Gly His Phe
145                 150                 155                 160

Leu Thr Ser Gly Tyr Ala Lys Asp Phe Asn Thr Asn Lys Val Ala Leu
                165                 170                 175

Asn Glu Ile Phe Pro Ala Leu Gln Asp Ala Tyr Ala Gln Val Tyr Pro
            180                 185                 190

Asp Leu Asp Ile Thr Phe Asp Glu Asn Lys Val Asn Glu Phe Lys Thr
        195                 200                 205

Val Leu Leu Asp Glu Lys Ala Thr Pro Ser Asp Thr Gln Arg Ala Leu
    210                 215                 220
```

```
Val Asn Leu Leu Leu Ala Glu Asp Gly Asp Lys Asp Ile Leu Lys Gln
225                 230                 235                 240

Gln Lys Gln Val Leu Thr Glu Phe Ala Lys Ala Val Val Gly Leu Lys
                245                 250                 255

Met Lys Leu Asn Val Ala Leu Gly Thr Glu Val Asp Ser Ser Glu Ala
            260                 265                 270

Thr Ala Trp Asn Phe Ser Leu Gly Gln Leu Asp Asp Lys Trp Ala Gly
        275                 280                 285

Ile Glu Ser Ala Met Thr Asp Glu Gly Thr Glu Ile Leu Asp Gln Ile
    290                 295                 300

Arg Asp Leu Tyr Arg Ala Arg Leu Leu Asn Gly Ile Val Pro Ala Gly
305                 310                 315                 320

Lys Thr Leu Ser Gln Ala Lys Val Asp Asp Tyr Glu Gln His His Glu
                325                 330                 335

Asp Leu Glu Leu Phe Lys Asp Tyr Leu Lys Gln Leu Glu Asp Asp Gly
            340                 345                 350

Met Ala Lys Val Ile Arg Gln Leu Tyr Asp Arg Tyr Ile Asp Gly Asp
        355                 360                 365

Asp Ala Lys Pro Phe Val Arg Glu Asp Phe Val Lys Ala Leu Thr Lys
    370                 375                 380

Glu Val Thr Ala His Pro Asn Ala Lys Ser Pro Glu Leu Leu Glu Arg
385                 390                 395                 400

Leu Val Gln Pro Asp Phe Met Leu Lys Gln Arg Asn Lys Ala Asn Gly
                405                 410                 415
```

```
Ala Ile Pro Val Gln Met Gln Gln Arg Glu Leu Asp Gln Ile Ile Lys
            420                 425                 430

Asn Gln Ser Val Tyr Tyr Asp Trp Leu Ala Ala Pro Asn Pro Val Glu
        435                 440                 445

Lys His Arg Gln Ser Met Pro Tyr Gln Leu Asp Glu Leu Leu Asn Phe
    450                 455                 460

Arg Ile Pro Tyr Tyr Val Gly Pro Leu Val Thr Ala Lys Glu Gln Lys
465                 470                 475                 480

Ala Ala Gln Gly Gly Val Phe Ala Trp Met Val Arg Lys Asp Pro Asp
                485                 490                 495

Gly Asn Ile Thr Pro Tyr Asn Phe Asp Glu Lys Val Asp Arg Glu Ala
            500                 505                 510

Ser Ala Asn Thr Phe Ile Gln Arg Met Lys Thr Thr Asp Thr Tyr Leu
        515                 520                 525

Ile Gly Glu Asp Val Leu Pro Lys Gln Ser Leu Leu Tyr Gln Ser Tyr
    530                 535                 540

Glu Val Leu Asn Glu Leu Asn Asn Val Arg Val Asn Asp Asn Lys Leu
545                 550                 555                 560

Ser Phe Asp Gln Lys Gln Gln Val Leu Gly Glu Leu Phe Glu Arg His
                565                 570                 575

Asn Thr Val Thr Ile Lys Gln Phe Val Asp Asn Leu Leu Ala His Gly
            580                 585                 590

Asp Tyr Asp Arg Ile Pro Glu Val Arg Gly Leu Ala Asp Glu Lys Arg
        595                 600                 605

Phe Leu Ser Ser Leu Ser Thr Tyr Asn Gln Leu Lys Gly Ile Leu His
    610                 615                 620
```

```
Glu Ala Ile Asp Asp Ser Asp Lys Gln Thr Asp Ile Glu Lys Ile Ile
625                 630                 635                 640

Ala Trp Ser Thr Ile Phe Glu Asp Lys Ala Ile Phe Lys Thr Lys Leu
                645                 650                 655

Asn Glu Ile Ser Trp Leu Thr Ala Gly Met Ile Asn Ser Leu Ala Asn
            660                 665                 670

Ile Arg Tyr Arg Gly Trp Gly Gln Phe Ser His Lys Leu Leu Asn Glu
        675                 680                 685

Leu Thr Leu Ser Thr Gly Arg Thr Val Phe Glu Glu Leu Leu Ile Ser
    690                 695                 700

Ser His Asn Leu Met Gln Ile Leu Thr Asp Glu Val Leu Lys Gln Lys
705                 710                 715                 720

Ile Ala Glu Leu Asn Ala His Glu Leu Lys Ala Ser Gly Ile Tyr Ala
                725                 730                 735

Ala Ile Asp Asp Ala Tyr Thr Ser Pro Ser Asn Lys Lys Ala Leu Arg
            740                 745                 750

Gln Val Leu Ser Val Ile Asp Asp Ile Thr Asn Ala Ala Gly Gln Ala
        755                 760                 765

Pro Asn Trp Leu Tyr Ile Glu Thr Ala Asp Gly Asp Gly Val Pro Gly
    770                 775                 780

Lys Arg Thr Asn Ser Arg Gln Arg Lys Ile Gln Glu Ile Tyr Ala Asn
785                 790                 795                 800

Ala Ala Gln Glu Leu Ile Thr Gly Ser Val Arg Gly Glu Leu Glu Asp
                805                 810                 815
```

```
Lys Ile Ala Ser Arg Ala Asp Phe Thr Asp Arg Leu Val Leu Tyr Phe
            820                 825                 830

Met Gln Gly Gly Arg Asp Ile Tyr Thr Gly Glu Pro Leu Asn Ile Asp
        835                 840                 845

Asn Leu Ser Ser Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Leu Ile
    850                 855                 860

Lys Asp Asn Ser Leu Asp Asn Arg Val Leu Val His Pro Leu Val Asn
865                 870                 875                 880

Arg Glu Lys Asp Thr Ile Phe Ala Ser Thr Arg Phe Ala Lys Gln Met
                885                 890                 895

Asn Gly Met Trp Arg Gln Trp His Ala Ala Gly Leu Ile Ser Ser Arg
            900                 905                 910

Lys Leu Arg Asn Leu Gln Met Arg Pro Asp Glu Ile Asp Lys Tyr Ala
        915                 920                 925

Ser Gly Phe Val Ala Arg Gln Leu Val Glu Thr Arg Gln Ile Ile Lys
    930                 935                 940

Leu Thr Glu Gln Ile Val Ala Asp Gln Tyr Pro Asp Ala Lys Ile Ile
945                 950                 955                 960

Ala Val Lys Ala Gly Leu Ser Ser Gln Leu Arg Lys Glu Leu Asp Phe
                965                 970                 975

Pro Lys Asn Arg Glu Val Asn His Tyr His His Ala Phe Asp Ala Phe
            980                 985                 990

Leu Ala Ala Arg Ile Gly Thr Tyr  Leu Leu Lys Arg Tyr  Pro Asn Leu
        995                 1000                1005

Glu Pro  Phe Phe Thr Tyr Gly  Lys Phe Lys Lys Thr  Glu Val Lys
    1010                1015                1020
```

```
Lys Leu  Lys Ser Leu Lys Ser  Phe Asn Phe Ile Arg  Asp Met Thr
    1025                1030                1035

His Ala  Lys Asp Lys Ile Val  Ala Lys Glu Thr Gly  Glu Ile Val
    1040                1045                1050

Trp Asp  Asn Ala Ser Asp Ile  Asn Glu Leu Asp Arg  Ile Tyr Asn
    1055                1060                1065

Phe Lys  Arg Met Leu Ile Thr  His Glu Val Arg Phe  Glu Thr Ala
    1070                1075                1080

Ser Leu  Phe Lys Gln Thr Leu  Tyr Ala Ala Lys Asn  Ser Lys Asn
    1085                1090                1095

Arg Gly  Gly Ser Arg Gln Leu  Ile Pro Lys Lys Lys  Gly Tyr Leu
    1100                1105                1110

Val Asp  Ile Tyr Gly Gly Tyr  Thr Gln Glu Thr Gly  Ser Tyr Leu
    1115                1120                1125

Ser Val  Val Arg Leu Thr Lys  Lys Ala Met Tyr Ala  Val Val Lys
    1130                1135                1140

Val Ser  Thr Arg Asp Ala Ala  Lys Leu Ala Val Ala  Lys Ser Ile
    1145                1150                1155

Ser Glu  Gln Lys Glu Asn Glu  Thr Leu Lys Lys Ile  Ile Asp Gly
    1160                1165                1170

Lys Leu  Ser Lys Thr Ser Lys  Lys Gly Lys Thr Thr  His Gln Leu
    1175                1180                1185

Phe Glu  Ile Val Leu Pro Arg  Val Gly Gln Lys Thr  Leu Phe Lys
    1190                1195                1200
```

```
Asn Ser  Lys Tyr Asn Gln Phe  Leu Val Asn Ser Asp  Thr Tyr Met
    1205                1210                1215

His Asn  Tyr Gln Glu Leu Trp  Met Pro Arg Glu Tyr  Gln Arg Met
    1220                1225                1230

Trp Lys  Asp Ile Leu Leu Ser  Asn His Gly Asp Ala  Gln Leu Glu
    1235                1240                1245

Gly Gln  Leu Asp Gln Ile Phe  Lys Phe Ile Val Ser  Gln Val Asn
    1250                1255                1260

Ser Tyr  Phe Asn Leu Tyr Asp  Ile Asn Gln Phe Arg  Lys Lys Ile
    1265                1270                1275

Ala Asp  Ala Thr Asp Lys Phe  Ala Lys Leu Pro Thr  His Asp Thr
    1280                1285                1290

Asp Asn  Ala Arg Gly Lys Ile  Ala Thr Ile Gly Gln  Leu Leu Ile
    1295                1300                1305

Gly Leu  Gln Ala Asn Ala Met  Arg Ser Asp Leu Arg  Asn Leu Asp
    1310                1315                1320

Ile Lys  Thr Pro Phe Gly Leu  Leu Gln Ile Gly Thr  Gly Ile Thr
    1325                1330                1335

Leu Asp  Leu Asp Thr Ser Ile  Ile Tyr Gln Ser Pro  Thr Gly Leu
    1340                1345                1350

Phe Glu  Arg Glu Val Pro Leu  Thr Asp Leu
    1355                1360
```

<210> 474
<211> 1360
<212> PRT
<213> Lactobacillus casei

<400> 474

```
Met Thr Lys Leu Gly Lys Pro Tyr Gly Ile Gly Val Asp Ile Gly Ser
1               5                  10                  15

Asn Ser Ile Gly Phe Ala Ala Val Asp Glu Asn Ser His Leu Ile Arg
            20                  25                  30

Leu Lys Gly Lys Thr Val Ile Gly Ala Arg Leu Phe Glu Glu Gly Lys
        35                  40                  45

Ala Ala Ala Asp Arg Arg Ala Ser Arg Thr Thr Arg Arg Arg Leu Ser
    50                  55                  60

Arg Asn Arg Trp Arg Leu Ser Phe Leu Arg Asp Phe Phe Glu Ser His
65                  70                  75                  80

Ile Thr Pro Thr Asp Pro Asn Phe Phe Met Arg Gln Lys Tyr Ser Glu
                85                  90                  95

Ile Ser Pro Lys Asp Lys Ala Arg Tyr Lys Tyr Glu Lys Arg Leu Phe
            100                 105                 110

Asn Asp Arg Thr Asp Ala Glu Phe Tyr Gln Gln Tyr Pro Thr Met Tyr
        115                 120                 125

His Leu Arg Thr Arg Leu Leu Thr Asp Pro Ser Lys Ala Asp Val Arg
    130                 135                 140

Glu Ile Tyr Phe Ala Ile His His Ile Leu Lys Ser Arg Gly His Phe
145                 150                 155                 160

Leu Thr Pro Gly Tyr Ala Lys Asp Phe Asn Thr Asn Lys Val Ala Leu
                165                 170                 175

Asn Glu Ile Phe Pro Ala Leu Gln Asp Ala Tyr Ala Gln Val Tyr Pro
            180                 185                 190

Asp Leu Asp Ile Thr Phe Asp Glu Asn Lys Val Asn Glu Phe Lys Thr
```

```
        195                 200                 205

Val Leu Leu Asn Glu Lys Ala Thr Pro Ser Asp Thr Gln Arg Ala Leu
    210                 215                 220

Val Asn Leu Leu Leu Ala Glu Asp Gly Asp Lys Asp Ile Leu Lys Gln
225                 230                 235                 240

Gln Lys Gln Val Leu Thr Glu Phe Ala Lys Ala Val Val Gly Leu Lys
                245                 250                 255

Thr Lys Leu Asn Val Ala Leu Gly Thr Glu Val Asp Ser Ser Glu Ala
            260                 265                 270

Thr Val Trp Asn Phe Ser Leu Gly Gln Leu Asp Asp Lys Trp Ala Gly
        275                 280                 285

Ile Glu Ser Ala Met Thr Asp Glu Gly Thr Glu Ile Leu Asp Gln Ile
    290                 295                 300

Arg Asp Leu Tyr Arg Ala Arg Leu Leu Asn Gly Ile Val Pro Ala Gly
305                 310                 315                 320

Lys Thr Leu Ser Gln Ala Lys Val Asp Asp Tyr Ala Gln His His Glu
                325                 330                 335

Asp Leu Glu Leu Phe Lys Asp Tyr Leu Lys Gln Leu Glu Asp Asp Gly
            340                 345                 350

Thr Ala Lys Ala Ile Arg Gln Leu Tyr Asp Arg Tyr Ile Asp Gly Asp
        355                 360                 365

Asp Ala Lys Pro Phe Val Arg Glu Asp Phe Val Lys Ala Leu Thr Lys
    370                 375                 380

Glu Val Thr Ala His Pro Asn Ala Lys Ser Pro Glu Leu Leu Glu Arg
385                 390                 395                 400
```

```
Leu Ala Gln Pro Asp Phe Met Leu Lys Gln Arg Asn Lys Ala Asn Gly
                405                 410                 415

Ala Ile Pro Val Gln Met Gln Gln Arg Glu Leu Asp Gln Ile Ile Lys
            420                 425                 430

Asn Gln Ser Val Tyr Tyr Asp Trp Leu Ala Ala Pro Asn Pro Val Glu
        435                 440                 445

Lys His Arg Lys Ser Met Pro Tyr Gln Leu Asp Glu Leu Leu Asn Phe
    450                 455                 460

Arg Ile Pro Tyr Tyr Val Gly Pro Leu Val Thr Ala Lys Glu Gln Lys
465                 470                 475                 480

Ala Ala Gln Gly Gly Val Phe Ala Trp Met Val Arg Lys Asp Pro Asp
                485                 490                 495

Gly Asn Ile Thr Pro Tyr Asn Phe Asp Glu Lys Val Asp Arg Glu Ala
            500                 505                 510

Ser Ala Asn Thr Phe Ile Gln Arg Met Lys Thr Thr Asp Thr Tyr Leu
        515                 520                 525

Ile Gly Glu Asp Val Leu Pro Lys Gln Ser Leu Leu Tyr Gln Ser Tyr
    530                 535                 540

Glu Val Leu Asn Glu Leu Asn Asn Val Arg Val Asn Asp Asn Lys Leu
545                 550                 555                 560

Ser Phe Asp Gln Lys Gln Gln Val Leu Gly Glu Leu Phe Glu Arg His
                565                 570                 575

Asn Thr Val Thr Ile Lys Gln Phe Val Asp Asn Leu Leu Ala His Gly
            580                 585                 590

Asp Tyr Asp Arg Ile Pro Glu Val Arg Gly Leu Ala Asp Glu Lys Arg
```

```
        595                 600                 605

Phe Leu Ser Ser Leu Ser Thr Tyr Asn Gln Leu Lys Gly Ile Leu His
    610                 615                 620

Glu Ala Ile Asp Asp Ala Asp Lys Gln Thr Asp Ile Glu Asn Ile Ile
625                 630                 635                 640

Ala Trp Ser Thr Ile Phe Glu Asp Lys Ala Ile Phe Lys Thr Lys Leu
                645                 650                 655

Asn Glu Ile Ser Trp Leu Asn Ala Gly Met Ile Asn Ser Leu Ala Asn
            660                 665                 670

Ile Arg Tyr Arg Gly Trp Gly Gln Phe Ser His Lys Leu Leu Asn Glu
        675                 680                 685

Leu Thr Leu Ser Thr Gly Arg Thr Val Phe Glu Glu Leu Leu Ile Ser
    690                 695                 700

Ser Arg Asn Leu Met Gln Ile Leu Thr Asp Glu Val Leu Lys Gln Lys
705                 710                 715                 720

Ile Ala Glu Leu Asn Ala His Glu Leu Lys Ala Ser Gly Ile Tyr Ala
                725                 730                 735

Ala Ile Asp Asp Ala Tyr Thr Ser Pro Ser Asn Lys Lys Ala Leu Arg
            740                 745                 750

Gln Val Leu Ser Val Ile Asp Asp Ile Thr Asn Ala Ala Gly Gln Ala
        755                 760                 765

Pro Asn Trp Leu Tyr Ile Glu Thr Ala Asp Gly Asp Gly Val Pro Gly
    770                 775                 780

Lys Arg Thr Asn Ser Arg Gln Arg Lys Ile Gln Glu Ile Tyr Ala Asn
785                 790                 795                 800
```

```
Ala Ala Gln Glu Leu Ile Thr Gly Ser Val Arg Gly Glu Leu Glu Asp
               805                 810                 815

Lys Ile Ala Ser Arg Ala Asp Phe Thr Asp Arg Leu Val Leu Tyr Phe
            820                 825                 830

Met Gln Gly Gly Arg Asp Ile Tyr Thr Gly Glu Pro Leu Asn Ile Asp
        835                 840                 845

Asn Leu Ser Ser Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Leu Ile
    850                 855                 860

Lys Asp Asn Ser Leu Asp Asn Arg Val Leu Val His Pro Leu Val Asn
865                 870                 875                 880

Arg Glu Lys Asp Thr Ile Phe Ala Ser Thr Arg Phe Ala Lys Gln Met
               885                 890                 895

Asn Gly Met Trp Arg Gln Trp His Ala Ala Gly Leu Ile Ser Ser Arg
            900                 905                 910

Lys Leu Arg Asn Leu Gln Met Arg Pro Asp Glu Ile Asp Lys Tyr Ala
        915                 920                 925

Ser Gly Phe Val Ala Arg Gln Leu Val Glu Thr Arg Gln Ile Ile Lys
    930                 935                 940

Leu Thr Glu Gln Ile Val Ala Asp Gln Tyr Pro Asp Thr Lys Ile Ile
945                 950                 955                 960

Ala Val Lys Ala Gly Leu Ser Ser Gln Leu Arg Lys Glu Leu Asp Phe
               965                 970                 975

Pro Lys Asn Arg Glu Val Asn His Tyr His His Ala Phe Asp Ala Phe
            980                 985                 990

Leu Ala Ala Arg Ile Gly Thr Tyr  Leu Leu Lys Arg Tyr  Pro Asn Leu
```

995 1000 1005

Glu Pro Phe Phe Thr Tyr Gly Lys Phe Lys Lys Thr Glu Val Lys
1010 1015 1020

Lys Leu Lys Ser Phe Asn Phe Ile Arg Asp Met Thr His Ala Lys
1025 1030 1035

Asp Lys Ile Val Ala Lys Glu Thr Gly Glu Ile Val Trp Asp Asn
1040 1045 1050

Ala Ser Asp Ile Asn Glu Leu Asp Arg Ile Tyr Asn Phe Lys Arg
1055 1060 1065

Met Leu Ile Thr His Glu Val Arg Phe Glu Thr Ala Ser Leu Phe
1070 1075 1080

Lys Gln Thr Leu Tyr Ala Ala Lys Asn Ser Lys Asn Arg Gly Gly
1085 1090 1095

Ser Arg Gln Leu Ile Pro Lys Lys Lys Gly Tyr Leu Val Asp Ile
1100 1105 1110

Tyr Gly Gly Tyr Thr Gln Glu Thr Gly Ser Tyr Leu Ser Val Val
1115 1120 1125

Arg Leu Thr Lys Lys Ala Met Tyr Ala Val Val Lys Val Ser Thr
1130 1135 1140

Arg Asp Ala Ala Lys Leu Ala Val Ala Lys Ser Ile Ser Glu Gln
1145 1150 1155

Lys Glu Asn Glu Thr Leu Lys Lys Ile Ile Asp Gly Lys Leu Ser
1160 1165 1170

Lys Thr Ser Lys Lys Gly Lys Thr Thr His Gln Leu Phe Glu Ile
1175 1180 1185

```
Val Leu  Pro Arg Val Gly Gln  Lys Thr Leu Phe Lys  Asn Ser Lys
    1190                1195                1200

Tyr Asn  Gln Phe Leu Val Asn  Ser Asp Thr Tyr Met  His Asn Tyr
    1205                1210                1215

Gln Glu  Leu Trp Met Pro Arg  Glu Tyr Gln Arg Met  Trp Lys Asp
    1220                1225                1230

Ile Leu  Leu Ser Asn His Gly  Asp Ala Gln Leu Glu  Gly Gln Leu
    1235                1240                1245

Asp Gln  Ile Phe Lys Phe Ile  Val Ser Gln Val Asn  Ser Tyr Phe
    1250                1255                1260

Asn Leu  Tyr Asp Ile Asn Gln  Phe Arg Lys Lys Ile  Ala Asp Ala
    1265                1270                1275

Thr Asp  Lys Phe Ala Lys Leu  Pro Thr His Asp Thr  Asp Asn Ala
    1280                1285                1290

Arg Gly  Lys Ile Ala Thr Ile  Gly Gln Leu Leu Ile  Gly Leu Gln
    1295                1300                1305

Ala Asn  Ala Met Arg Ser Asp  Leu Arg Asn Leu Asp  Ile Lys Thr
    1310                1315                1320

Pro Phe  Gly Leu Leu Gln Ile  Gly Thr Gly Ile Thr  Leu Asp Leu
    1325                1330                1335

Asp Thr  Ser Ile Ile Tyr Gln  Ser Pro Thr Gly Leu  Phe Glu Arg
    1340                1345                1350

Glu Val  Pro Leu Thr Asp Leu
    1355                1360
```

<210> 475

<211> 700
<212> PRT
<213> Lactobacillus casei

<400> 475

```
Met Thr Lys Leu Gly Lys Pro Tyr Gly Ile Gly Val Asp Ile Gly Ser
1               5                   10                  15


Asn Ser Ile Gly Phe Ala Ala Val Asp Glu Asn Ser His Leu Ile Arg
            20                  25                  30


Leu Lys Gly Lys Thr Val Ile Gly Ala Arg Leu Phe Glu Glu Gly Lys
        35                  40                  45


Ala Ala Ala Asp Arg Arg Ala Ser Arg Thr Thr Arg Arg Arg Leu Ser
    50                  55                  60


Arg Asn Arg Trp Arg Leu Ser Phe Leu Arg Asp Phe Phe Glu Ser His
65                  70                  75                  80


Ile Thr Pro Thr Asp Pro Asn Phe Phe Met Arg Gln Lys Tyr Ser Glu
                85                  90                  95


Ile Ser Pro Lys Asp Lys Ala Arg Tyr Lys Tyr Glu Lys Arg Leu Phe
            100                 105                 110


Asn Asp Arg Thr Asp Ala Glu Phe Tyr Gln Gln Tyr Pro Thr Met Tyr
        115                 120                 125


His Leu Arg Thr Arg Leu Leu Thr Asp Pro Ser Lys Ala Asp Val Arg
    130                 135                 140


Glu Ile Tyr Phe Ala Ile His His Ile Leu Lys Ser Arg Gly His Phe
145                 150                 155                 160


Leu Thr Ser Gly Tyr Ala Lys Asp Phe Asn Thr Asn Lys Val Ala Leu
                165                 170                 175
```

```
Asn Glu Ile Phe Pro Ala Leu Gln Asp Ala Tyr Ala Gln Val Tyr Pro
            180                 185                 190

Asp Leu Asp Ile Thr Phe Asp Glu Asn Lys Val Asn Glu Phe Lys Thr
        195                 200                 205

Val Leu Leu Asp Glu Lys Ala Thr Pro Ser Asp Thr Gln Arg Ala Leu
    210                 215                 220

Val Asn Leu Leu Leu Ala Glu Asp Gly Asp Lys Asp Ile Leu Lys Gln
225                 230                 235                 240

Gln Lys Gln Val Leu Thr Glu Phe Ala Lys Ala Val Val Gly Leu Lys
                245                 250                 255

Thr Lys Leu Asn Val Ala Leu Gly Thr Glu Val Asp Ser Ser Glu Ala
            260                 265                 270

Thr Ala Trp Asn Phe Ser Leu Gly Gln Leu Asp Asp Lys Trp Ala Gly
        275                 280                 285

Ile Glu Ser Ala Met Thr Asp Glu Gly Thr Glu Ile Leu Asp Gln Ile
    290                 295                 300

Arg Asp Leu Tyr Arg Ala Arg Leu Leu Asn Gly Ile Val Pro Ala Gly
305                 310                 315                 320

Lys Thr Leu Ser Gln Ala Lys Val Asp Asp Tyr Glu Gln His His Glu
                325                 330                 335

Asp Leu Glu Leu Phe Lys Asp Tyr Leu Lys Gln Leu Glu Asp Asp Gly
            340                 345                 350

Met Ala Lys Ala Ile Arg Gln Leu Tyr Asp Arg Tyr Ile Asp Gly Asp
        355                 360                 365

Asp Ala Lys Pro Phe Val Arg Glu Asp Phe Val Lys Ala Leu Thr Lys
    370                 375                 380
```

```
Glu Val Thr Ala His Pro Asn Ala Lys Ser Pro Glu Leu Leu Glu Arg
385                 390                 395                 400

Leu Val Gln Pro Asp Phe Met Leu Lys Gln Arg Asn Lys Ala Asn Gly
                405                 410                 415

Ala Ile Pro Val Gln Met Gln Gln Arg Glu Leu Asp Gln Ile Ile Lys
            420                 425                 430

Asn Gln Ser Val Tyr Tyr Asp Trp Leu Ala Ala Pro Asn Pro Val Glu
        435                 440                 445

Lys His Arg Gln Ser Met Pro Tyr Gln Leu Asp Glu Leu Leu Asn Phe
    450                 455                 460

Arg Ile Pro Tyr Tyr Val Gly Pro Leu Val Thr Ala Lys Glu Gln Lys
465                 470                 475                 480

Ala Ala Gln Gly Gly Val Phe Ala Trp Met Val Arg Lys Asp Pro Asp
                485                 490                 495

Gly Asn Ile Thr Pro Tyr Asn Phe Asp Glu Lys Val Asp Arg Glu Ala
            500                 505                 510

Ser Ala Asn Thr Phe Ile Gln Arg Met Lys Thr Thr Asp Thr Tyr Leu
        515                 520                 525

Ile Gly Glu Asp Val Leu Pro Lys Gln Ser Leu Leu Tyr Gln Ser Tyr
    530                 535                 540

Glu Val Leu Asn Glu Leu Asn Asn Val Arg Val Asn Asp Asn Lys Leu
545                 550                 555                 560

Ser Phe Asp Gln Lys Gln Gln Val Leu Gly Glu Leu Phe Glu Arg His
                565                 570                 575
```

```
Asn Thr Val Thr Ile Lys Gln Phe Val Asp Asn Leu Leu Ala His Gly
            580                 585                 590

Asp Tyr Asp Arg Ile Pro Glu Val Arg Gly Leu Ala Asp Glu Lys Arg
        595                 600                 605

Phe Leu Ser Ser Leu Ser Thr Tyr Asn Gln Leu Lys Gly Ile Leu His
    610                 615                 620

Glu Ala Ile Asp Asp Ser Asp Lys Gln Thr Asp Ile Glu Lys Ile Ile
625                 630                 635                 640

Ala Trp Ser Thr Ile Phe Glu Asp Lys Ala Ile Phe Lys Thr Lys Leu
                645                 650                 655

Asn Glu Ile Ser Trp Leu Asn Ala Gly Met Ile Asn Ser Leu Ala Asn
            660                 665                 670

Ile Arg Tyr Arg Gly Trp Gly Gln Phe Ser His Lys Leu Leu Asn Glu
        675                 680                 685

Leu Thr Leu Ser Thr Gly Arg Thr Val Phe Glu Ala
    690                 695                 700
```

<210> 476
<211> 330
<212> PRT
<213> Lactobacillus casei

<400> 476

```
Met Thr Lys Leu Gly Lys Pro Tyr Gly Ile Gly Val Asp Ile Gly Ser
1               5                   10                  15

Asn Ser Ile Gly Phe Ala Ala Val Asp Glu Asn Ser His Leu Ile Arg
            20                  25                  30

Leu Lys Gly Lys Thr Val Ile Gly Ala Arg Leu Phe Glu Glu Gly Lys
        35                  40                  45
```

```
Ala Ala Ala Asp Arg Arg Ala Ser Arg Thr Thr Arg Arg Arg Leu Ser
    50                  55                  60

Arg Asn Arg Trp Arg Leu Ser Phe Leu Arg Asp Phe Phe Glu Ser His
65                  70                  75                  80

Ile Thr Pro Thr Asp Pro Asn Phe Phe Met Arg Gln Lys Tyr Ser Glu
                85                  90                  95

Ile Ser Pro Lys Asp Lys Asn Arg Tyr Lys Tyr Glu Lys Arg Leu Phe
            100                 105                 110

Asn Asp Arg Thr Asp Ala Glu Phe Tyr Gln Gln Tyr Pro Thr Met Tyr
        115                 120                 125

His Leu Arg Asn Arg Leu Leu Thr Asp Pro Ser Lys Ala Asp Val Arg
    130                 135                 140

Glu Ile Tyr Phe Ala Ile His His Ile Leu Lys Ser Arg Gly His Phe
145                 150                 155                 160

Leu Thr Pro Gly Asp Ala Lys Asp Phe Asn Thr Asn Lys Val Ala Leu
                165                 170                 175

Asn Glu Ile Phe Pro Ala Leu Gln Asp Ala Tyr Ala Gln Val Tyr Pro
            180                 185                 190

Asp Leu Asp Ile Thr Phe Asp Glu Asn Lys Met Asn Glu Phe Lys Thr
        195                 200                 205

Val Leu Leu Asn Glu Lys Ala Thr Pro Ser Asp Thr Gln Arg Ala Leu
    210                 215                 220

Val Asn Leu Leu Leu Ala Glu Asp Gly Asp Lys Asp Ile Leu Lys Gln
225                 230                 235                 240

Gln Lys Gln Val Leu Thr Glu Phe Ala Lys Ala Val Val Gly Leu Lys
```

245 250 255

Thr Lys Leu Asn Val Ala Leu Gly Thr Glu Val Asp Ser Ser Glu Ala
260 265 270

Thr Ala Trp Asn Phe Ser Leu Gly Gln Leu Asp Asp Lys Trp Ala Gly
275 280 285

Ile Glu Ser Ala Met Thr Asp Glu Gly Thr Glu Ile Leu Asp Gln Ile
290 295 300

Arg Asp Leu Tyr Arg Ala Arg Leu Leu Asn Gly Ile Val Pro Ala Gly
305 310 315 320

Lys Thr Leu Ser Gln Ala Lys Val Asp Asp
325 330

<210> 477
<211> 330
<212> PRT
<213> Lactobacillus casei

<400> 477

Met Thr Lys Leu Gly Lys Pro Tyr Gly Ile Gly Val Asp Ile Gly Ser
1 5 10 15

Asn Ser Ile Gly Phe Ala Ala Val Asp Glu Asn Ser His Leu Ile Arg
20 25 30

Leu Lys Gly Lys Thr Val Ile Gly Ala Arg Leu Phe Glu Glu Gly Lys
35 40 45

Ala Ala Ala Asp Arg Arg Ala Ser Arg Thr Thr Arg Arg Arg Leu Ser
50 55 60

Arg Asn Arg Trp Arg Leu Ser Phe Leu Arg Asp Phe Phe Glu Ser His
65 70 75 80

```
Ile Thr Pro Thr Asp Pro Asn Phe Phe Met Arg Gln Lys Tyr Ser Glu
                85                  90                  95

Ile Ser Pro Lys Asp Lys Asn Arg Tyr Lys Tyr Glu Lys Arg Leu Phe
            100                 105                 110

Asn Asp Arg Thr Asp Ala Glu Phe Tyr Gln Gln Tyr Pro Thr Met Tyr
        115                 120                 125

His Leu Arg Asn Arg Leu Leu Thr Asp Pro Ser Lys Ala Asp Val Arg
    130                 135                 140

Glu Ile Tyr Phe Ala Ile His His Ile Leu Lys Ser Arg Gly His Phe
145                 150                 155                 160

Leu Thr Pro Gly Asp Ala Lys Asp Phe Asn Thr Asn Lys Val Ala Leu
                165                 170                 175

Asn Glu Ile Phe Pro Ala Leu Gln Asp Ala Tyr Ala Gln Val Tyr Pro
            180                 185                 190

Asp Leu Asp Ile Thr Phe Asp Glu Asn Lys Met Asn Glu Phe Lys Thr
        195                 200                 205

Val Leu Leu Asn Glu Lys Ala Thr Pro Ser Asp Thr Gln Arg Ala Leu
    210                 215                 220

Val Asn Leu Leu Leu Ala Glu Asp Gly Asp Lys Asp Ile Leu Lys Gln
225                 230                 235                 240

Gln Lys Gln Val Leu Thr Glu Phe Ala Lys Ala Val Val Gly Leu Lys
                245                 250                 255

Thr Lys Leu Asn Val Ala Leu Gly Thr Glu Val Asp Ser Ser Glu Ala
            260                 265                 270

Thr Ala Trp Asn Phe Ser Leu Gly Gln Leu Asp Asp Lys Trp Ala Gly
        275                 280                 285
```

```
Ile Glu Ser Ala Met Thr Asp Glu Gly Thr Glu Ile Leu Asp Gln Ile
    290                 295                 300

Arg Asp Leu Tyr Arg Ala Arg Leu Leu Asn Gly Ile Val Pro Ala Gly
305                 310                 315                 320

Lys Thr Leu Ser His Ala Lys Val Asp Asp
                325                 330
```

<210> 478
<211> 1361
<212> PRT
<213> Lactobacillus casei

<400> 478

```
Met Thr Lys Leu Gly Lys Pro Tyr Gly Ile Gly Val Asp Ile Gly Ser
1               5                   10                  15

Asn Ser Ile Gly Phe Ala Ala Val Asp Glu Asn Ser His Leu Ile Arg
            20                  25                  30

Leu Lys Gly Lys Thr Val Ile Gly Ala Arg Leu Phe Glu Glu Gly Lys
        35                  40                  45

Ala Ala Ala Asp Arg Arg Ala Ser Arg Thr Thr Arg Arg Arg Leu Ser
    50                  55                  60

Arg Asn Arg Trp Arg Leu Ser Phe Leu Arg Asp Phe Phe Glu Ser His
65                  70                  75                  80

Ile Thr Pro Thr Gly Pro Asn Phe Phe Met Arg Gln Lys Tyr Ser Glu
                85                  90                  95

Ile Ser Pro Lys Asp Lys Ala Arg Tyr Lys Tyr Glu Lys Arg Leu Phe
            100                 105                 110

Asn Asp Arg Thr Asp Ala Glu Phe Tyr Gln Gln Tyr Pro Thr Met Tyr
```

```
        115                 120                 125

His Leu Arg Asn Arg Leu Leu Thr Asp Pro Ser Lys Ala Asp Val Arg
    130                 135                 140

Glu Ile Tyr Phe Ala Ile His His Ile Leu Lys Ser Arg Gly His Phe
145                 150                 155                 160

Leu Thr Ser Gly Tyr Ala Lys Asp Phe Asn Thr Asn Lys Val Ala Leu
                165                 170                 175

Asn Glu Ile Phe Pro Ala Leu Gln Asp Ala Tyr Ala Gln Val Tyr Pro
            180                 185                 190

Asp Leu Asp Ile Thr Phe Asp Glu Asn Lys Val Asn Glu Phe Lys Thr
        195                 200                 205

Val Leu Leu Asn Glu Lys Ala Thr Pro Ser Asp Thr Gln Arg Ala Leu
    210                 215                 220

Val Asn Leu Leu Leu Ala Glu Asp Gly Asp Lys Asp Ile Leu Lys Gln
225                 230                 235                 240

Gln Lys Gln Val Leu Thr Glu Phe Ala Lys Ala Val Val Gly Leu Lys
                245                 250                 255

Thr Lys Leu Asn Val Ala Leu Gly Thr Glu Val Asp Ser Ser Glu Ala
            260                 265                 270

Thr Val Trp Asn Phe Ser Leu Gly Gln Leu Asp Asp Lys Trp Ala Gly
        275                 280                 285

Ile Glu Ser Ala Met Thr Asp Glu Gly Thr Glu Ile Leu Asp Gln Ile
    290                 295                 300

Arg Asp Leu Tyr Arg Ala Arg Leu Leu Asn Gly Ile Val Pro Ala Gly
305                 310                 315                 320
```

```
Asn Thr Leu Ser Gln Ala Lys Val Asp Asp Tyr Ala Gln His His Glu
                325                 330                 335

Asp Leu Glu Leu Phe Lys Asp Tyr Leu Lys Gln Leu Glu Asp Asp Gly
            340                 345                 350

Thr Ala Lys Ala Ile Arg Gln Leu Tyr Asp Arg Tyr Ile Asp Gly Asp
        355                 360                 365

Asp Ala Lys Pro Phe Val Arg Glu Asp Phe Val Lys Ala Leu Thr Lys
    370                 375                 380

Glu Val Thr Ala His Pro Asn Ala Lys Ser Pro Glu Leu Leu Glu Arg
385                 390                 395                 400

Leu Ala Gln Pro Asp Phe Met Leu Lys Gln Arg Asn Lys Ala Asn Gly
                405                 410                 415

Ala Ile Pro Val Gln Met Gln Gln Arg Glu Leu Asp Gln Ile Ile Lys
            420                 425                 430

Asn Gln Ser Val Tyr Tyr Asp Trp Leu Ala Ala Pro Asn Pro Val Glu
        435                 440                 445

Lys His Arg Lys Ser Met Pro Tyr Gln Leu Asp Glu Leu Leu Asn Phe
    450                 455                 460

Arg Ile Pro Tyr Tyr Val Gly Pro Leu Val Thr Ala Lys Glu Gln Lys
465                 470                 475                 480

Ala Ala Gln Gly Gly Val Phe Ala Trp Met Val Arg Lys Asp Pro Asp
                485                 490                 495

Gly Asn Ile Thr Pro Tyr Asn Phe Asp Glu Lys Val Asp Arg Glu Ala
            500                 505                 510

Ser Ala Asn Thr Phe Ile Gln Arg Met Lys Thr Thr Asp Thr Tyr Leu
```

```
        515                 520                 525

Ile Gly Glu Asp Val Leu Pro Lys Gln Ser Leu Leu Tyr Gln Arg Tyr
    530                 535                 540

Glu Val Leu Asn Glu Leu Asn Asn Val Arg Val Asn Asn Glu Lys Leu
545                 550                 555                 560

Ser Ile Glu Gln Lys Gln Gln Val Ile Arg Glu Leu Phe Glu Arg His
                565                 570                 575

Asn Ser Val Thr Ile Lys Gln Phe Ala Glu Asn Leu Arg Ala His Gly
            580                 585                 590

Asp Tyr Ala His Ile Pro Glu Ile Arg Gly Leu Ala Asp Glu Lys Arg
        595                 600                 605

Phe Leu Ser Ser Leu Ser Thr Tyr Arg Gln Leu Lys Ser Leu Leu Pro
    610                 615                 620

Asp Ala Ile Asp Asp Pro Ala Lys Gln Ala Asp Ile Glu Asn Ile Ile
625                 630                 635                 640

Ala Trp Ser Thr Val Phe Glu Asp Ala Ala Ile Phe Lys Thr Lys Leu
                645                 650                 655

Lys Glu Ile Asn Trp Leu Asp Ser Gln Thr Ile Thr Lys Leu Ser Asn
            660                 665                 670

Ile Arg Tyr Arg Gly Trp Gly Gln Phe Ser His Lys Phe Leu Asn Gly
        675                 680                 685

Leu Thr Leu Gly Asn Gly His Thr Ile Ile Gln Glu Leu Phe Leu Ser
    690                 695                 700

Asn Asn Asn Leu Met Gln Ile Leu Thr Asp Glu Thr Leu Gln Lys Lys
705                 710                 715                 720
```

```
Met Thr Glu Leu Asn Ala Asp Lys Leu Lys Ala Ala Asn Ile Asn Asp
                725                 730                 735

Ala Ile Asp Asp Ala Tyr Thr Ser Pro Ser Asn Lys Lys Ala Leu Arg
            740                 745                 750

Gln Val Leu Arg Val Ile Glu Asp Ile Lys Arg Ala Ala Asp Gly Gln
        755                 760                 765

Asp Pro Ser Trp Leu Tyr Val Glu Thr Ala Asp Gly Gly Gly Thr Pro
    770                 775                 780

Gly Lys Arg Thr Arg Ala Arg Gln His Gln Leu Gln Glu Ile Tyr Ala
785                 790                 795                 800

Asn Ala Ala His Glu Leu Ile Asp Ser Ala Val Arg Gly Glu Leu Glu
                805                 810                 815

Asp Lys Ile Ala Asp Lys Ala Asp Phe Asn Asp Arg Leu Val Leu Tyr
            820                 825                 830

Phe Met Gln Gly Gly Arg Asp Ile Tyr Thr Gly Thr Pro Leu Asn Ile
        835                 840                 845

Asp Gln Leu Ser Ser Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Leu
    850                 855                 860

Ile Lys Asp Asn Ser Leu Asp Asn Arg Val Leu Val His Ala Ile Ile
865                 870                 875                 880

Asn Arg Glu Lys Asn Ala Thr Phe Ala Ser Thr Ile Tyr Ala Gln Lys
                885                 890                 895

Met Asn Ala Thr Trp Arg Gln Trp His Glu Ala Gly Leu Ile Ser Gly
            900                 905                 910

Arg Lys Leu Arg Asn Leu Gln Met Arg Pro Asp Gln Ile Asp Lys Tyr
```

```
        915                 920                 925

Ala Ser Gly Phe Val Ala Arg Gln Leu Val Glu Thr Arg Gln Ile Ile
    930                 935                 940

Lys Leu Thr Glu Gln Ile Val Ala Ala Gln Tyr Pro Glu Thr Lys Ile
945                 950                 955                 960

Ile Ala Val Lys Ala Gly Leu Ser His Gln Leu Arg Glu Glu Leu Glu
                965                 970                 975

Phe Pro Lys Asn Arg Asp Val Asn His Tyr His His Ala Phe Asp Ala
            980                 985                 990

Phe Leu Ala Ala Arg Ile Gly Thr  Tyr Leu Leu Lys Arg  Phe Pro Asn
        995                 1000                1005

Leu Gln  Ala Phe Phe Thr Tyr  Gly Lys Phe Lys Lys  Ala Asp Val
    1010                1015                1020

Lys Lys  Leu Arg Gly Phe Asn  Phe Ile Arg Asp Ile  Thr His Ala
    1025                1030                1035

Glu Asp  Lys Ile Val Val Lys  Asp Thr Gly Glu Val  Ile Trp Asp
    1040                1045                1050

Lys Lys  Arg Asp Val Asp Glu  Leu Asp Arg Ile Tyr  Asn Phe Lys
    1055                1060                1065

Arg Met  Leu Ile Thr His Glu  Val His Phe Glu Lys  Ala Asp Leu
    1070                1075                1080

Phe Lys  Gln Thr Val Tyr Gly  Ala Lys Asp Ser Lys  Glu Ala Gly
    1085                1090                1095

Gly Lys  Lys Gln Leu Ile Ser  Lys Lys Lys Gly Tyr  Pro Val Asp
    1100                1105                1110
```

```
Ile Tyr  Gly Gly Tyr Thr Gln  Glu Thr Gly Ser Tyr  Leu Ser Val
    1115                1120                1125

Val Arg  Leu Thr Lys Lys Ala  Met Tyr Ala Val Val  Lys Val Ser
    1130                1135                1140

Thr Arg  Asp Ala Ala Lys Leu  Ala Val Ala Lys Ser  Ile Ser Glu
    1145                1150                1155

Gln Lys  Glu Asn Glu Thr Leu  Asn Asp Ile Ile Asp  Glu Lys Leu
    1160                1165                1170

Ser Lys  Ile Ser Lys Asn Gly  Lys Ile Thr His Glu  Leu Phe Glu
    1175                1180                1185

Val Val  Leu Pro Arg Val Gly  Gln Lys Thr Leu Phe  Lys Asn Ser
    1190                1195                1200

Lys Tyr  Asn Leu Phe Leu Val  Asn Ser Asp Thr Tyr  Met His Asn
    1205                1210                1215

Tyr Gln  Glu Leu Trp Met Pro  Arg Glu Tyr Gln Lys  Met Trp Lys
    1220                1225                1230

Asp Ile  Ser Leu Ser Lys Tyr  Gly Asp Ala Gln Thr  Glu Asp Gln
    1235                1240                1245

Leu Asp  Gln Ile Phe Gly Phe  Ile Val Ser Gln Val  Asn Ser Tyr
    1250                1255                1260

Phe Asn  Leu Tyr Asp Ile Asn  Gln Phe Arg Lys Lys  Leu Asn Asp
    1265                1270                1275

Ala Ala  Asp Lys Phe Ala Thr  Leu Pro Met Arg Asp  Thr Asp Asp
    1280                1285                1290

Met Gln  Gly Lys Ile Ala Thr  Ile Gly Gln Leu Leu  Ile Gly Leu
```

```
    1295                1300                1305

Gln Ala  Asn Ala Ala Arg Ser  Asp Leu Arg Asn Leu  Asp Ile Lys
    1310                1315                1320

Thr Pro  Leu Gly Leu Leu Gln  Ile Pro Asn Gly Ile  Ser Leu Asp
    1325                1330                1335

Ser Asp  Thr Ser Val Val Tyr  Gln Ser Pro Thr Gly  Leu Leu Glu
    1340                1345                1350

Arg Glu  Val His Leu Ser Asp  Leu
    1355                1360
```

<210> 479
<211> 1128
<212> PRT
<213> Lactobacillus casei

<400> 479

```
Met Thr Lys Leu Gly Lys Pro Tyr Gly Ile Gly Val Asp Ile Gly Ser
1               5                   10                  15

Asn Ser Ile Gly Phe Ala Ala Val Asp Glu Asn Ser His Leu Ile Arg
            20                  25                  30

Leu Lys Gly Lys Thr Val Ile Gly Ala Arg Leu Phe Glu Glu Gly Lys
        35                  40                  45

Ala Ala Ala Lys Arg Arg Ala Gly Arg Thr Thr Arg Arg Arg Leu Ser
    50                  55                  60

Arg Asn Arg Trp Arg Leu Ser Phe Leu Arg Asp Phe Phe Glu Ser His
65                  70                  75                  80

Ile Thr Pro Thr Asp Pro Asn Phe Phe Met Arg Gln Lys Tyr Ser Glu
                85                  90                  95
```

```
Ile Ser Pro Lys Asp Lys Ala Arg Tyr Lys Tyr Glu Lys Arg Leu Phe
            100                 105                 110

Asn Asp Arg Thr Asp Ala Glu Phe Tyr Gln Gln Tyr Ser Thr Met Tyr
        115                 120                 125

His Leu Arg Asn Arg Leu Met Thr Asp Pro Ser Arg Ala Asp Val Arg
    130                 135                 140

Glu Ile Tyr Phe Ala Ile His His Ile Leu Lys Ser Arg Gly His Phe
145                 150                 155                 160

Leu Thr Pro Gly Asp Ala Lys Asp Phe Asn Thr Asn Asp Val Ala Leu
                165                 170                 175

Asp Glu Ile Phe Pro Ala Leu Gln Asp Ala Tyr Ala Gln Val Tyr Pro
            180                 185                 190

Asp Leu Gly Ile Thr Phe Asp Glu Asp Lys Ala Asn Glu Phe Lys Thr
        195                 200                 205

Ile Leu Leu Asn Glu Ile Ala Thr Ser Ile Asp Thr Gln Arg Ala Leu
    210                 215                 220

Val Lys Leu Leu Leu Ala Glu Glu Asp Asp Lys Asp Ile Leu Lys Gln
225                 230                 235                 240

Gln Lys Gln Val Leu Thr Glu Phe Ala Lys Ala Val Val Gly Leu Lys
                245                 250                 255

Thr Lys Leu Asn Leu Ala Leu Gly Thr Glu Val Asp Ser Ser Glu Ala
            260                 265                 270

Thr Ala Trp Asn Phe Ser Leu Gly Gln Leu Asp Asp Lys Trp Ala Gly
        275                 280                 285

Ile Glu Ser Ala Met Thr Asp Glu Gly Thr Glu Ile Leu Asp Gln Ile
    290                 295                 300
```

```
Arg Asp Leu Tyr Arg Ala Arg Leu Leu Asn Gly Ile Val Pro Thr Gly
305                 310                 315                 320

Lys Thr Leu Ser Gln Ala Lys Val Asp Asp Tyr Thr Gln His His Glu
                325                 330                 335

Asp Leu Gln Leu Phe Lys Ala Tyr Leu Lys Gln Leu Glu Asp Asp Gly
            340                 345                 350

Thr Ala Lys Ala Ile Arg Gln Leu Tyr Asp Arg Tyr Ile Asp Gly Asp
        355                 360                 365

Asp Ala Ala Pro Phe Leu Arg Glu Asn Phe Val Lys Ala Leu Thr Lys
    370                 375                 380

Asp Val Thr Ala His Pro Asn Thr Lys Ser Pro Glu Leu Leu Glu Arg
385                 390                 395                 400

Leu Ala Gln Pro Asp Phe Met Leu Lys Gln Arg Asn Lys Ala Asn Gly
                405                 410                 415

Ala Ile Pro Val Gln Met Gln Gln Arg Glu Leu Asp Gln Ile Ile Lys
            420                 425                 430

Asn Gln Ala Val Tyr Tyr Asp Trp Leu Ala Ala Pro Asn Pro Val Glu
        435                 440                 445

Lys His Arg Lys Ser Met Pro Tyr Gln Leu Asp Glu Leu Leu Asn Phe
    450                 455                 460

Arg Ile Pro Tyr Tyr Val Gly Pro Leu Val Thr Ala Lys Glu Gln Lys
465                 470                 475                 480

Ala Ala Gln Gly Gly Val Phe Ala Trp Met Val Arg Lys Asp Pro Glu
                485                 490                 495
```

```
Gly Asn Ile Thr Pro Tyr Asn Phe Asp Glu Lys Val Asp Arg Glu Ala
            500                 505                 510

Ser Ala Asn Thr Phe Ile Gln Arg Met Lys Thr Thr Asp Thr Tyr Leu
        515                 520                 525

Ile Gly Glu Asp Val Leu Pro Lys Gln Ser Leu Leu Tyr Gln Arg Tyr
    530                 535                 540

Glu Val Leu Asn Glu Leu Asn Asn Val Arg Val Asn Asn Glu Lys Leu
545                 550                 555                 560

Ser Ile Glu Gln Lys Gln Gln Val Ile Arg Glu Leu Phe Glu Arg His
                565                 570                 575

Asn Ser Val Thr Ile Lys Gln Phe Ala Glu Asn Leu Arg Ala His Gly
            580                 585                 590

Asp Tyr Ala His Ile Pro Glu Ile Arg Gly Leu Ala Asp Glu Lys Arg
        595                 600                 605

Phe Leu Ser Ser Leu Ser Thr Tyr Arg Gln Leu Lys Ser Leu Leu Pro
    610                 615                 620

Glu Ala Ile Asp Asp Pro Ala Lys Gln Ala Asp Ile Glu Asn Ile Ile
625                 630                 635                 640

Ala Trp Ser Thr Val Phe Glu Asp Ala Ala Ile Phe Lys Thr Lys Leu
                645                 650                 655

Lys Glu Ile Ser Trp Leu Gly Ser Glu Ala Ile Thr Lys Leu Ser Asn
            660                 665                 670

Ile Arg Tyr Arg Gly Trp Gly Gln Phe Ser Arg Lys Phe Leu Asn Gly
        675                 680                 685

Leu Thr Leu Gly Asn Gly His Thr Ile Ile Gln Glu Leu Leu Leu Ser
    690                 695                 700
```

```
Thr Asn Asn Leu Met Gln Ile Leu Thr Asp Glu Thr Leu Gln Lys Lys
705                 710                 715                 720

Met Thr Glu Leu Asn Ala Asp Lys Leu Lys Thr Ala Asn Ile Asn Asp
                725                 730                 735

Ala Ile Asp Asn Ala Tyr Thr Ser Pro Ser Asn Lys Lys Ala Leu Arg
            740                 745                 750

Gln Val Leu Arg Val Val Asp Asp Ile Lys Arg Ala Ala Asp Gly Gln
        755                 760                 765

Asp Pro Ser Trp Leu Tyr Val Glu Thr Ala Asp Gly Gly Gly Thr Pro
    770                 775                 780

Gly Lys Arg Thr Arg Ala Arg Gln His Gln Leu Gln Glu Ile Tyr Ala
785                 790                 795                 800

Asn Ala Ala His Glu Leu Ile Asp Thr Ala Val Arg Gly Glu Leu Glu
                805                 810                 815

Asp Lys Ile Ser Asp Lys Ala Asp Phe Asn Asp Arg Leu Val Leu Tyr
            820                 825                 830

Phe Met Gln Gly Gly Arg Asp Ile Tyr Thr Gly Ala Pro Leu Asn Ile
        835                 840                 845

Asp Gln Leu Ser Ser Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Leu
    850                 855                 860

Ile Lys Asp Asn Ser Leu Asp Asn Arg Val Leu Val His Ala Ile Ile
865                 870                 875                 880

Asn Arg Glu Lys Asn Ala Thr Phe Ala Ser Thr Ile Tyr Ala Gln Lys
                885                 890                 895
```

```
Met Asn Ala Thr Trp Arg Gln Trp His Glu Ala Gly Leu Ile Ser Gly
            900                 905                 910

Arg Lys Leu Arg Asn Leu Gln Met Arg Pro Asp Gln Ile Asp Lys Tyr
        915                 920                 925

Ala Ser Gly Phe Val Ala Arg Gln Leu Val Glu Thr Arg Gln Ile Ile
    930                 935                 940

Lys Leu Thr Glu Gln Ile Val Ala Ala Gln Tyr Pro Asp Thr Lys Ile
945                 950                 955                 960

Ile Ala Val Lys Ala Gly Leu Ser His Gln Leu Arg Glu Glu Leu Glu
                965                 970                 975

Phe Pro Lys Asn Arg Asp Val Asn His Tyr His His Ala Phe Asp Ala
            980                 985                 990

Phe Leu Ala Ala Arg Ile Gly Thr  Tyr Leu Leu Lys Arg  Phe Pro Asn
        995                 1000                1005

Leu Gln  Ala Phe Phe Thr Tyr  Gly Lys Phe Thr Lys  Ala Asp Val
    1010                1015                1020

Lys Lys  Leu Arg Gly Phe Asn  Phe Ile Arg Asp Ile  Thr His Ala
    1025                1030                1035

Glu Asp  Lys Ile Val Ala Lys  Asp Thr Gly Glu Val  Val Trp Asp
    1040                1045                1050

Lys Gln  Arg Asp Val Asp Glu  Leu Asp Arg Ile Tyr  Asn Phe Lys
    1055                1060                1065

Arg Met  Leu Ile Thr His Glu  Val Arg Phe Glu Thr  Ala Asp Leu
    1070                1075                1080

Phe Lys  Gln Thr Val Tyr Gly  Ala Arg Asp Ser Lys  Glu Ala Gly
    1085                1090                1095
```

Gly Ser Lys Gln Leu Ile Pro Lys Lys Lys Asp Ile Gln Leu Ile
    1100   1105   1110

Phe Met Gly Ala Ile Ser Glu Arg Thr Arg Pro Ile Leu Pro Leu
    1115   1120   1125

<210> 480
<211> 1366
<212> PRT
<213> Lactobacillus casei

<400> 480

Met Thr Lys Leu Gly Lys Pro Tyr Gly Ile Gly Val Asp Ile Gly Ser
1   5   10   15

Asn Ser Ile Gly Phe Ala Ala Val Asp Glu Asn Ser His Leu Ile Arg
            20   25   30

Leu Lys Gly Lys Thr Val Ile Gly Ala Arg Leu Phe Glu Glu Gly Lys
        35   40   45

Ala Ala Ala Tyr Arg Arg Ala Ser Arg Thr Thr Arg Arg Arg Leu Ser
    50   55   60

Arg Asn Arg Trp Arg Leu Ser Phe Leu Arg Asp Phe Phe Glu Ser His
65   70   75   80

Ile Thr Pro Thr Asp Pro Asn Phe Phe Met Arg Gln Lys Tyr Ser Glu
                85   90   95

Ile Ser Pro Lys Asp Lys Ala Arg Tyr Lys Tyr Glu Lys Arg Leu Phe
            100   105   110

Asn Asp Arg Thr Asp Ala Glu Phe Tyr Gln Gln Tyr Pro Thr Met Tyr
        115   120   125

His Leu Arg Thr Arg Leu Leu Thr Asp Pro Ser Lys Ala Asp Val Arg

```
    130                 135                 140

Glu Ile Tyr Phe Ala Ile His His Ile Leu Lys Ser Arg Gly His Phe
145                 150                 155                 160

Leu Thr Pro Gly Tyr Ala Lys Asp Phe Asn Thr Asn Lys Val Ala Leu
                165                 170                 175

Asn Glu Ile Phe Pro Ala Leu Gln Asp Ala Tyr Ala Gln Val Tyr Pro
            180                 185                 190

Asp Leu Asp Ile Thr Phe Asp Glu Asn Lys Val Asn Glu Phe Lys Thr
        195                 200                 205

Val Leu Leu Asn Glu Lys Ala Thr Pro Ser Asp Thr Gln Arg Ala Leu
    210                 215                 220

Val Asn Leu Leu Leu Ala Lys Glu Gly Asp Arg Asp Ile Leu Lys Gln
225                 230                 235                 240

Gln Lys Gln Val Leu Thr Glu Phe Ala Lys Ala Val Val Gly Leu Lys
                245                 250                 255

Thr Lys Leu Asn Val Ala Leu Gly Thr Glu Val Asp Ser Ser Glu Ala
            260                 265                 270

Thr Ala Trp Asn Phe Ser Leu Gly Gln Leu Asp Asp Lys Trp Ala Gly
        275                 280                 285

Ile Glu Ser Ala Met Thr Asp Glu Gly Thr Glu Ile Leu Asp Gln Ile
    290                 295                 300

Arg Asp Leu Tyr Arg Ala Arg Leu Leu Asn Gly Ile Val Pro Ala Gly
305                 310                 315                 320

Lys Thr Leu Ser Gln Ala Lys Val Asp Asp Tyr Ala Gln His His Glu
                325                 330                 335
```

```
Asp Leu Glu Leu Phe Lys Asp Tyr Leu Lys Gln Leu Glu Asp Asp Gly
            340                 345                 350

Thr Ala Lys Ala Ile Arg Gln Leu Tyr Asp Arg Tyr Ile Asp Gly Asp
        355                 360                 365

Asp Ala Lys Pro Phe Val Arg Glu Asp Phe Val Lys Ala Leu Thr Lys
    370                 375                 380

Glu Val Thr Ala His Pro Asn Ala Lys Ser Pro Glu Leu Leu Glu Arg
385                 390                 395                 400

Leu Ala Gln Pro Asp Phe Met Leu Lys Gln Arg Asn Lys Ala Asn Gly
                405                 410                 415

Ala Ile Pro Val Gln Met Gln Gln Arg Glu Leu Asp Gln Ile Ile Lys
            420                 425                 430

Asn Gln Ala Val Tyr Tyr Asp Trp Leu Ala Ala Pro Asn Pro Val Glu
        435                 440                 445

Lys His Arg Gln Ser Met Thr Tyr Gln Leu Asp Glu Leu Leu Asn Phe
    450                 455                 460

Arg Ile Pro Tyr Tyr Val Gly Pro Leu Val Thr Ala Lys Glu Gln Lys
465                 470                 475                 480

Ala Ala Gln Gly Gly Val Phe Ala Trp Met Val Arg Lys Asp Pro Asp
                485                 490                 495

Gly Asn Ile Thr Pro Tyr Asn Phe Asp Glu Lys Val Asp Arg Glu Ala
            500                 505                 510

Ser Ala Asn Thr Phe Ile Gln Arg Met Lys Thr Thr Asp Thr Tyr Leu
        515                 520                 525

Ile Gly Glu Asp Val Leu Pro Lys Gln Ser Leu Leu Tyr Gln Ser Tyr
```

```
    530                 535                 540

Glu Val Leu Asn Glu Leu Asn Asn Val Arg Val Asn Asp Asn Lys Leu
545                 550                 555                 560

Ser Phe Asp Gln Lys Gln Gln Val Leu Gly Glu Leu Phe Glu Arg His
                565                 570                 575

Asn Thr Val Thr Ile Lys Gln Phe Val Asp Asn Leu Leu Ala His Gly
            580                 585                 590

Asp Tyr Asp Arg Ile Pro Glu Val Arg Gly Leu Ala Asp Glu Lys Arg
        595                 600                 605

Phe Leu Ser Ser Leu Ser Thr Tyr Asn Gln Leu Lys Gly Ile Leu His
    610                 615                 620

Glu Ala Ile Asp Asp Ala Asp Lys Gln Thr Asp Ile Glu Asn Ile Ile
625                 630                 635                 640

Ala Trp Ser Thr Ile Phe Glu Asp Lys Ala Ile Phe Lys Thr Lys Leu
                645                 650                 655

Asn Glu Ile Ser Trp Leu Asn Ala Gly Met Ile Asn Ser Leu Ala Asn
            660                 665                 670

Ile Arg Tyr Arg Gly Trp Gly Gln Phe Ser His Lys Leu Leu Asn Glu
        675                 680                 685

Leu Thr Leu Ser Thr Gly Arg Thr Val Phe Glu Glu Leu Leu Ile Ser
    690                 695                 700

Ser Arg Asn Leu Met Gln Ile Leu Thr Asp Glu Val Leu Lys Gln Lys
705                 710                 715                 720

Ile Ala Glu Leu Asn Ala His Glu Leu Lys Ala Ser Gly Ile Tyr Ala
                725                 730                 735
```

```
Ala Ile Asp Asp Ala Tyr Thr Ser Pro Ser Asn Lys Lys Ala Leu Arg
            740                 745                 750

Gln Val Leu Ser Val Ile Asp Asp Ile Thr Asn Ala Ala Gly Gln Ala
        755                 760                 765

Pro Asn Trp Leu Tyr Ile Glu Thr Ala Asp Gly Asp Gly Val Pro Gly
    770                 775                 780

Lys Arg Thr Asn Ser Arg Gln Arg Lys Ile Gln Glu Ile Tyr Ala Asn
785                 790                 795                 800

Ala Ala Gln Glu Leu Ile Thr Gly Ser Val Arg Gly Glu Phe Glu Asp
                805                 810                 815

Lys Ile Ala Ser Arg Ala Asp Phe Thr Asp Arg Leu Val Leu Tyr Phe
            820                 825                 830

Met Gln Gly Gly Arg Asp Ile Tyr Thr Gly Glu Pro Leu Asn Ile Asp
        835                 840                 845

Asn Leu Ser Ser Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Leu Ile
    850                 855                 860

Lys Asp Asn Ser Leu Asp Asn Arg Val Leu Val His Pro Leu Val Asn
865                 870                 875                 880

Arg Glu Lys Asp Thr Ile Phe Ala Ser Thr Arg Phe Ala Lys Gln Met
                885                 890                 895

Asn Gly Met Trp Arg Gln Trp His Ala Ala Gly Leu Ile Ser Ser Arg
            900                 905                 910

Lys Leu Arg Asn Leu Gln Met Arg Pro Asp Glu Ile Asp Lys Tyr Ala
        915                 920                 925

Ser Gly Phe Val Ala Arg Gln Leu Val Glu Thr Arg Gln Ile Ile Lys
```

```
    930                 935                 940

Leu Thr Glu Gln Ile Val Ala Asp Gln Tyr Pro Asp Thr Lys Ile Ile
945                 950                 955                 960

Ala Val Lys Ala Gly Leu Ser Ser Gln Leu Arg Lys Glu Leu Asp Phe
                965                 970                 975

Pro Lys Asn Arg Glu Val Asn His Tyr His His Ala Phe Asp Ala Phe
            980                 985                 990

Leu Ala Ala Arg Ile Gly Thr Tyr  Leu Leu Lys Arg Tyr  Pro Asn Leu
        995                 1000                1005

Glu Pro  Phe Phe Thr Tyr Gly  Lys Phe Lys Lys Thr  Glu Val Lys
    1010                1015                1020

Lys Leu  Lys Ser Leu Lys Ser  Leu Lys Ser Phe Asn  Phe Ile Arg
    1025                1030                1035

Asp Met  Thr His Ala Lys Asp  Lys Ile Val Ala Lys  Glu Thr Gly
    1040                1045                1050

Glu Ile  Val Trp Asp Asn Ala  Ser Asp Ile Asn Glu  Leu Asp Arg
    1055                1060                1065

Ile Tyr  Asn Phe Lys Arg Met  Leu Ile Thr His Glu  Val Arg Phe
    1070                1075                1080

Glu Thr  Ala Ser Leu Phe Lys  Gln Thr Leu Tyr Ala  Ala Lys Asn
    1085                1090                1095

Ser Lys  Asn Arg Gly Gly Ser  Arg Gln Leu Ile Pro  Lys Lys Lys
    1100                1105                1110

Gly Tyr  Leu Val Asp Ile Tyr  Gly Gly Tyr Thr Gln  Glu Thr Gly
    1115                1120                1125
```

```
Ser Tyr  Leu Ser Val Val Arg  Leu Thr Lys Lys Ala  Met Tyr Ala
    1130                1135                1140

Val Val  Lys Val Ser Thr Arg  Asp Ala Ala Lys Leu  Ala Val Ala
    1145                1150                1155

Lys Ser  Ile Ser Glu Gln Lys  Glu Asn Glu Thr Leu  Lys Lys Ile
    1160                1165                1170

Ile Asp  Gly Lys Leu Ser Lys  Thr Ser Lys Lys Gly  Lys Thr Thr
    1175                1180                1185

His Gln  Leu Phe Glu Ile Val  Leu Pro Arg Val Gly  Gln Lys Thr
    1190                1195                1200

Leu Phe  Lys Asn Ser Lys Tyr  Asn Gln Phe Leu Val  Asn Ser Asp
    1205                1210                1215

Thr Tyr  Met His Asn Tyr Gln  Glu Leu Trp Met Pro  Arg Glu Tyr
    1220                1225                1230

Gln Arg  Met Trp Lys Asp Ile  Leu Leu Ser Asn His  Gly Asp Ala
    1235                1240                1245

Gln Ile  Glu Gly Gln Leu Asp  Gln Ile Phe Lys Phe  Ile Val Ser
    1250                1255                1260

Gln Val  Asn Ser Tyr Phe Asn  Leu Tyr Asp Ile Asn  Gln Phe Arg
    1265                1270                1275

Lys Lys  Ile Ala Asp Ala Thr  Asp Lys Phe Ala Lys  Leu Pro Thr
    1280                1285                1290

His Asp  Thr Asp Asn Ala Arg  Gly Lys Ile Ala Thr  Ile Gly Gln
    1295                1300                1305

Leu Leu  Ile Gly Leu Gln Ala  Asn Ala Met Arg Ser  Asp Leu Arg
```

1310 1315 1320

Asn Leu Asp Ile Lys Thr Pro Phe Gly Leu Leu Gln Ile Gly Thr
1325 1330 1335

Gly Ile Thr Leu Asp Leu Asp Thr Ser Ile Ile Tyr Gln Ser Pro
1340 1345 1350

Thr Gly Leu Phe Glu Arg Glu Val Pro Leu Thr Asp Leu
1355 1360 1365

<210> 481
<211> 1354
<212> PRT
<213> Lactobacillus coryniformis

<400> 481

Met Thr Leu His Tyr Asn Val Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Tyr Thr Ile Val Asp Asp Asn Gly Lys Ile Leu Gln Val Lys Gly
20 25 30

Lys Asn Gly Tyr Gly Val Arg Val Phe Lys Glu Gly Ala Thr Ala Ala
35 40 45

Glu Arg Arg Ile Phe Arg Thr Thr His Arg Arg Leu Lys Arg Arg Lys
50 55 60

Trp Arg Leu Arg Leu Leu Gln Asp Phe Phe Glu Pro Tyr Ile Leu Pro
65 70 75 80

Gln Asp Asp Gly Phe Phe Ile Arg Arg Lys Glu Ser Asn Leu Val Leu
85 90 95

Asn Asp Arg Asp Glu Asp Thr Ala Ser Leu Phe Asn Asp Arg Ser Asp
100 105 110

```
Arg Asp Phe Tyr Gln Ala Tyr Pro Thr Ile Tyr His Leu Arg Gln Ala
        115                 120                 125

Leu Met Thr Glu Lys Arg Gln Phe Asp Val Arg Glu Ile Tyr Leu Ala
    130                 135                 140

Met His His Ile Ile Lys Tyr Arg Gly His Phe Leu Leu Asn Gly Thr
145                 150                 155                 160

Val Asn Asn Phe Thr Asn Asn Lys Ile Asp Leu His Ser Asp Phe Glu
                165                 170                 175

Glu Leu Asn Ala Leu Leu Leu Asn Val Ile Pro Glu Leu Lys Phe Gln
            180                 185                 190

Ile Asp Leu Asp His Ser Thr Met Phe Gln Thr Thr Leu Leu Asn Thr
        195                 200                 205

Thr Ile Ser Arg Ser Gly Arg Gln Arg Asp Leu Val Lys Ser Phe Tyr
    210                 215                 220

Asn Gly Ser Asp Asp Lys Gln Leu Ala Lys Gln Gln Lys Ser Val Ala
225                 230                 235                 240

Thr Glu Leu Leu Lys Ala Ile Leu Gly Leu Lys Ala Lys Phe His Lys
                245                 250                 255

Leu Phe Asn Leu Asp Leu Leu Glu Thr Thr Glu Trp Glu Phe Ser Phe
            260                 265                 270

Asp Ala Glu Asp Ile Asp Asp Lys Leu Ala Lys Leu Glu Pro Leu Met
        275                 280                 285

Thr Glu Asn Gln Gln Gln Val Met Asp Ile Leu Gln Arg Ile Phe Ala
    290                 295                 300

Ala Ile Thr Leu Asn Gly Ile Val Pro Glu Gly Lys Thr Leu Ser Ala
305                 310                 315                 320
```

```
Ser Lys Val Asp Ser Tyr Gln Lys His Lys Gln Asp Leu Lys Leu Leu
                325                 330                 335

Lys Ala Ile Ala Gln His Ser Asp Lys Lys Thr Ala Thr Val Leu Gln
            340                 345                 350

Thr Ala Tyr Asn Glu Tyr Ile Asn Gly Ile Ala Ser Lys Pro Leu Lys
        355                 360                 365

Gln Glu Asp Phe Tyr Lys Arg Leu Thr Asn Ala Val Lys Lys Ser Ser
    370                 375                 380

Asp Pro Gln Val Ala Asp Met Leu Ala Leu Ile Asp Gln Glu Lys Phe
385                 390                 395                 400

Leu Pro Lys Gln Arg Thr Lys Glu Asn Gly Ala Ile Pro His Gln Leu
                405                 410                 415

His Gln Leu Glu Leu Glu Arg Ile Ile Asp Asn Gln Lys Asp Tyr Tyr
            420                 425                 430

Pro Trp Leu Ala Glu Leu Asn Pro Asn Gln Ala Arg Gln Lys Val Ala
        435                 440                 445

Lys Tyr Lys Leu Ser Glu Leu Val Ala Phe Arg Val Pro Tyr Tyr Val
    450                 455                 460

Gly Pro Leu Ile Glu Pro Glu Val Gln Gln Ala Thr Ser Asn Ala His
465                 470                 475                 480

Phe Ala Trp Met Ala Arg Lys Glu Ala Gly Pro Ile Thr Pro Trp Asn
                485                 490                 495

Phe Asp Gln Lys Val Asp Arg Asn Val Ser Ala Glu Arg Phe Ile Lys
            500                 505                 510
```

```
Arg Met Thr Thr Lys Asp Thr Tyr Leu Leu Ala Glu Asp Val Leu Pro
        515                 520                 525

Leu His Ser Leu Leu Tyr Gln Arg Phe Ile Val Leu Asn Glu Leu Asn
    530                 535                 540

Asn Val Arg Val Asn Gly Gln Lys Leu Thr Lys Lys Gln Lys Gln Ala
545                 550                 555                 560

Val Tyr Gln Asp Leu Phe Lys Arg Gln Pro His Val Thr Lys Lys Gln
                565                 570                 575

Phe Lys Ser Tyr Leu Val Gln Thr Gly Glu Phe Ala Glu Ser Ser Lys
            580                 585                 590

Ile Glu Gly Leu Ala Asn Glu Thr Ser Phe Asn Ser Gly Leu Thr Thr
        595                 600                 605

Glu Asn Glu Leu Arg Lys Ile Phe Gly Ala Gln Leu Asp Glu Ala Arg
    610                 615                 620

Tyr Gln Val Asp Phe Glu Gln Ile Ile Glu Trp Ala Thr Leu Phe Glu
625                 630                 635                 640

Asp Ala Lys Ile Leu Arg Thr Lys Leu Ala Glu Ile Thr Trp Leu Thr
                645                 650                 655

Thr Glu Gln Ile Glu Lys Leu Ala Gly Ile Arg Tyr Arg Gly Trp Gly
            660                 665                 670

Arg Phe Ser Arg Lys Leu Leu Ala Gly Leu Arg Asp Gln Asn Gly Gln
        675                 680                 685

Gln Ile Ile Asp Leu Leu Trp Asp Thr Pro Asn Asn Phe Met Val Ile
    690                 695                 700

Val Ser Gln Ala Ala Phe Ser Glu Ala Ile Thr Lys Glu Asn Glu Lys
705                 710                 715                 720
```

```
Leu Ile Asp Arg Arg Gly Ala Gln Asp Val Ile Thr Asp Leu Tyr Thr
               725                 730                 735

Ser Pro Gln Asn Lys Lys Ala Leu Arg Gln Val Leu Ala Ile Val Ala
            740                 745                 750

Asp Val Gln Lys Ala Met Gly Gly Val Pro Pro Gln Arg Ile Phe Ile
        755                 760                 765

Glu Phe Ala Arg Glu Asp Glu Lys Asn Pro Arg Arg Ser Val Glu Arg
    770                 775                 780

Ser Arg Gln Leu Glu Lys Leu Tyr Gln Thr Ile Ser Asn Glu Phe Leu
785                 790                 795                 800

Ile Asn Ser Glu Val Arg Gln Glu Leu Lys Glu Ala Val Asp Gln Lys
                805                 810                 815

Val Asn Phe Lys Asp Arg Leu Phe Leu Tyr Phe Leu Gln Gly Gly Val
            820                 825                 830

Asp Leu Tyr Ser Gly Lys Arg Ile Asn Ile Asp Gln Leu Ser His Tyr
        835                 840                 845

Asp Ile Asp His Ile Leu Pro Gln Ser Phe Ile Lys Asp Asp Ser Leu
    850                 855                 860

Asp Asn Arg Val Leu Val Ser Gln Lys Leu Asn Arg Ser Lys Ser Asp
865                 870                 875                 880

Ser Val Pro Leu Ser Glu Phe Ala Asn Tyr Lys Phe Gly Pro Ala Met
                885                 890                 895

Gln Ala Lys Trp Leu Gln Leu Lys Glu Ala Gly Leu Leu Ser Lys Arg
            900                 905                 910
```

```
Lys Tyr Asp Asn Leu Thr Leu Asp Pro Thr Lys Leu Ser Lys Phe Ala
        915                 920                 925

Pro Leu Gly Phe Val Asn Arg Gln Leu Val Glu Thr Arg Gln Val Ile
    930                 935                 940

Lys Leu Ala Ala Asn Leu Leu Ala Ser Glu Glu Thr Lys Val Val Thr
945                 950                 955                 960

Ile Lys Ala Asn Met Thr His Gln Val Arg Lys Glu Leu Asp Phe Pro
                965                 970                 975

Lys Asn Arg Asn Val Asn Asn Tyr His His Ala Phe Asp Ala Tyr Leu
            980                 985                 990

Thr Ala Phe Val Gly Ile Phe Leu  Ser Lys Arg Tyr Pro  Lys Leu Lys
        995                 1000                1005

Pro Tyr  Phe Thr Tyr Gly Asp  Phe Gln Lys Gly Asn  Lys Leu Pro
    1010                1015                1020

Asp Leu  Lys Asn Phe Asn Phe  Leu Tyr Glu Leu Lys  Asn Lys Asp
    1025                1030                1035

Arg Ser  Ile Asp Ser Asn Thr  Gly Glu Ile Ile Trp  Asp Lys Gln
    1040                1045                1050

Arg Asp  Leu Ala Tyr Met Asn  Lys Ile Tyr Asn Phe  Lys Lys Val
    1055                1060                1065

Thr Val  Val His Glu Val Leu  Thr Lys Ser Gly Ala  Leu Tyr Asn
    1070                1075                1080

Gln Thr  Leu Tyr Lys Ala Ser  Glu Asp Lys Ala Ser  Gly Arg Gly
    1085                1090                1095

Thr Lys  Gln Leu Ile Arg Lys  Lys Asp Asn Met Pro  Thr Glu Leu
    1100                1105                1110
```

```
Tyr Gly  Gly Tyr Thr Gly Ser  Thr Ser Ala Phe Met  Ser Ile Val
    1115                1120                1125

Arg Leu  Trp Lys Lys Asp Lys  Pro Tyr Tyr Lys Val  Val Gly Ile
    1130                1135                1140

Pro Thr  Arg Met Ala Ala Lys  Leu Ala Asn Gln Ala  Gln Leu Leu
    1145                1150                1155

Asp Tyr  Leu Thr Lys Lys Phe  Thr Thr Arg Lys Leu  Val Lys Lys
    1160                1165                1170

Thr Gly  Asp Tyr Lys Thr Thr  Val Glu Arg Phe Glu  Leu Val Val
    1175                1180                1185

Pro Lys  Val Gly Phe Asn Gln  Leu Val Ile Asp Gly  Gly Gln Pro
    1190                1195                1200

Phe Met  Leu Gly Ser Ala Thr  Tyr Gln Tyr Asn Ala  Arg Glu Leu
    1205                1210                1215

Phe Ile  Ser Lys Glu Ala Val  Lys Ala Leu Asn Lys  Gln Leu Ser
    1220                1225                1230

Thr His  Val Asp Leu Val Gln  Val Phe Asp Glu Ile  Leu Val Gln
    1235                1240                1245

Val Asn  Arg Trp Phe Pro Leu  Tyr Asp Thr Asn Gly  Phe Arg Glu
    1250                1255                1260

Lys Leu  Ser His Gly Arg Asp  Arg Phe Met Lys Leu  Asn Asp Ser
    1265                1270                1275

Phe Glu  Glu Lys Ser Asp Thr  Gln Ile Asp Val Leu  Asn Arg Ile
    1280                1285                1290
```

```
Leu Ile  Gly Phe His Ala Asn  Ala Ala Arg Thr Asn  Leu Lys Ile
    1295                1300                1305


Leu Gly  Leu Gly Thr Asp Leu  Gly Phe Met Thr Gln  Gln Ala Gly
    1310                1315                1320


Ile Arg  Leu Thr Glu Lys Ala  Ile Leu Val His Gln  Ser Pro Ser
    1325                1330                1335


Gly Leu  Phe Glu Arg Lys Val  Ala Leu Arg Asp Leu  Lys Gly Leu
    1340                1345                1350


Arg
```

<210> 482
<211> 544
<212> PRT
<213> Lactobacillus crispatus

<400> 482

```
Lys Tyr Tyr Leu Tyr Phe Met Gln Leu Gly Arg Asp Ala Tyr Thr Gly
1               5                   10                  15


Lys Pro Ile Asn Ile Asp Glu Val Ser Gln Tyr Tyr Asp Ile Asp His
            20                  25                  30


Ile Leu Pro Gln Ser Phe Ile Lys Asp Asp Ser Leu Asn Asn Arg Val
        35                  40                  45


Leu Val Ala Lys Pro Ile Asn Asn Gly Lys Ser Asp Gly Val Pro Leu
    50                  55                  60


Lys Leu Phe Gly Asp Asn Leu Ala Thr Gly Leu Gly Ile Thr Val Lys
65                  70                  75                  80


Gln Met Trp Asn Asn Trp Ala Asp Lys Gly Leu Ile Asn Lys Ala Lys
                85                  90                  95
```

```
Gln Asn Asn Leu Phe Leu Asp Pro Glu Asn Ile Asn Lys His Gln Ala
            100                 105                 110

Ser Gly Phe Ile Arg Lys Gln Leu Val Glu Thr Ser Gln Ile Ile Lys
        115                 120                 125

Leu Ala Thr Thr Ile Leu Gln Ala Glu Tyr Pro Lys Thr Lys Ile Ile
    130                 135                 140

Val Val Lys Ala Ser Ser Asn His Tyr Leu Arg Asn Glu Phe Asp Leu
145                 150                 155                 160

Tyr Lys Ser Arg Glu Val Asn Asp Tyr His His Ala Ile Asp Ala Tyr
                165                 170                 175

Leu Thr Thr Ile Cys Gly Asn Leu Leu Tyr Gln Ala Tyr Pro Lys Leu
            180                 185                 190

Arg Pro Phe Phe Val Tyr Gly Gln Phe Lys Lys Phe Ser Ser Asp Pro
        195                 200                 205

Lys Lys Glu Asn Glu Ile Leu Lys Lys Thr Lys Asn Phe Asp Phe Val
    210                 215                 220

Ala Lys Leu Leu Gly Ser Lys Ala Pro Asn Glu Ile Arg Ser Gln Gln
225                 230                 235                 240

Gly Lys Val Leu Phe Glu Lys Asn Lys Ile Arg Leu Gln Leu Asn Lys
                245                 250                 255

Ala Tyr Asn Tyr Lys Tyr Met Leu Val Ser Arg Asp Thr Thr Thr Lys
            260                 265                 270

Asn Gln Glu Met Phe Gly Met Thr Ile Tyr Pro Arg Ala Glu Arg Asp
        275                 280                 285

Ile Ala Lys Ser Arg Lys Leu Ile Glu Lys Arg Lys Gly Phe Ser Thr
```

```
    290                 295                 300

Asp Ile Tyr Gly Gly Tyr Thr Gly Thr Ala Ala Ala Tyr Met Ala Ile
305                 310                 315                 320

Val Arg Ile Asn Lys Thr Lys Ser Ser Gln Tyr Lys Val Ile Ala Val
                325                 330                 335

Pro Met Thr Lys Arg Ala Ile Leu Asn Lys Ala Glu Lys Glu Gly Asn
            340                 345                 350

Tyr Glu Lys Ile Leu Lys Gln Ile Leu Ser Pro Ser Ile Leu Tyr Asn
        355                 360                 365

Asp Lys Gly Lys Arg Lys Ala Gly Val Ile Ser Phe Asp Ile Ile Lys
    370                 375                 380

Gly Lys Val Pro Tyr Asn Gln Val Val Gln Asp Gly Asn Lys Lys Phe
385                 390                 395                 400

Leu Leu Lys Ser Ala Ile Tyr Leu Cys Asn Ala Lys Gln Leu Val Leu
                405                 410                 415

Ser Glu Glu Ala Met Arg Val Ile Thr Gly His Trp Leu Asp Ser Asp
            420                 425                 430

Lys Gln Asp Gln Glu Leu Leu Asp Val Tyr Asp Glu Ile Leu Glu Lys
        435                 440                 445

Ile Asp Arg Tyr Leu Pro Leu Phe Asp Ile Arg Asp Phe Arg Asn Lys
    450                 455                 460

Leu His Lys Gly Arg Glu Lys Phe Leu Lys Leu Asn Ala Glu Asp Lys
465                 470                 475                 480

Phe Lys Ala Ile Ile Gln Ile Leu Lys Gly Leu His Asp Asn Ser Asp
                485                 490                 495
```

```
Thr Gly Glu Leu Lys Asp Ile Gly Ile Thr Val Pro Phe Gly Gln Leu
            500                 505                 510


Gln Asn Asn Ser Gly Ile Thr Leu Ser Ser Asp Thr Ile Leu Val Tyr
        515                 520                 525


Gln Ser Pro Thr Gly Leu Phe Glu Lys Arg Val Lys Ile Ser Ser Leu
    530                 535                 540


<210>  483
<211>  298
<212>  PRT
<213>  Lactobacillus crispatus

<400>  483

Met Asp Glu Leu Asn Lys Ile Ser Val Asn Gly Lys Lys Leu Ser Val
1               5                   10                  15


Ser Val Lys Gln Glu Leu Tyr Glu Asp Leu Phe Lys Lys Asn Asn Thr
            20                  25                  30


Val Ser Ala Lys Gln Leu Lys Asn Trp Leu Ile Glu Asn Gln Lys Leu
        35                  40                  45


Pro Tyr Ile Lys Ile Lys Gly Leu Ala Asp Gln Thr Lys Phe Asn Ser
    50                  55                  60


Ser Leu Ser Thr Tyr Ile Lys Leu Lys Lys Ser Gly Leu Phe Val Asp
65                  70                  75                  80


Lys Leu Asp Ser Asn Glu Phe Arg Asp Asp Phe Glu Lys Ile Ile Glu
                85                  90                  95


Trp Ser Thr Ile Phe Glu Asp Lys Gln Ile Tyr Ile Gln Lys Leu Gln
            100                 105                 110


Thr Ile Asp Trp Leu Thr Ala Lys Gln Ile Gln Phe Leu Gln Asn Ile
        115                 120                 125
```

```
Arg Leu Gln Gly Trp Gly Arg Leu Ser Lys Lys Leu Leu Thr Ala Ile
    130                 135                 140

Val Asp Ser Asn Gly Gln Asn Ile Ile Glu Gln Leu Trp Asn Ser Gln
145                 150                 155                 160

Gln Ile Phe Met Ser Ile Val Asn Lys Ala Asp Ile Lys Gly Thr Ile
                165                 170                 175

Thr Asp Ala Asn Gln Asp Leu Met His Ser Asn Ser Met Glu Asp Ile
            180                 185                 190

Leu Ser Glu Ala Tyr Thr Ser Pro Ala Asn Lys Lys Met Ile Arg Gln
        195                 200                 205

Val Val Lys Val Val His Asp Ile Gln Lys Ala Ala Ser Gly Gln Ala
    210                 215                 220

Pro Lys Gln Ile Ala Ile Glu Phe Ala Arg Glu Ser Arg Arg Asn Ser
225                 230                 235                 240

Lys Leu Ser Gln Thr Arg Gly His Lys Leu Gln Asp Ile Tyr Gln Lys
                245                 250                 255

Ile Ser Gly Asp Ile Val Asn Lys Asn Leu Lys Asp Lys Leu Ala Glu
            260                 265                 270

Tyr Ile Lys Asn Asn Gln Leu Ser Val Trp Glu Lys Thr Ser Phe Gln
        275                 280                 285

Met Asn Lys Asn Asp Gln Asp Phe Leu Phe
    290                 295
```

<210> 484
<211> 279
<212> PRT
<213> Lactobacillus crispatus

<400> 484

```
Met Asn Gly Lys Lys Leu Ser Val Ser Val Lys Gln Glu Leu Tyr Glu
1               5                   10                  15


Asp Leu Phe Lys Lys Asn Asn Thr Val Ser Ala Lys Gln Leu Lys Asn
            20                  25                  30


Trp Leu Ile Glu Asn Gln Lys Leu Pro Tyr Ile Lys Ile Lys Gly Leu
        35                  40                  45


Ala Asp Gln Thr Lys Phe Asn Ser Ser Leu Ser Thr Tyr Ile Lys Leu
    50                  55                  60


Lys Lys Ser Gly Leu Phe Val Asp Lys Leu Asp Ser Asn Glu Phe Arg
65                  70                  75                  80


Asp Asp Phe Glu Lys Ile Ile Glu Trp Ser Thr Ile Phe Glu Asp Lys
                85                  90                  95


Gln Ile Tyr Ile Gln Lys Leu Gln Thr Ile Asp Trp Leu Thr Ala Lys
            100                 105                 110


Gln Ile Gln Phe Leu Gln Asn Ile Arg Leu Gln Gly Trp Gly Arg Leu
        115                 120                 125


Ser Lys Lys Leu Leu Thr Ala Ile Val Asp Ser Asn Gly Gln Asn Ile
    130                 135                 140


Ile Glu Gln Leu Trp Asn Ser Gln Gln Ile Phe Met Ser Ile Val Asn
145                 150                 155                 160


Lys Ala Asp Ile Lys Gly Thr Ile Thr Asp Ala Asn Gln Asp Leu Met
                165                 170                 175


His Ser Asn Ser Met Glu Asp Ile Leu Ser Glu Ala Tyr Thr Ser Pro
            180                 185                 190
```

```
Ala Asn Lys Lys Met Ile Arg Gln Val Val Lys Val Val His Asp Ile
        195                 200                 205

Gln Lys Ala Ala Ser Gly Gln Ala Pro Lys Gln Ile Ala Ile Glu Phe
    210                 215                 220

Ala Arg Glu Ser Arg Arg Asn Ser Lys Leu Ser Gln Thr Arg Gly His
225                 230                 235                 240

Lys Leu Gln Asp Ile Tyr Gln Lys Ile Ser Gly Asp Ile Val Asn Lys
                245                 250                 255

Asn Leu Lys Asp Lys Leu Ala Glu Tyr Ile Lys Asn Asn Gln Leu Asn
            260                 265                 270

Lys Asp Lys Tyr Tyr Thr Arg
        275
```

<210> 485
<211> 538
<212> PRT
<213> Lactobacillus crispatus

<400> 485

```
Met Gln Leu Gly Arg Asp Ala Tyr Thr Gly Lys Pro Ile Asn Ile Asp
1               5                   10                  15

Glu Val Ser Gln Tyr Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Phe
            20                  25                  30

Ile Lys Asp Asp Ser Leu Asn Asn Arg Val Leu Val Ala Lys Pro Ile
        35                  40                  45

Asn Asn Gly Lys Ser Asp Gly Val Pro Leu Lys Leu Phe Gly Asp Asn
    50                  55                  60

Leu Ala Thr Gly Leu Gly Ile Thr Val Lys Gln Met Trp Asn Asn Trp
65                  70                  75                  80
```

```
Ala Asp Lys Gly Leu Ile Asn Lys Ala Lys Gln Asn Asn Leu Phe Leu
                85                  90                  95

Asp Pro Glu Asn Ile Asn Lys His Gln Ala Ser Gly Phe Ile Arg Lys
            100                 105                 110

Gln Leu Val Glu Thr Ser Gln Ile Ile Lys Leu Ala Thr Thr Ile Leu
        115                 120                 125

Gln Ala Glu Tyr Pro Lys Thr Lys Ile Ile Val Val Lys Ala Ser Ser
    130                 135                 140

Asn His Tyr Leu Arg Asn Glu Phe Asp Leu Tyr Lys Ser Arg Glu Val
145                 150                 155                 160

Asn Asp Tyr His His Ala Ile Asp Ala Tyr Leu Thr Thr Ile Cys Gly
                165                 170                 175

Asn Leu Leu Tyr Gln Ala Tyr Pro Lys Leu Arg Pro Phe Phe Val Tyr
            180                 185                 190

Gly Gln Phe Lys Lys Phe Ser Ser Asp Pro Lys Lys Glu Asn Glu Ile
        195                 200                 205

Leu Lys Lys Thr Lys Asn Phe Asp Phe Val Ala Lys Leu Leu Gly Ser
    210                 215                 220

Lys Ala Pro Asn Glu Ile Arg Ser Gln Gln Gly Lys Val Leu Phe Glu
225                 230                 235                 240

Lys Asn Lys Ile Arg Leu Gln Leu Asn Lys Ala Tyr Asn Tyr Lys Tyr
                245                 250                 255

Met Leu Val Ser Arg Asp Thr Thr Thr Lys Asn Gln Glu Met Phe Gly
            260                 265                 270
```

```
Met Thr Ile Tyr Pro Arg Ala Glu Arg Asp Ile Ala Lys Ser Arg Lys
        275                 280                 285

Leu Ile Glu Lys Arg Lys Gly Phe Ser Thr Asp Ile Tyr Gly Gly Tyr
    290                 295                 300

Thr Gly Thr Ala Ala Ala Tyr Met Ala Ile Val Arg Ile Asn Lys Thr
305                 310                 315                 320

Lys Ser Ser Gln Tyr Lys Val Ile Ala Val Pro Met Thr Lys Arg Ala
                325                 330                 335

Ile Leu Asn Lys Ala Glu Lys Glu Gly Asn Tyr Glu Lys Ile Leu Lys
            340                 345                 350

Gln Ile Leu Ser Pro Ser Ile Leu Tyr Asn Asp Lys Gly Lys Arg Lys
        355                 360                 365

Ala Gly Val Ile Ser Phe Asp Ile Ile Lys Gly Lys Val Pro Tyr Asn
    370                 375                 380

Gln Val Val Gln Asp Gly Asn Lys Lys Phe Leu Leu Lys Ser Ala Ile
385                 390                 395                 400

Tyr Leu Cys Asn Ala Lys Gln Leu Val Leu Ser Glu Glu Ala Met Arg
                405                 410                 415

Val Ile Thr Gly His Trp Leu Asp Ser Asp Lys Gln Asp Gln Glu Leu
            420                 425                 430

Leu Asp Val Tyr Asp Glu Ile Leu Glu Lys Ile Asp Arg Tyr Leu Pro
        435                 440                 445

Leu Phe Asp Ile Arg Asp Phe Arg Asn Lys Leu His Lys Gly Arg Glu
    450                 455                 460

Lys Phe Leu Lys Leu Asn Ala Glu Asp Lys Phe Lys Ala Ile Ile Gln
465                 470                 475                 480
```

```
Ile Leu Lys Gly Leu His Asp Asn Ser Asp Thr Gly Glu Leu Lys Asp
                485                 490                 495


Ile Gly Ile Thr Val Pro Phe Gly Gln Leu Gln Asn Asn Ser Gly Ile
            500                 505                 510


Thr Leu Ser Ser Asp Thr Ile Leu Val Tyr Gln Ser Pro Thr Gly Leu
        515                 520                 525


Phe Glu Lys Arg Val Lys Ile Ser Ser Leu
    530                 535
```

<210> 486
<211> 206
<212> PRT
<213> Lactobacillus crispatus

<400> 486

```
Met Gln Leu Gly Arg Asp Ala Tyr Thr Gly Lys Pro Ile Asn Ile Asp
1               5                   10                  15


Glu Val Ser Gln Tyr Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Phe
            20                  25                  30


Ile Lys Asp Asp Ser Leu Asn Asn Arg Val Leu Val Ala Lys Pro Ile
        35                  40                  45


Asn Asn Gly Lys Ser Asp Gly Val Pro Leu Lys Leu Phe Gly Asp Asn
    50                  55                  60


Leu Ala Thr Gly Leu Gly Ile Thr Val Lys Gln Met Trp Asn Asn Trp
65                  70                  75                  80


Ala Asp Lys Gly Leu Ile Asn Lys Ala Lys Gln Asn Asn Leu Phe Leu
                85                  90                  95


Asp Pro Glu Asn Ile Asn Lys His Gln Ala Ser Gly Phe Ile Arg Lys
```

```
            100                 105                 110

Gln Leu Val Glu Thr Ser Gln Ile Ile Lys Leu Ala Thr Thr Ile Leu
        115                 120                 125

Gln Ala Glu Tyr Pro Lys Thr Lys Ile Ile Val Val Lys Ala Ser Ser
    130                 135                 140

Asn His Tyr Leu Arg Asn Glu Phe Asp Leu Tyr Lys Ser Arg Glu Val
145                 150                 155                 160

Asn Asp Tyr His His Ala Ile Asp Ala Tyr Leu Thr Thr Ile Cys Gly
                165                 170                 175

Asn Leu Leu Tyr Gln Ala Tyr Pro Lys Leu Arg Pro Phe Phe Val Tyr
            180                 185                 190

Gly Gln Phe Lys Lys Phe Ser Ser Asp Pro Lys Lys Arg Lys
        195                 200                 205


<210>  487
<211>  857
<212>  PRT
<213>  Lactobacillus crispatus

<400>  487

Met Thr Lys Leu Asn Asn Glu Tyr Met Val Gly Leu Asp Ile Gly Thr
1               5                   10                  15

Asn Ser Cys Gly Trp Val Ala Thr Asp Phe Asp Asn Asn Ile Leu Lys
            20                  25                  30

Met His Gly Lys Arg Ala Leu Gly Ser His Leu Phe Asp Glu Gly Val
        35                  40                  45

Ser Ala Ala Asp Arg Arg Ala Phe Arg Thr Thr Arg Arg Arg Ile Lys
    50                  55                  60
```

```
Arg Arg Lys Trp Arg Leu Lys Leu Leu Glu Glu Ile Phe Asp Glu Glu
65                  70                  75                  80

Met Ala Lys Val Asp Pro Asn Phe Phe Ala Arg Leu Lys Glu Ser Gly
                85                  90                  95

Leu Ser Pro Leu Asp Thr Arg Lys Asn Val Ser Ser Ile Val Phe Pro
            100                 105                 110

Thr Lys Lys Met Asp Lys Gln Phe Tyr Lys Lys Phe Pro Thr Ile Tyr
        115                 120                 125

His Leu Arg Asn Ala Leu Met Lys Gln Asp Lys Lys Phe Asp Leu Arg
    130                 135                 140

Ala Ile Tyr Ile Ala Ile His His Ile Val Lys Tyr Arg Gly Asn Phe
145                 150                 155                 160

Leu Ser Asn Ser Ser Ile Ser Asn Phe Ser Ala Ser Lys Ile Glu Ile
                165                 170                 175

Asp Arg Phe Val Asn Glu Leu Asn Asp Leu Tyr Ser Ile Phe Leu Pro
            180                 185                 190

Glu Ser Gly Val Ile Phe Asp Ala Gly Asn Ala Ser Lys Val Glu Asp
        195                 200                 205

Ile Ile Arg Asn Glu Gln Met Phe Lys Leu Asp Lys Ile Lys Glu Ile
    210                 215                 220

Ala Asp Val Leu Pro Asp Thr Glu Asn Lys Ser Gly Leu Lys Leu Ser
225                 230                 235                 240

Lys Lys Ile Ser Lys Glu Ile Ser Lys Ala Ile Leu Gly Tyr Lys Ala
                245                 250                 255

Lys Phe Glu Ile Ile Leu Gln Val Asn Val Asp Lys Thr Asp Ser Ser
            260                 265                 270
```

```
Ile Trp Asn Phe Lys Leu Asn Asp Glu Asn Ala Asp Val Asn Leu Ser
        275                 280                 285

Glu Ile Thr Ser Asp Leu Thr Asp Thr Gln Leu Gln Ile Leu Asp Leu
    290                 295                 300

Val Arg Asn Leu Phe Ser Ala Ile Ser Leu Leu Asn Ile Val Asp Glu
305                 310                 315                 320

Gly Ser Thr Leu Ser Glu Ser Met Ile Arg Lys Tyr Asn Asp His Ala
                325                 330                 335

Gln Asp Leu Lys Leu Leu Lys Thr Val Ile Lys Asn His Ser Asp Arg
            340                 345                 350

Lys Lys Ala His Asn Leu Gln Leu Ala Tyr Asp Lys Tyr Val Asn Asn
        355                 360                 365

Arg His Phe Val Asp Val Glu Thr Lys Lys Ala Phe Pro Asn Lys His
    370                 375                 380

Leu Tyr Arg Lys Ser Asp Phe Tyr Glu Ile Val Lys Lys Asn Leu Asp
385                 390                 395                 400

Ala Ser Lys Glu Ala Val Gln Ile Arg Lys Glu Ile Ala Leu Asp Lys
                405                 410                 415

Phe Met Pro Lys Gln Arg Ser Asp Glu Asn Gly Val Ile Pro Phe Gln
            420                 425                 430

Leu Asn Gln Ile Glu Leu Asp Lys Ile Ile Glu Asn Gln Gly Lys Tyr
        435                 440                 445

Tyr Pro Phe Leu Lys Glu Ile Asn Pro Ile Lys Ala His Arg Met Gln
    450                 455                 460
```

```
Ala Pro Tyr Lys Leu Asp Glu Leu Ile Arg Phe Arg Val Pro Tyr Tyr
465                 470                 475                 480


Val Gly Pro Met Ile Glu Pro Thr Asn Ser Ser Tyr Pro Gln Thr Arg
                485                 490                 495


Gln Asn Gln Ser Phe Ala Trp Met Val Arg Lys Ala Lys Gly Arg Ile
            500                 505                 510


Thr Pro Trp Asn Phe Asp Glu Lys Val Asp Arg Gln Lys Ser Ala Asn
        515                 520                 525


Asn Phe Ile Lys Arg Leu Thr Thr Lys Asp Thr Tyr Leu Phe Gly Glu
    530                 535                 540


Asp Val Leu Pro Ala Asn Ser Leu Leu Tyr Gln Lys Tyr Thr Val Leu
545                 550                 555                 560


Asp Glu Leu Asn Lys Ile Ser Val Asn Gly Lys Lys Leu Ser Val Ser
                565                 570                 575


Val Lys Gln Glu Leu Tyr Glu Asp Leu Phe Lys Lys Asn Asn Thr Val
            580                 585                 590


Ser Ala Lys Gln Leu Lys Asn Trp Leu Ile Glu Asn Gln Lys Leu Pro
        595                 600                 605


Tyr Ile Lys Ile Lys Gly Leu Ala Asp Gln Thr Lys Phe Asn Ser Ser
    610                 615                 620


Leu Ser Thr Tyr Ile Lys Leu Lys Lys Ser Gly Leu Phe Val Asp Lys
625                 630                 635                 640


Leu Asp Ser Asn Glu Phe Arg Asp Asp Phe Glu Lys Ile Ile Glu Trp
                645                 650                 655


Ser Thr Ile Phe Glu Asp Lys Gln Ile Tyr Ile Gln Lys Leu Gln Thr
            660                 665                 670
```

```
Ile Asp Trp Leu Thr Ala Lys Gln Ile Gln Phe Leu Gln Asn Ile Arg
        675                 680                 685

Leu Gln Gly Trp Gly Arg Leu Ser Lys Lys Leu Leu Thr Ala Ile Val
    690                 695                 700

Asp Ser Asn Gly Gln Asn Ile Ile Glu Gln Leu Trp Asn Ser Gln Gln
705                 710                 715                 720

Ile Phe Met Ser Ile Val Asn Lys Ala Asp Ile Lys Gly Thr Ile Thr
                725                 730                 735

Asp Ala Asn Gln Asp Leu Met His Ser Asn Ser Met Glu Asp Ile Leu
            740                 745                 750

Ser Glu Ala Tyr Thr Ser Pro Ala Asn Lys Lys Met Ile Arg Gln Val
        755                 760                 765

Val Lys Val Val His Asp Ile Gln Lys Ala Ala Ser Gly Gln Ala Pro
    770                 775                 780

Lys Gln Ile Ala Ile Glu Phe Ala Arg Glu Ser Arg Arg Asn Ser Lys
785                 790                 795                 800

Leu Ser Gln Thr Arg Gly His Lys Leu Gln Asp Ile Tyr Gln Lys Ile
                805                 810                 815

Ser Gly Asp Ile Val Asn Lys Asn Leu Lys Asp Lys Leu Ala Glu Tyr
            820                 825                 830

Ile Lys Asn Asn Gln Leu Ser Val Trp Glu Lys Thr Ser Phe Gln Met
        835                 840                 845

Asn Lys Asn Asp Gln Asp Phe Leu Phe
    850                 855
```

<210> 488
<211> 857
<212> PRT
<213> Lactobacillus crispatus

<400> 488

Met Thr Lys Leu Asn Asn Glu Tyr Met Val Gly Leu Asp Ile Gly Thr
1 5 10 15

Asn Ser Cys Gly Trp Val Ala Thr Asp Phe Asp Asn Asn Ile Leu Lys
20 25 30

Met His Gly Lys Arg Ala Leu Gly Ser His Leu Phe Asp Glu Gly Val
35 40 45

Ser Ala Ala Asp Arg Arg Ala Phe Arg Thr Thr Arg Arg Arg Ile Lys
50 55 60

Arg Arg Lys Trp Arg Leu Lys Leu Leu Glu Glu Ile Phe Asp Glu Glu
65 70 75 80

Met Ala Lys Val Asp Pro Asn Phe Phe Ala Arg Leu Lys Glu Ser Gly
85 90 95

Leu Ser Pro Leu Asp Thr Arg Lys Asn Val Ser Ser Ile Val Phe Pro
100 105 110

Thr Lys Lys Met Asp Lys Gln Phe Tyr Lys Lys Phe Pro Thr Ile Tyr
115 120 125

His Leu Arg Asn Ala Leu Met Lys Gln Asp Lys Lys Phe Asp Leu Arg
130 135 140

Ala Ile Tyr Ile Ala Ile His His Ile Val Lys Tyr Arg Gly Asn Phe
145 150 155 160

Leu Ser Asn Ser Ser Ile Ser Asn Phe Ser Ala Ser Lys Ile Glu Ile
165 170 175

```
Asp Arg Phe Val Asn Glu Leu Asn Asp Leu Tyr Ser Ile Phe Leu Pro
            180                 185                 190

Glu Ser Gly Val Ile Phe Asp Ala Gly Asn Ala Ser Lys Val Glu Asp
        195                 200                 205

Ile Ile Arg Asn Glu Gln Met Phe Lys Leu Asp Lys Ile Lys Glu Ile
    210                 215                 220

Ala Asp Val Leu Pro Asp Thr Glu Asn Lys Ser Gly Leu Lys Leu Ser
225                 230                 235                 240

Lys Lys Ile Ser Lys Glu Ile Ser Lys Ala Ile Leu Gly Tyr Lys Ala
                245                 250                 255

Lys Phe Glu Ile Ile Leu Gln Val Asn Val Asp Lys Thr Asp Ser Ser
            260                 265                 270

Ile Trp Asn Phe Lys Leu Asn Asp Glu Asn Ala Asp Val Asn Leu Ser
        275                 280                 285

Glu Ile Thr Ser Asp Leu Thr Asp Thr Gln Leu Gln Ile Leu Asp Leu
    290                 295                 300

Val Arg Asn Leu Phe Ser Ala Ile Ser Leu Leu Asn Ile Val Asp Glu
305                 310                 315                 320

Gly Ser Thr Leu Ser Glu Ser Met Ile Arg Lys Tyr Asn Asp His Ala
                325                 330                 335

Gln Asp Leu Lys Leu Leu Lys Thr Val Ile Lys Asn His Ser Asp Arg
            340                 345                 350

Lys Lys Ala His Asn Leu Gln Leu Ala Tyr Asp Lys Tyr Val Asn Asn
        355                 360                 365

Arg His Phe Val Asp Val Glu Thr Lys Lys Ala Phe Pro Asn Lys His
```

```
    370                 375                 380

Leu Tyr Arg Lys Ser Asp Phe Tyr Glu Ile Val Lys Lys Asn Leu Asp
385                 390                 395                 400

Ala Ser Lys Glu Ala Val Gln Ile Arg Lys Glu Ile Ala Leu Asp Lys
                405                 410                 415

Phe Met Pro Lys Gln Arg Ser Asp Glu Asn Gly Val Ile Pro Phe Gln
            420                 425                 430

Leu Asn Gln Ile Glu Leu Asp Lys Ile Ile Glu Asn Gln Gly Lys Tyr
        435                 440                 445

Tyr Pro Phe Leu Lys Glu Ile Asn Pro Ile Lys Ala His Arg Met Gln
    450                 455                 460

Ala Pro Tyr Lys Leu Asp Glu Leu Ile Arg Phe Arg Val Pro Tyr Tyr
465                 470                 475                 480

Val Gly Pro Met Ile Glu Pro Thr Asn Ser Ser Tyr Pro Gln Thr Arg
                485                 490                 495

Gln Asn Gln Ser Phe Ala Trp Met Val Arg Lys Ala Lys Gly Arg Ile
            500                 505                 510

Thr Pro Trp Asn Phe Asp Glu Lys Val Asp Arg Gln Lys Ser Ala Asn
        515                 520                 525

Asn Phe Ile Lys Arg Leu Thr Thr Lys Asp Thr Tyr Leu Phe Gly Glu
    530                 535                 540

Asp Val Leu Pro Ala Asn Ser Leu Leu Tyr Gln Lys Tyr Thr Val Leu
545                 550                 555                 560

Asp Glu Leu Asn Lys Ile Ser Val Asn Gly Lys Lys Leu Ser Val Ser
                565                 570                 575
```

```
Val Lys Gln Glu Leu Tyr Glu Asp Leu Phe Lys Lys Asn Asn Thr Val
            580                 585                 590

Ser Ala Lys Gln Leu Lys Asn Trp Leu Ile Glu Asn Gln Lys Leu Pro
        595                 600                 605

Tyr Ile Lys Ile Lys Gly Leu Ala Asp Gln Thr Lys Phe Asn Ser Ser
    610                 615                 620

Leu Ser Thr Tyr Ile Lys Leu Lys Lys Ser Gly Leu Phe Val Asp Lys
625                 630                 635                 640

Leu Asp Ser Asn Glu Phe Arg Asp Asp Phe Glu Lys Ile Ile Glu Trp
                645                 650                 655

Ser Thr Ile Phe Glu Asp Lys Gln Ile Tyr Ile Gln Lys Leu Gln Thr
            660                 665                 670

Ile Asp Trp Leu Thr Ala Lys Gln Ile Gln Phe Leu Gln Asn Ile Arg
        675                 680                 685

Leu Gln Gly Trp Gly Arg Leu Ser Lys Lys Leu Leu Thr Ala Ile Val
    690                 695                 700

Asp Ser Asn Gly Gln Asn Ile Ile Glu Gln Leu Trp Asn Ser Gln Gln
705                 710                 715                 720

Ile Phe Met Ser Ile Val Asn Lys Ala Asp Ile Lys Gly Thr Ile Thr
                725                 730                 735

Asp Ala Asn Gln Asp Leu Met His Ser Asn Ser Met Glu Asp Ile Leu
            740                 745                 750

Ser Glu Ala Tyr Thr Ser Pro Ala Asn Lys Lys Met Ile Arg Gln Val
        755                 760                 765

Val Lys Val Val His Asp Ile Gln Lys Ala Ala Ser Gly Gln Ala Pro
```

770 775 780

Lys Gln Ile Ala Ile Glu Phe Ala Arg Glu Ser Arg Arg Asn Ser Lys
785 790 795 800

Leu Ser Gln Thr Arg Gly His Lys Leu Gln Asp Ile Tyr Gln Lys Ile
805 810 815

Ser Gly Asp Ile Val Asn Lys Asn Leu Lys Asp Lys Leu Ala Glu Tyr
820 825 830

Ile Lys Asn Asn Gln Leu Ser Val Trp Glu Lys Asn Ser Phe Gln Met
835 840 845

Asn Lys Asn Asp Gln Asp Phe Leu Phe
850 855

<210> 489
<211> 347
<212> PRT
<213> Lactobacillus crispatus

<400> 489

Met Val Asn Leu Lys Ser Leu Val Leu Ile Leu Lys Lys Glu Asn Glu
1 5 10 15

Ile Leu Lys Lys Thr Lys Asn Phe Asp Phe Val Ala Lys Leu Leu Gly
20 25 30

Ser Lys Ala Pro Asn Glu Ile Arg Ser Gln Gln Gly Lys Val Leu Phe
35 40 45

Glu Lys Asn Lys Ile Arg Leu Gln Leu Asn Lys Ala Tyr Asn Tyr Lys
50 55 60

Tyr Met Leu Val Ser Arg Asp Thr Thr Thr Lys Asn Gln Glu Met Phe
65 70 75 80

```
Gly Met Thr Ile Tyr Pro Arg Ala Glu Arg Asp Ile Ala Lys Ser Arg
                85                  90                  95

Lys Leu Ile Glu Lys Arg Lys Gly Phe Ser Thr Asp Ile Tyr Gly Gly
            100                 105                 110

Tyr Thr Gly Thr Ala Ala Ala Tyr Met Ala Ile Val Arg Ile Asn Lys
        115                 120                 125

Thr Lys Ser Ser Gln Tyr Lys Val Ile Ala Val Pro Met Thr Lys Arg
    130                 135                 140

Ala Ile Leu Asn Lys Ala Glu Lys Glu Gly Asn Tyr Glu Lys Ile Leu
145                 150                 155                 160

Lys Gln Ile Leu Ser Pro Ser Ile Leu Tyr Asn Asp Lys Gly Lys Arg
                165                 170                 175

Lys Ala Gly Val Ile Ser Phe Asp Ile Ile Lys Gly Lys Val Pro Tyr
            180                 185                 190

Asn Gln Val Val Gln Asp Gly Asn Lys Lys Phe Leu Leu Lys Ser Ala
        195                 200                 205

Ile Tyr Leu Cys Asn Ala Lys Gln Leu Val Leu Ser Glu Glu Ala Met
    210                 215                 220

Arg Val Ile Thr Gly His Trp Leu Asp Ser Asp Lys Gln Asp Gln Glu
225                 230                 235                 240

Leu Leu Asp Val Tyr Asp Glu Ile Leu Glu Lys Ile Asp Arg Tyr Leu
                245                 250                 255

Pro Leu Phe Asp Ile Arg Asp Phe Arg Asn Lys Leu His Lys Gly Arg
            260                 265                 270

Glu Lys Phe Leu Lys Leu Asn Ala Glu Asp Lys Phe Lys Ala Ile Ile
        275                 280                 285
```

```
Gln Ile Leu Lys Gly Leu His Asp Asn Ser Asp Thr Gly Glu Leu Lys
    290                 295                 300


Asp Ile Gly Ile Thr Val Pro Phe Gly Gln Leu Gln Asn Asn Ser Gly
305                 310                 315                 320


Ile Thr Leu Ser Ser Asp Thr Ile Leu Val Tyr Gln Ser Pro Thr Gly
                325                 330                 335


Leu Phe Glu Lys Arg Val Lys Ile Ser Ser Leu
            340                 345


<210>  490
<211>  534
<212>  PRT
<213>  Lactobacillus crispatus

<400>  490

Arg Asp Ala Tyr Thr Asp Lys Pro Ile Asn Ile Asp Glu Val Ser Gln
1               5                   10                  15


Tyr Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Phe Ile Lys Asp Asp
            20                  25                  30


Ser Leu Asn Asn Arg Val Leu Val Ala Lys Pro Ile Asn Asn Gly Lys
        35                  40                  45


Ser Asp Gly Val Pro Leu Lys Leu Phe Gly Asp Asn Leu Ala Thr Gly
    50                  55                  60


Leu Gly Ile Thr Val Lys Gln Met Trp Asn Asn Trp Ala Asp Lys Gly
65                  70                  75                  80


Leu Ile Asn Lys Ala Lys Gln Asn Asn Leu Phe Leu Asp Pro Glu Asn
                85                  90                  95


Ile Asn Lys His Gln Ala Ser Gly Phe Ile Arg Lys Gln Leu Val Glu
```

```
            100                 105                 110

Thr Ser Gln Ile Ile Lys Leu Ala Thr Thr Ile Leu Gln Ala Glu Tyr
        115                 120                 125

Pro Lys Thr Lys Ile Ile Val Val Lys Ala Ser Ser Asn His Tyr Leu
    130                 135                 140

Arg Asn Glu Phe Asp Leu Tyr Lys Ser Arg Glu Val Asn Asp Tyr His
145                 150                 155                 160

His Ala Ile Asp Ala Tyr Leu Thr Thr Ile Cys Gly Asn Leu Leu Tyr
                165                 170                 175

Gln Ala Tyr Pro Lys Leu Arg Pro Phe Phe Val Tyr Gly Gln Phe Lys
            180                 185                 190

Lys Phe Ser Ser Asp Pro Lys Lys Glu Asn Glu Ile Leu Lys Lys Thr
        195                 200                 205

Lys Asn Phe Asp Phe Val Ala Lys Leu Leu Gly Ser Lys Ala Pro Asn
    210                 215                 220

Glu Ile Arg Ser Gln Gln Gly Lys Val Leu Phe Glu Lys Asn Lys Ile
225                 230                 235                 240

Arg Leu Gln Leu Asn Lys Ala Tyr Asn Tyr Lys Tyr Met Leu Val Ser
                245                 250                 255

Arg Asp Thr Thr Thr Lys Asn Gln Glu Met Phe Gly Met Thr Ile Tyr
            260                 265                 270

Pro Arg Ala Glu Arg Asp Ile Ala Lys Ser Arg Lys Leu Ile Glu Lys
        275                 280                 285

Arg Lys Gly Phe Ser Thr Asp Ile Tyr Gly Gly Tyr Thr Gly Thr Ala
    290                 295                 300
```

```
Ala Ala Tyr Met Ala Ile Val Arg Ile Asn Lys Thr Lys Ser Ser Gln
305                 310                 315                 320

Tyr Lys Val Ile Ala Val Pro Met Thr Lys Arg Ala Ile Leu Asn Lys
                325                 330                 335

Ala Glu Lys Glu Gly Asn Tyr Glu Lys Ile Leu Lys Gln Ile Leu Ser
            340                 345                 350

Pro Ser Ile Leu Tyr Asn Asp Lys Gly Lys Arg Lys Ala Gly Val Ile
        355                 360                 365

Ser Phe Asp Ile Ile Lys Gly Lys Val Pro Tyr Asn Gln Val Val Gln
    370                 375                 380

Asp Gly Asn Lys Lys Phe Leu Leu Lys Ser Ala Ile Tyr Leu Cys Asn
385                 390                 395                 400

Ala Lys Gln Leu Val Leu Ser Glu Glu Ala Met Arg Val Ile Thr Gly
                405                 410                 415

His Trp Leu Asp Ser Asp Lys Gln Asp Gln Glu Leu Leu Asp Val Tyr
            420                 425                 430

Asp Glu Ile Leu Glu Lys Ile Asp Arg Tyr Leu Pro Leu Phe Asp Ile
        435                 440                 445

Arg Asp Phe Arg Asn Lys Leu His Lys Gly Arg Glu Lys Phe Leu Lys
    450                 455                 460

Leu Asn Ala Glu Asp Lys Phe Lys Ala Ile Ile Gln Ile Leu Lys Gly
465                 470                 475                 480

Leu His Asp Asn Ser Asp Thr Gly Glu Leu Lys Asp Ile Gly Ile Thr
                485                 490                 495

Val Pro Phe Gly Gln Leu Gln Asn Asn Ser Gly Ile Thr Leu Ser Ser
```

```
            500                 505                 510

Asp Thr Ile Leu Val Tyr Gln Ser Pro Thr Gly Leu Phe Glu Lys Arg
        515                 520                 525

Val Lys Ile Ser Ser Leu
    530
```

<210> 491
<211> 278
<212> PRT
<213> Lactobacillus crispatus

<400> 491

```
Ser Val Asn Gly Lys Lys Leu Ser Val Ser Val Lys Gln Glu Leu Tyr
1               5                   10                  15

Glu Asp Leu Phe Lys Lys Asn Asn Thr Val Ser Ala Lys Gln Leu Lys
            20                  25                  30

Asn Trp Leu Ile Glu Asn Gln Lys Leu Pro Tyr Ile Lys Ile Lys Gly
        35                  40                  45

Leu Ala Asp Gln Thr Lys Phe Asn Ser Ser Leu Ser Thr Tyr Ile Lys
    50                  55                  60

Leu Lys Lys Ser Gly Leu Phe Val Asp Lys Leu Asp Ser Asn Glu Phe
65                  70                  75                  80

Arg Asp Asp Phe Glu Lys Ile Ile Glu Trp Ser Thr Ile Phe Glu Asp
                85                  90                  95

Lys Gln Ile Tyr Ile Gln Lys Leu Gln Thr Ile Asp Trp Leu Thr Ala
            100                 105                 110

Lys Gln Ile Gln Phe Leu Gln Asn Ile Arg Leu Gln Gly Trp Gly Arg
        115                 120                 125
```

```
Leu Ser Lys Lys Leu Leu Thr Ala Ile Val Asp Ser Asn Gly Gln Asn
    130                 135                 140

Ile Ile Glu Gln Leu Trp Asn Ser Gln Gln Ile Phe Met Ser Ile Val
145                 150                 155                 160

Asn Lys Ala Asp Ile Lys Gly Thr Ile Thr Asp Ala Asn Gln Asp Leu
                165                 170                 175

Met His Ser Asn Ser Met Glu Asp Ile Leu Ser Glu Ala Tyr Thr Ser
            180                 185                 190

Pro Ala Asn Lys Lys Met Ile Arg Gln Val Val Lys Val Val His Asp
        195                 200                 205

Ile Gln Lys Ala Ala Ser Gly Gln Ala Pro Lys Gln Ile Ala Ile Glu
    210                 215                 220

Phe Ala Arg Glu Ser Arg Arg Asn Ser Lys Leu Ser Gln Thr Arg Gly
225                 230                 235                 240

His Lys Leu Gln Asp Ile Tyr Gln Lys Ile Ser Gly Asp Ile Val Asn
                245                 250                 255

Lys Asn Leu Lys Asp Lys Leu Ala Glu Tyr Ile Lys Asn Asn Gln Leu
            260                 265                 270

Asn Lys Asp Lys Tyr Tyr
        275
```

<210> 492
<211> 277
<212> PRT
<213> Lactobacillus crispatus

<400> 492

```
Ser Val Asn Gly Lys Lys Leu Ser Val Ser Val Lys Gln Glu Leu Tyr
1               5                   10                  15
```

```
Glu Asp Leu Phe Lys Lys Asn Asn Thr Val Ser Ala Lys Gln Leu Lys
            20                  25                  30

Asn Trp Leu Ile Glu Asn Gln Lys Leu Pro Tyr Ile Lys Ile Lys Gly
        35                  40                  45

Leu Ala Asp Gln Thr Lys Phe Asn Ser Ser Leu Ser Thr Tyr Ile Lys
    50                  55                  60

Leu Lys Lys Ser Gly Leu Phe Val Asp Lys Leu Asp Ser Asn Glu Phe
65                  70                  75                  80

Arg Asp Asp Phe Glu Lys Ile Ile Glu Trp Ser Thr Ile Phe Glu Asp
                85                  90                  95

Lys Gln Ile Tyr Ile Gln Lys Leu Gln Thr Ile Asp Trp Leu Thr Ala
            100                 105                 110

Lys Gln Ile Gln Phe Leu Gln Asn Ile Arg Leu Gln Gly Trp Gly Arg
        115                 120                 125

Leu Ser Lys Lys Leu Leu Thr Ala Ile Val Asp Ser Asn Gly Gln Asn
    130                 135                 140

Ile Ile Glu Gln Leu Trp Asn Ser Gln Gln Ile Phe Met Ser Ile Val
145                 150                 155                 160

Asn Lys Ala Asp Ile Lys Gly Thr Ile Thr Asp Ala Asn Gln Asp Leu
                165                 170                 175

Met His Ser Asn Ser Met Glu Asp Ile Leu Ser Glu Ala Tyr Thr Ser
            180                 185                 190

Pro Ala Asn Lys Lys Met Ile Arg Gln Val Val Lys Val Val His Asp
        195                 200                 205

Ile Gln Lys Ala Ala Ser Gly Gln Ala Pro Lys Gln Ile Ala Ile Glu
```

```
    210                 215                 220

Phe Ala Arg Glu Ser Arg Arg Asn Ser Lys Leu Ser Gln Thr Arg Gly
225                 230                 235                 240

His Lys Leu Gln Asp Ile Tyr Gln Lys Ile Ser Gly Asp Ile Val Asn
                245                 250                 255

Lys Asn Leu Lys Asp Lys Leu Ala Glu Tyr Ile Lys Asn Asn Gln Leu
            260                 265                 270

Asn Lys Asp Lys Tyr
        275
```

<210> 493
<211> 1368
<212> PRT
<213> Lactobacillus curvatus

<400> 493

```
Met Ser Arg Pro Tyr Asn Ile Gly Leu Asp Ile Gly Thr Ser Ser Ile
1               5                   10                  15

Gly Trp Ser Val Val Asp Asp Gln Ser Lys Leu Val Ser Val Arg Gly
            20                  25                  30

Lys Tyr Gly Tyr Gly Val Arg Leu Tyr Asp Glu Gly Gln Thr Ala Ala
        35                  40                  45

Glu Arg Arg Ser Phe Arg Thr Thr Arg Arg Arg Leu Lys Arg Arg Lys
    50                  55                  60

Trp Arg Leu Gly Leu Leu Arg Glu Ile Phe Glu Pro Tyr Ile Thr Pro
65                  70                  75                  80

Ile Asp Asp Thr Phe Phe Leu Arg Gln Lys Gln Ser Asn Leu Ser Pro
                85                  90                  95
```

```
Lys Asp Gln Arg Lys Leu Tyr Thr Gln Thr Ser Leu Phe Asn Asp Arg
            100                 105                 110

Thr Asp Arg Ala Phe Tyr Asp Asp Tyr Pro Thr Ile Tyr His Leu Arg
        115                 120                 125

Tyr Arg Leu Met Thr Glu Lys Arg Gln Phe Asp Ile Arg Glu Ile Tyr
    130                 135                 140

Leu Ala Met His His Ile Val Lys Tyr Arg Gly His Phe Leu Asn Glu
145                 150                 155                 160

Ala Pro Val Ser Ser Phe Lys Ser Ser Glu Ile Asn Leu Val Ala His
                165                 170                 175

Phe Asp Arg Leu Asn Thr Ile Phe Ala Asp Leu Phe Ser Glu Ser Gly
            180                 185                 190

Phe Gln Leu Glu Thr Asp Lys Leu Ala Glu Val Lys Ala Leu Leu Leu
        195                 200                 205

Asp Asn Gln Gln Ser Ala Ser Asn Arg Gln Arg Gln Ala Leu Ser Leu
    210                 215                 220

Ile Tyr Thr Pro Ser Thr Asn Lys Ala Val Glu Lys Gln Asn Lys Ala
225                 230                 235                 240

Ile Ala Thr Glu Leu Leu Lys Ala Ile Leu Gly Leu Lys Ala Lys Phe
                245                 250                 255

Asn Val Leu Thr Gly Ile Glu Ala Glu Asp Val Lys Ala Trp Thr Leu
            260                 265                 270

Thr Phe Asn Ala Glu Asn Phe Asp Glu Glu Met Val Lys Leu Glu Ser
        275                 280                 285

Ser Leu Asp Asp Asn Ala His Gln Ile Ile Glu Ser Leu Gln Glu Leu
    290                 295                 300
```

```
Tyr Ser Gly Val Leu Leu Ala Gly Ile Val Pro Glu Asn Gln Ser Leu
305                 310                 315                 320

Ser Gln Ala Met Ile Thr Lys Tyr Asp Asp His Gln Lys His Leu Lys
                325                 330                 335

Met Leu Lys Ala Val Arg Glu Ala Leu Ala Pro Gly Asp Arg Gln Arg
            340                 345                 350

Leu Lys Gln Ala Tyr Asp Gln Tyr Val Asp Gly Gln Glu Asn Thr Lys
        355                 360                 365

Ala Tyr Ser Lys Glu Asp Phe Tyr Gly Asp Ile Thr Lys Ala Leu Lys
    370                 375                 380

Asn Asn Pro Asp His Pro Ile Val Ser Glu Ile Lys Lys Leu Ile Glu
385                 390                 395                 400

Leu Asp Gln Phe Met Pro Lys Gln Arg Thr Lys Asp Asn Gly Ala Ile
                405                 410                 415

Pro His Gln Leu His Gln Gln Glu Leu Asp Arg Ile Ile Glu Asn Gln
            420                 425                 430

Gln Gln Tyr Tyr Pro Trp Leu Ala Glu Leu Asn Pro Asn Ser Lys Arg
        435                 440                 445

Gln Thr Val Ala Lys Tyr Lys Leu Asp Glu Leu Val Ala Phe Arg Val
    450                 455                 460

Pro Tyr Tyr Val Gly Pro Leu Ile Thr Ala Glu Gln Gln Arg Gln Ser
465                 470                 475                 480

Ser Asp Ala Lys Phe Ala Trp Leu Ile Arg Lys Ala Glu Gly Arg Ile
                485                 490                 495
```

```
Thr Pro Trp Asn Phe Asp Asp Lys Val Asp Arg Gln Ala Ser Ala Asn
            500                 505                 510

Glu Phe Ile Lys Arg Met Thr Thr Thr Asp Thr Tyr Leu Leu Ala Glu
        515                 520                 525

Asp Val Leu Pro Lys Gln Ser Leu Ile Tyr Gln Arg Phe Glu Val Leu
    530                 535                 540

Asn Glu Leu Asn Gly Leu Lys Ile Asp Asp Gln Pro Ile Thr Thr Glu
545                 550                 555                 560

Leu Lys Gln Ala Ile Phe Thr Asp Leu Phe Met Gln Lys Ile Ser Val
                565                 570                 575

Thr Val Lys Asn Ile Gln Asp Tyr Leu Val Ser Glu Lys Arg Tyr Ala
            580                 585                 590

Ser Arg Pro Ala Ile Thr Gly Leu Ser Asp Glu Asn Lys Phe Asn Ser
        595                 600                 605

Arg Leu Ser Thr Tyr His Asp Leu Lys Met Ile Val Gly Asp Ala Val
    610                 615                 620

Asp Asp Val Asp Lys Gln Ala Asp Leu Glu Lys Cys Ile Glu Trp Ser
625                 630                 635                 640

Thr Ile Phe Glu Asp Gly Lys Ile Tyr Ser Ala Lys Leu Asn Glu Ile
                645                 650                 655

Asp Trp Leu Thr Asp Gln Gln Arg Val Gln Leu Ala Ala Lys Arg Tyr
            660                 665                 670

Arg Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu Thr Gln Ile Val Asn
        675                 680                 685

Ala Asn Gly Gln Arg Ile Met Asp Leu Leu Trp Asp Thr Thr Asp Asn
    690                 695                 700
```

```
Phe Met Arg Ile Val His Ser Glu Asp Phe Asp Lys Leu Ile Thr Glu
705                 710                 715                 720


Ala Asn Gln Met Met Leu Ala Glu Asn Asp Val Gln Asp Val Ile Asn
                725                 730                 735


Asp Leu Tyr Thr Ser Pro Gln Asn Lys Lys Ala Leu Arg Gln Ile Leu
            740                 745                 750


Leu Val Val Asn Asp Ile Gln Lys Ala Met Lys Gly Gln Ala Pro Glu
        755                 760                 765


Arg Ile Leu Ile Glu Phe Ala Arg Glu Asp Glu Val Asn Ser Arg Leu
    770                 775                 780


Ser Val Gln Arg Lys Arg Gln Val Glu Gln Val Tyr Gln Asn Ile Ser
785                 790                 795                 800


Asn Glu Leu Leu Asn Asn Thr Glu Ile Arg Asn Glu Leu Lys Asp Leu
                805                 810                 815


Ser Asn Ser Ala Leu Ser Asn Thr Arg Leu Phe Leu Tyr Phe Met Gln
            820                 825                 830


Gly Gly Arg Asp Met Tyr Thr Gly Asp Ser Leu Asn Ile Asp Arg Leu
        835                 840                 845


Ser Thr Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Phe Ile Lys Asp
    850                 855                 860


Asn Ser Leu Asp Asn Arg Val Leu Val Ser Gln Lys Met Asn Arg Ser
865                 870                 875                 880


Lys Ala Asp Gln Val Pro Thr Asp Phe Thr Ser Val Glu Leu Gly Gln
                885                 890                 895
```

```
Lys Met Gln Ile Gln Trp Glu Gln Met Leu Arg Ala Gly Leu Ile Thr
            900                 905                 910

Lys Lys Lys Tyr Asp Asn Leu Thr Leu Asn Pro Asp His Ile Ser Lys
        915                 920                 925

Tyr Ala Met Lys Gly Phe Ile Asn Arg Gln Leu Val Glu Thr Arg Gln
    930                 935                 940

Val Ile Lys Leu Ala Thr Asn Leu Leu Met Glu Gln Tyr Gly Glu Asp
945                 950                 955                 960

Asn Ile Glu Leu Ile Thr Val Lys Ser Gly Leu Thr His Gln Met Arg
                965                 970                 975

Thr Glu Phe Asp Phe Pro Lys Asn Arg Asn Leu Asn Asn His His His
            980                 985                 990

Ala Phe Asp Ala Tyr Leu Thr Ala  Phe Val Gly Leu Tyr  Leu Leu Lys
        995                 1000                1005

Arg Tyr  Pro Lys Leu Lys Pro  Tyr Phe Val Tyr Gly  Glu Tyr Gln
    1010                1015                1020

Lys Ala  Ser Gln Gln Asp Lys  Trp Arg Asn Phe Asn  Phe Leu Asn
    1025                1030                1035

Gly Leu  Lys Lys Asp Glu Leu  Val Asp Glu Asn Thr  Glu Ala Val
    1040                1045                1050

Ile Trp  Asp Lys Glu Ser Gly  Leu Ala Tyr Leu Asn  Lys Ile Tyr
    1055                1060                1065

Gln Phe  Lys Lys Ile Leu Val  Thr Arg Gly Val His  Glu Asn Ser
    1070                1075                1080

Gly Ala  Leu Phe Asn Gln Thr  Leu Tyr Ala Ala Lys  Asp Asp Lys
    1085                1090                1095
```

```
Ala Ser  Gly Gln Gly Gly Lys  Gln Leu Ile Pro Ala  Lys Gln Asp
    1100                1105                1110

Arg Ser  Thr Ala Leu Tyr Gly  Gly Tyr Ser Gly Lys  Thr Val Ala
    1115                1120                1125

Tyr Met  Cys Ile Val Arg Ile  Lys Asn Lys Lys Gly  Asp Leu Tyr
    1130                1135                1140

Lys Val  Cys Gly Val Glu Thr  Ser Trp Leu Ala Gln  Leu Lys Gln
    1145                1150                1155

Leu Thr  Asp Glu Asp Ser Gln  Lys Ala Phe Leu Glu  Gln Lys Ile
    1160                1165                1170

Ser Pro  Gln Phe Thr Lys Val  Lys Lys Gln Lys Gly  Asn Ile Ile
    1175                1180                1185

Glu Ala  Val Glu Glu Phe Glu  Val Ile Ala Pro His  Ile Leu Ile
    1190                1195                1200

Asn Gln  Arg Phe Phe Asp Asn  Gly Gln Glu Leu Thr  Leu Gly Ser
    1205                1210                1215

Ala Thr  Tyr Lys His Asn Glu  Gln Glu Leu Ile Leu  Asp Lys Thr
    1220                1225                1230

Ala Val  Lys Leu Leu Asn Gly  Ala Leu Pro Leu Thr  Gln Ser Glu
    1235                1240                1245

Glu Leu  Ala Glu Gln Val Tyr  Asp Glu Ile Leu Asp  Gln Val Met
    1250                1255                1260

His Tyr  Phe Pro Leu Tyr Asp  Thr Asn Gln Phe Arg  Ala Lys Leu
    1265                1270                1275
```

```
Ser Thr  Gly Lys Ala Ala Phe  Met Lys Leu Pro Trp  Lys Ser Gln
    1280                1285                1290

Trp Asp  Gly Asn Lys Met Val  Gln Val Gly Gln Gln  Val Ile Leu
    1295                1300                1305

Asp Arg  Ile Leu Ile Gly Leu  His Ala Asn Ala Ala  Met Ser Asp
    1310                1315                1320

Leu Lys  Val Leu Lys Met Thr  Thr Pro Phe Gly Met  Ile Gln Gln
    1325                1330                1335

Ser Thr  Gly Ile Thr Leu Ser  Ala Asp Thr Gln Ile  Ile Tyr Gln
    1340                1345                1350

Ser Pro  Thr Gly Leu Phe Glu  Arg Arg Val Ala Leu  Arg Asp Leu
    1355                1360                1365
```

<210> 494
<211> 669
<212> PRT
<213> Lactobacillus delbrueckii

<400> 494

```
Met Ala Lys Pro Lys Asp Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn
1               5                   10                  15

Ser Val Gly Trp Val Val Thr Asp Asp Gln Asn Asn Ile Leu Arg Ile
            20                  25                  30

Lys Gly Lys Lys Ala Ile Gly Ala Arg Leu Phe Thr Glu Gly Lys Val
        35                  40                  45

Ala Ala Glu Arg Arg Ser Phe Arg Thr Thr Arg Arg Arg Leu Ser Arg
    50                  55                  60

Arg Arg Trp Arg Ile Lys Met Leu Glu Glu Leu Phe Asp Glu Glu Ile
65                  70                  75                  80
```

```
Ala Lys Val Asp Pro Ser Phe Phe Ala Arg Leu His Glu Ser Trp Ile
                85                  90                  95

Ser Pro Lys Asp Lys Arg Lys Arg Tyr Ser Ala Ile Val Phe Pro Ser
            100                 105                 110

Pro Glu Glu Asp Lys Lys Phe His Glu Ser Tyr Pro Thr Ile Tyr His
        115                 120                 125

Leu Arg Asp Lys Leu Met Lys Asp Asp Gln Lys His Asp Ile Arg Glu
    130                 135                 140

Ile Tyr Ile Ala Val His Gln Met Ile Lys Ala Arg Gly Asn Phe Leu
145                 150                 155                 160

His Asp Glu Ser Val Glu Thr Tyr Arg Ser Gly Met Ser Ser Leu Gly
                165                 170                 175

Gly Arg Ser Glu Arg Asn Ile Leu Ser Val Gln Thr Leu Glu Glu Leu
            180                 185                 190

Asn Asp Leu Phe Ala Glu Asn Glu Gly Thr Glu Glu Val Glu Leu Asn
        195                 200                 205

Val Ala Ser Ala Glu Gln Ile Asn Asp Ile Leu Thr Gly Gly His Leu
    210                 215                 220

Asn Ala Asp Ser Gln Lys Glu Ile Ser Asn Leu Leu Leu Pro Ser Ser
225                 230                 235                 240

Phe Pro Ser Phe Asp Asp Lys Ala Lys Glu Lys Gln Val Lys Lys Leu
                245                 250                 255

Ile Asn Asn Val Ala Thr Asn Ile Ser Lys Ala Trp Leu Gly Tyr Lys
            260                 265                 270

Ala Asp Phe Ser Thr Ile Leu Asn Leu Ala Lys Val Asp Lys Asp Gln
```

```
        275                 280                 285

Lys Lys Ile Phe Ala Phe Ala Leu Gln Gly Gly Asp Glu Glu Asp Lys
    290                 295                 300

Val Gln Glu Leu Glu Ser Leu Leu Glu Gln Ser Gln Thr Asp Ile Val
305                 310                 315                 320

Asp Arg Leu Ile Glu Ile Arg His Ala Ile Val Leu Ser Glu Ile Val
                325                 330                 335

Pro Val Gly Met Thr Leu Ser Glu Ala Met Ile Asp Lys Tyr Asp Gln
            340                 345                 350

His Lys Glu Asp Leu Ile Thr Leu Lys Ala Val Ile Arg Asn Thr Lys
        355                 360                 365

Asp Lys Lys Lys Ala Ala Lys Leu Gln Ala Ile Tyr Asp Leu Tyr Val
    370                 375                 380

Lys Lys Arg His Ala Asp Leu Ala Lys Ala Met Lys Leu Thr Gly Ile
385                 390                 395                 400

Lys Lys Arg Ser Glu Leu Leu Asp Pro Glu Glu Leu Lys Lys Gly Ile
                405                 410                 415

Ser Ser Leu Leu Asp Asp Ser Pro Glu Ala Val Glu Ile Lys Gln Arg
            420                 425                 430

Leu Glu Glu Lys Thr Phe Leu Pro Leu Gln Arg Ser Asn Asn Asn Gly
        435                 440                 445

Val Ile Pro Asn Gln Leu His Gln Val Glu Leu Asp Glu Ile Ile Lys
    450                 455                 460

Lys Gln Ser Lys Tyr Tyr Pro Phe Leu Ala Glu Lys Asn Pro Asp Glu
465                 470                 475                 480
```

```
Ser Glu Glu Ala Gln Lys Lys Ala Pro Thr Lys Leu Asp Ala Leu Leu
                485                 490                 495

Thr Phe Arg Val Pro Tyr Tyr Val Gly Pro Met Ile Thr Lys Glu Glu
            500                 505                 510

Gln Glu Ala Gln Asn Gly His Ser Phe Ala Trp Met Val Arg Arg Asp
        515                 520                 525

Pro Gln Asp His Glu Ala Ile Thr Pro Trp Asn Phe Glu Lys Lys Val
    530                 535                 540

Asp Lys Met Ala Ser Ala Thr Gln Phe Ile Lys Arg Met Thr Thr Lys
545                 550                 555                 560

Asp Thr Tyr Leu Leu Gly Glu Asp Val Leu Pro Ala Ser Ser Leu Lys
                565                 570                 575

Tyr Gln Leu Phe Thr Val Leu Asn Glu Leu Asn Asn Leu Arg Val Asn
            580                 585                 590

Gly Lys Lys Leu Thr Ser Asp Glu Lys Glu Gln Val Ile Glu Gly Leu
        595                 600                 605

Phe Lys Lys Gln Lys Thr Val Lys Ala Asp Lys Phe Val Lys Tyr Trp
    610                 615                 620

Gln Ala Lys His Ile Gly Ala Asp Ile Lys Val Lys Gly Leu Ser Asp
625                 630                 635                 640

Pro Ser Lys Phe Asn Ser Thr Met Ser Thr Tyr Ile Asp Phe Lys Lys
                645                 650                 655

Ile Phe Gly Asp Gln Leu Asn Asp Val Asn Arg Gln Arg
            660                 665
```

<210> 495

<211> 544
<212> PRT
<213> Lactobacillus delbrueckii

<400> 495

Met Thr Gly Cys Ala Asp Tyr Asp Val Asp His Ile Met Pro Gln Ser
1 5 10 15

Phe Val Lys Asp Asp Ser Leu Asp Asn Arg Val Leu Val Ala Arg Ala
20 25 30

Val Asn Asn Gln Lys Ser Asp Lys Val Pro Ala Leu Leu Phe Gly Asn
35 40 45

Lys Val Val Ala Asp Leu Gly Ile Thr Val Arg Glu Met Trp Asp Lys
50 55 60

Trp Gln Lys Leu Gly Met Ile Ser Lys Arg Lys Leu Ser Asn Leu Leu
65 70 75 80

Thr Asp Pro Asp Ala Leu Thr Glu Tyr Arg Ala Gln Gly Phe Ile Arg
85 90 95

Arg Gln Leu Val Glu Thr Ser Gln Val Ile Lys Leu Thr Ala Thr Ile
100 105 110

Leu Gln Ser Glu Phe Pro Asp Ser Lys Ile Ile Glu Val Pro Ala Lys
115 120 125

Tyr Asn Ser Ile Val Arg Lys Gln Phe Asp Leu Tyr Lys Ser Arg Glu
130 135 140

Val Asn Asp Phe His His Ala Ile Asp Ala Tyr Leu Ser Thr Ile Val
145 150 155 160

Gly Asn Tyr Leu Tyr Gln Val Tyr Pro Asn Leu Arg Arg Met Phe Val
165 170 175

```
Tyr Gly Glu Phe Lys Lys Phe Ser Ser Asn Ala Glu Glu Ser Ala His
            180                 185                 190

Asp Val Ala Arg Arg Val Lys Ser Met Asn Phe Leu Asp Asp Leu Leu
        195                 200                 205

Arg Gly Thr His Gly Asp Asn Ile Tyr Cys Arg Ser Thr Gly Glu Ile
    210                 215                 220

Val Phe Asn Arg Asn Asp Ile Ile Ser Lys Leu Lys Gln Ala Tyr Ser
225                 230                 235                 240

Phe Lys Gln Met Leu Val Thr Gln Glu Val Phe Thr Lys Lys Ser Ala
                245                 250                 255

Leu Phe Asp Gln Thr Val Tyr Pro Ser Pro Glu Arg Asp Ser Lys Lys
            260                 265                 270

Arg Ser Gly Leu Ile Pro Arg Lys Lys Gly Met Asp Thr Glu Ile Tyr
        275                 280                 285

Gly Gly Tyr Ser Gly Asn Lys Asp Ala Tyr Phe Val Leu Ala Glu Ala
    290                 295                 300

Val Lys Glu Lys Gly His Thr Leu Gln Ile Val Gly Val Pro Ile Arg
305                 310                 315                 320

Ala Leu Asn Thr Leu Lys Asn Ser Ala Asn Tyr Ser Glu Lys Leu Leu
                325                 330                 335

Glu Ile Ile Lys Pro Gln Val Met Phe Asn Lys Asp Thr Gly Lys Pro
            340                 345                 350

Ile Lys Gly Ile Lys Asp Val Lys Ile Leu Met Asp Lys Ile Pro Cys
        355                 360                 365

Arg Gln Pro Val Leu Glu Gly Glu Ser Tyr Tyr Met Leu Ala Ser Ser
    370                 375                 380
```

```
Lys Tyr Arg Tyr Ser Leu Lys Gln Ile Ser Leu Ser Gln Met Ser Met
385                 390                 395                 400


Lys Tyr Ile Leu Asp Tyr Ile Asp Asp Pro Asn Phe Asn Lys His Glu
                405                 410                 415


Met Ile Asn Ile Asp Gln Gln Asp Glu Lys Glu Cys Leu Leu Ser Val
            420                 425                 430


Tyr Asp Glu Ile Leu Glu Lys Met Asp Lys Tyr Leu Pro Leu Phe Asp
        435                 440                 445


Ile Arg Ser Phe Arg Lys Lys Leu His Asp Gly Arg Asp Ala Phe Ile
    450                 455                 460


Ala Leu Pro Val Ala Ser Glu Glu Lys Lys Pro Gly Glu Val Asp Val
465                 470                 475                 480


Ile Arg Lys Ile Leu Lys Gly Leu His Ala Asn Ala Asp Ile Thr Asn
                485                 490                 495


Leu Ala Glu Leu Gly Phe Gly Thr Ala Ala Leu Gly Ala Leu Val Ser
            500                 505                 510


Thr Gly Gly Ile Lys Ile Ser Asp Asp Ala Val Phe Ile Tyr Gln Ser
        515                 520                 525


Pro Thr Gly Leu Phe Glu Arg Arg Val Lys Val Ser Asp Leu Leu Lys
    530                 535                 540


<210>  496
<211>  1356
<212>  PRT
<213>  Lactobacillus farciminis

<400>  496

Met Thr Lys Lys Glu Gln Pro Tyr Asn Ile Gly Leu Asp Ile Gly Thr
```

```
1               5                   10                  15

Ser Ser Val Gly Trp Ala Val Thr Asn Asp Asn Tyr Asp Leu Leu Asn
            20                  25                  30

Ile Lys Lys Lys Asn Leu Trp Gly Val Arg Leu Phe Glu Glu Ala Gln
        35                  40                  45

Thr Ala Lys Glu Thr Arg Leu Asn Arg Ser Thr Arg Arg Arg Tyr Arg
    50                  55                  60

Arg Arg Lys Asn Arg Ile Asn Trp Leu Asn Glu Ile Phe Ser Glu Glu
65                  70                  75                  80

Leu Ala Lys Thr Asp Pro Ser Phe Leu Ile Arg Leu Gln Asn Ser Trp
                85                  90                  95

Val Ser Lys Lys Asp Pro Asp Arg Lys Arg Asp Lys Tyr Asn Leu Phe
            100                 105                 110

Ile Asp Gly Pro Tyr Thr Asp Lys Glu Tyr Tyr Arg Glu Phe Pro Thr
        115                 120                 125

Ile Phe His Leu Arg Lys Glu Leu Ile Leu Asn Lys Asp Lys Ala Asp
    130                 135                 140

Ile Arg Leu Ile Tyr Leu Ala Leu His Asn Ile Leu Lys Tyr Arg Gly
145                 150                 155                 160

Asn Phe Thr Tyr Glu His Gln Lys Phe Asn Ile Ser Asn Leu Asn Asn
                165                 170                 175

Asn Leu Ser Lys Glu Leu Ile Glu Leu Asn Gln Gln Leu Ile Lys Tyr
            180                 185                 190

Asp Ile Ser Phe Pro Asp Asp Cys Asp Trp Asn His Ile Ser Asp Ile
        195                 200                 205
```

```
Leu Ile Gly Arg Gly Asn Ala Thr Gln Lys Ser Ser Asn Ile Leu Lys
    210                 215                 220

Asp Phe Thr Leu Asp Lys Glu Thr Lys Lys Leu Leu Lys Glu Val Ile
225                 230                 235                 240

Asn Leu Ile Leu Gly Asn Val Ala His Leu Asn Thr Ile Phe Lys Thr
                245                 250                 255

Ser Leu Thr Lys Asp Glu Glu Lys Leu Asn Phe Ser Gly Lys Asp Ile
            260                 265                 270

Glu Ser Lys Leu Asp Asp Leu Asp Ser Ile Leu Asp Asp Asp Gln Phe
        275                 280                 285

Thr Val Leu Asp Ala Ala Asn Arg Ile Tyr Ser Thr Ile Thr Leu Asn
    290                 295                 300

Glu Ile Leu Asn Gly Glu Ser Tyr Phe Ser Met Ala Lys Val Asn Gln
305                 310                 315                 320

Tyr Glu Asn His Ala Ile Asp Leu Cys Lys Leu Arg Asp Met Trp His
                325                 330                 335

Thr Thr Lys Asn Glu Glu Ala Val Glu Gln Ser Arg Gln Ala Tyr Asp
            340                 345                 350

Asp Tyr Ile Asn Lys Pro Lys Tyr Gly Thr Lys Glu Leu Tyr Thr Ser
        355                 360                 365

Leu Lys Lys Phe Leu Lys Val Ala Leu Pro Thr Asn Leu Ala Lys Glu
    370                 375                 380

Ala Glu Glu Lys Ile Ser Lys Gly Thr Tyr Leu Val Lys Pro Arg Asn
385                 390                 395                 400

Ser Glu Asn Gly Val Val Pro Tyr Gln Leu Asn Lys Ile Glu Met Glu
```

```
                405                 410                 415

Lys Ile Ile Asp Asn Gln Ser Gln Tyr Tyr Pro Phe Leu Lys Glu Asn
            420                 425                 430

Lys Glu Lys Leu Leu Ser Ile Leu Ser Phe Arg Ile Pro Tyr Tyr Val
        435                 440                 445

Gly Pro Leu Gln Ser Ala Glu Lys Asn Pro Phe Ala Trp Met Glu Arg
    450                 455                 460

Lys Ser Asn Gly His Ala Arg Pro Trp Asn Phe Asp Glu Ile Val Asp
465                 470                 475                 480

Arg Glu Lys Ser Ser Asn Lys Phe Ile Arg Arg Met Thr Val Thr Asp
                485                 490                 495

Ser Tyr Leu Val Gly Glu Pro Val Leu Pro Lys Asn Ser Leu Ile Tyr
            500                 505                 510

Gln Arg Tyr Glu Val Leu Asn Glu Leu Asn Asn Ile Arg Ile Thr Glu
        515                 520                 525

Asn Leu Lys Thr Asn Pro Ile Gly Ser Arg Leu Thr Val Glu Thr Lys
    530                 535                 540

Gln Arg Ile Tyr Asn Glu Leu Phe Lys Lys Tyr Lys Lys Val Thr Val
545                 550                 555                 560

Lys Lys Leu Thr Lys Trp Leu Ile Ala Gln Gly Tyr Tyr Lys Asn Pro
                565                 570                 575

Ile Leu Ile Gly Leu Ser Gln Lys Asp Glu Phe Asn Ser Thr Leu Thr
            580                 585                 590

Thr Tyr Leu Asp Met Lys Lys Ile Phe Gly Ser Ser Phe Met Glu Asp
        595                 600                 605
```

```
Asn Lys Asn Tyr Asp Gln Ile Glu Glu Leu Ile Glu Trp Leu Thr Ile
    610                 615                 620

Phe Glu Asp Lys Gln Ile Leu Asn Glu Lys Leu His Ser Ser Lys Tyr
625                 630                 635                 640

Ser Tyr Thr Pro Asp Gln Ile Lys Lys Ile Ser Asn Met Arg Tyr Lys
                645                 650                 655

Gly Trp Gly Arg Leu Ser Lys Lys Ile Leu Met Asp Ile Thr Thr Glu
            660                 665                 670

Thr Asn Thr Pro Gln Leu Leu Gln Leu Ser Asn Tyr Ser Ile Leu Asp
        675                 680                 685

Leu Met Trp Ala Thr Asn Asn Asn Phe Ile Ser Ile Met Ser Asn Asp
    690                 695                 700

Lys Tyr Asp Phe Lys Asn Tyr Ile Glu Asn His Asn Leu Asn Lys Asn
705                 710                 715                 720

Glu Asp Gln Asn Ile Ser Asp Leu Val Asn Asp Ile His Val Ser Pro
                725                 730                 735

Ala Leu Lys Arg Gly Ile Thr Gln Ser Ile Lys Ile Val Gln Glu Ile
            740                 745                 750

Val Lys Phe Met Gly His Ala Pro Lys His Ile Phe Ile Glu Val Thr
        755                 760                 765

Arg Glu Thr Lys Lys Ser Glu Ile Thr Thr Ser Arg Glu Lys Arg Ile
    770                 775                 780

Lys Arg Leu Gln Ser Lys Leu Leu Asn Lys Ala Asn Asp Phe Lys Pro
785                 790                 795                 800

Gln Leu Arg Glu Tyr Leu Val Pro Asn Lys Lys Ile Gln Glu Glu Leu
```

```
                805                 810                 815

Lys Lys His Lys Asn Asp Leu Ser Ser Glu Arg Ile Met Leu Tyr Phe
            820                 825                 830

Leu Gln Asn Gly Lys Ser Leu Tyr Ser Glu Glu Ser Leu Asn Ile Asn
        835                 840                 845

Lys Leu Ser Asp Tyr Gln Val Asp His Ile Leu Pro Arg Thr Tyr Ile
    850                 855                 860

Pro Asp Asp Ser Leu Glu Asn Lys Ala Leu Val Leu Ala Lys Glu Asn
865                 870                 875                 880

Gln Arg Lys Ala Asp Asp Leu Leu Leu Asn Ser Asn Val Ile Asp Arg
                885                 890                 895

Asn Leu Glu Arg Trp Thr Tyr Met Leu Asn Asn Asn Met Ile Gly Leu
            900                 905                 910

Lys Lys Phe Lys Asn Leu Thr Arg Arg Val Ile Thr Asp Lys Asp Lys
        915                 920                 925

Leu Gly Phe Ile His Arg Gln Leu Val Gln Thr Ser Gln Met Val Lys
    930                 935                 940

Gly Val Ala Asn Ile Leu Asp Asn Met Tyr Lys Asn Gln Gly Thr Thr
945                 950                 955                 960

Cys Ile Gln Ala Arg Ala Asn Leu Ser Thr Ala Phe Arg Lys Ala Leu
                965                 970                 975

Ser Gly Gln Asp Asp Thr Tyr His Phe Lys His Pro Glu Leu Val Lys
            980                 985                 990

Asn Arg Asn Val Asn Asp Phe His  His Ala Gln Asp Ala  Tyr Leu Ala
        995                 1000                1005
```

```
Ser Phe  Leu Gly Thr Tyr Arg  Leu Arg Arg Phe Pro  Thr Asn Glu
    1010                1015                1020

Met Leu  Leu Met Asn Gly Glu  Tyr Asn Lys Phe Tyr  Gly Gln Val
    1025                1030                1035

Lys Glu  Leu Tyr Ser Lys Lys  Lys Lys Leu Pro Asp  Ser Arg Lys
    1040                1045                1050

Asn Gly  Phe Ile Ile Ser Pro  Leu Val Asn Gly Thr  Thr Gln Tyr
    1055                1060                1065

Asp Arg  Asn Thr Gly Glu Ile  Ile Trp Asn Val Gly  Phe Arg Asp
    1070                1075                1080

Lys Ile  Leu Lys Ile Phe Asn  Tyr His Gln Cys Asn  Val Thr Arg
    1085                1090                1095

Lys Thr  Glu Ile Lys Thr Gly  Gln Phe Tyr Asp Gln  Thr Ile Tyr
    1100                1105                1110

Ser Pro  Lys Asn Pro Lys Tyr  Lys Lys Leu Ile Ala  Gln Lys Lys
    1115                1120                1125

Asp Met  Asp Pro Asn Ile Tyr  Gly Gly Phe Ser Gly  Asp Asn Lys
    1130                1135                1140

Ser Ser  Ile Thr Ile Val Lys  Ile Asp Asn Asn Lys  Ile Lys Pro
    1145                1150                1155

Val Ala  Ile Pro Ile Arg Leu  Ile Asn Asp Leu Lys  Asp Lys Lys
    1160                1165                1170

Thr Leu  Gln Asn Trp Leu Glu  Glu Asn Val Lys His  Lys Lys Ser
    1175                1180                1185

Ile Gln  Ile Ile Lys Asn Asn  Val Pro Ile Gly Gln  Ile Ile Tyr
```

```
    1190                1195                1200

Ser Lys  Lys Val Gly Leu Leu  Ser Leu Asn Ser Asp  Arg Glu Val
    1205                1210                1215

Ala Asn  Arg Gln Gln Leu Ile  Leu Pro Pro Glu His  Ser Ala Leu
    1220                1225                1230

Leu Arg  Leu Leu Gln Ile Pro  Asp Glu Asp Leu Asp  Gln Ile Leu
    1235                1240                1245

Ala Phe  Tyr Asp Lys Asn Ile  Leu Val Glu Ile Leu  Gln Glu Leu
    1250                1255                1260

Ile Thr  Lys Met Lys Lys Phe  Tyr Pro Phe Tyr Lys  Gly Glu Arg
    1265                1270                1275

Glu Phe  Leu Ile Ala Asn Ile  Glu Asn Phe Asn Gln  Ala Thr Thr
    1280                1285                1290

Ser Glu  Lys Val Asn Ser Leu  Glu Glu Leu Ile Thr  Leu Leu His
    1295                1300                1305

Ala Asn  Ser Thr Ser Ala His  Leu Ile Phe Asn Asn  Ile Glu Lys
    1310                1315                1320

Lys Ala  Phe Gly Arg Lys Thr  His Gly Leu Thr Leu  Asn Asn Thr
    1325                1330                1335

Asp Phe  Ile Tyr Gln Ser Val  Thr Gly Leu Tyr Glu  Thr Arg Ile
    1340                1345                1350

His Ile  Glu
    1355
```

<210> 497
<211> 1313
<212> PRT

<213> Lactobacillus fermentum

<400> 497

```
Met His Tyr Leu Asp Glu Ile Phe Ala Pro His Leu Gln Glu Val Asp
1               5                  10                  15


Glu Asn Phe Leu Arg Arg Leu Lys Gln Ser Asn Ile His Pro Glu Asp
            20                  25                  30


Pro Ala Lys Asn Gln Ala Phe Ile Gly Lys Leu Leu Phe Pro Asp Leu
        35                  40                  45


Leu Lys Lys Asn Glu Arg Gly Tyr Pro Thr Leu Ile Lys Met Arg Asp
    50                  55                  60


Glu Leu Pro Val Glu Gln Arg Ala His Tyr Pro Val Thr Asn Ile Tyr
65                  70                  75                  80


Lys Leu Arg Glu Ala Met Ile Asn Glu Asp Arg Gln Phe Asp Leu Arg
                85                  90                  95


Glu Val Tyr Leu Ala Val His His Ile Met Lys Tyr Arg Gly His Phe
            100                 105                 110


Leu Asn Asn Ala Ser Val Asp Lys Phe Lys Val Gly Arg Ile Asp Phe
        115                 120                 125


Tyr Lys Ser Phe Asn Val Leu Asn Glu Ala Tyr Glu Glu Leu Gln Asn
    130                 135                 140


Gly Glu Gly Ser Phe Thr Ile Glu Pro Ser Lys Val Glu Lys Ile Gly
145                 150                 155                 160


Gln Leu Leu Leu Asp Thr Lys Met Arg Lys Leu Asn Arg Gln Lys Ala
                165                 170                 175


Val Ala Lys Leu Leu Glu Val Lys Val Ala Asp Lys Glu Glu Thr Lys
            180                 185                 190
```

```
Arg Asn Lys Gln Ile Ala Thr Ala Met Ser Lys Leu Val Leu Gly Tyr
        195                 200                 205

Lys Ala Asp Phe Ala Thr Val Ala Met Ala Asn Gly Asn Glu Trp Lys
    210                 215                 220

Ile Asp Leu Ser Ser Glu Thr Ser Glu Asp Glu Ile Glu Lys Phe Arg
225                 230                 235                 240

Glu Glu Leu Ser Asp Ala Gln Asn Asp Ile Leu Thr Glu Ile Thr Ser
                245                 250                 255

Leu Phe Ser Gln Ile Met Leu Asn Glu Ile Val Pro Asn Gly Met Ser
            260                 265                 270

Ile Ser Glu Ser Met Met Asp Arg Tyr Trp Thr His Glu Arg Gln Leu
        275                 280                 285

Ala Glu Val Lys Glu Tyr Leu Ala Thr Gln Pro Ala Ser Ala Arg Lys
    290                 295                 300

Glu Phe Asp Gln Val Tyr Asn Lys Tyr Ile Gly Gln Ala Pro Lys Glu
305                 310                 315                 320

Arg Gly Phe Asp Leu Glu Lys Gly Leu Lys Lys Ile Leu Ser Lys Lys
                325                 330                 335

Glu Asn Trp Lys Glu Ile Asp Glu Leu Leu Lys Ala Gly Asp Phe Leu
            340                 345                 350

Pro Lys Gln Arg Thr Ser Ala Asn Gly Val Ile Pro His Gln Met His
        355                 360                 365

Gln Gln Glu Leu Asp Arg Ile Ile Glu Lys Gln Ala Lys Tyr Tyr Pro
    370                 375                 380
```

```
Trp Leu Ala Thr Glu Asn Pro Ala Thr Gly Glu Arg Asp Arg His Gln
385                 390                 395                 400

Ala Lys Tyr Glu Leu Asp Gln Leu Val Ser Phe Arg Ile Pro Tyr Tyr
                405                 410                 415

Val Gly Pro Leu Val Thr Pro Glu Val Gln Lys Ala Thr Ser Gly Ala
            420                 425                 430

Lys Phe Ala Trp Ala Lys Arg Lys Glu Asp Gly Glu Ile Thr Pro Trp
        435                 440                 445

Asn Leu Trp Asp Lys Ile Asp Arg Ala Glu Ser Ala Glu Ala Phe Ile
    450                 455                 460

Lys Arg Met Thr Val Lys Asp Thr Tyr Leu Leu Asn Glu Asp Val Leu
465                 470                 475                 480

Pro Ala Asn Ser Leu Leu Tyr Gln Lys Tyr Asn Val Leu Asn Glu Leu
                485                 490                 495

Asn Asn Val Arg Val Asn Gly Arg Arg Leu Ser Val Gly Ile Lys Gln
            500                 505                 510

Asp Ile Tyr Thr Glu Leu Phe Lys Lys Lys Lys Thr Val Lys Val Ser
        515                 520                 525

Asp Val Ala Ser Leu Val Met Ala Lys Thr Arg Gly Val Asn Lys Pro
    530                 535                 540

Ser Val Glu Gly Leu Ser Asp Pro Lys Lys Phe Asn Ser Asn Leu Ala
545                 550                 555                 560

Thr Tyr Leu Asp Leu Lys Ser Ile Val Gly Asp Lys Val Asp Asp Asn
                565                 570                 575

Arg Tyr Gln Thr Asp Leu Glu Asn Ile Ile Glu Trp Arg Ser Val Phe
            580                 585                 590
```

```
Glu Asp Gly Glu Ile Phe Ala Asp Lys Leu Thr Glu Val Glu Trp Leu
        595                 600                 605

Thr Asp Gln Gln Arg Ser Ala Leu Val Lys Lys Arg Tyr Lys Gly Trp
    610                 615                 620

Gly Arg Leu Ser Lys Lys Leu Leu Thr Gly Ile Val Asp Glu Asn Gly
625                 630                 635                 640

Gln Arg Ile Ile Asp Leu Met Trp Asn Thr Asp Gln Asn Phe Met Gln
                645                 650                 655

Ile Val Asn Gln Pro Val Phe Lys Glu Gln Ile Asp Gln Leu Asn Gln
            660                 665                 670

Lys Ala Ile Thr Asn Asp Gly Met Thr Leu Arg Glu Trp Val Glu Ser
        675                 680                 685

Val Leu Asp Gly Ala Tyr Thr Ser Pro Gln Asn Lys Lys Ala Ile Trp
    690                 695                 700

Gln Val Val Arg Val Val Glu Asp Ile Val Lys Ala Val Gly Asn Ala
705                 710                 715                 720

Pro Lys Ser Ile Ser Ile Glu Phe Ala Arg Asn Glu Gly Asn Lys Gly
                725                 730                 735

Glu Ile Thr Arg Ser Arg Arg Thr Gln Leu Gln Lys Leu Phe Glu Asp
            740                 745                 750

Gln Ala His Glu Leu Val Lys Asp Thr Ser Leu Thr Glu Glu Leu Glu
        755                 760                 765

Lys Ala Pro Asp Leu Ser Asp Arg Tyr Tyr Leu Tyr Phe Thr Gln Gly
    770                 775                 780
```

```
Gly Lys Asp Met Tyr Thr Gly Asp Pro Ile Asn Phe Asp Glu Ile Ser
785                 790                 795                 800

Thr Lys Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Phe Val Lys Asp
                805                 810                 815

Asp Ser Leu Asp Asn Arg Val Leu Val Ser Arg Ala Glu Asn Asn Lys
            820                 825                 830

Lys Ser Asp Arg Val Pro Ala Lys Leu Tyr Ala Ala Lys Met Lys Pro
        835                 840                 845

Tyr Trp Asn Gln Leu Leu Lys Gln Gly Leu Ile Thr Gln Arg Lys Phe
    850                 855                 860

Glu Asn Leu Thr Met Asp Val Asp Gln Asn Ile Lys Tyr Arg Ser Leu
865                 870                 875                 880

Gly Phe Val Lys Arg Gln Leu Val Glu Thr Arg Gln Val Ile Lys Leu
                885                 890                 895

Thr Ala Asn Ile Leu Gly Ser Met Tyr Gln Glu Ala Gly Thr Asp Ile
            900                 905                 910

Ile Glu Thr Arg Ala Gly Leu Thr Lys Gln Leu Arg Glu Glu Phe Asp
        915                 920                 925

Leu Pro Lys Val Arg Glu Val Asn Asp Tyr His His Ala Val Asp Ala
    930                 935                 940

Tyr Leu Thr Thr Phe Ala Gly Gln Tyr Leu Asn Arg Arg Tyr Pro Lys
945                 950                 955                 960

Leu Arg Ser Phe Phe Val Tyr Gly Glu Tyr Met Lys Phe Lys His Gly
                965                 970                 975

Ser Asp Leu Lys Leu Arg Asn Phe Asn Phe Phe His Glu Leu Met Glu
            980                 985                 990
```

```
Gly Asp Lys Ser Gln Gly Lys Val  Val Asp Gln Gln Thr  Gly Glu Leu
        995                 1000                1005


Ile Thr  Thr Arg Asp Glu Val  Ala Lys Ser Phe Asp  Arg Leu Leu
    1010                1015                1020


Asn Met  Lys Tyr Met Leu Val  Ser Lys Glu Val His  Asp Arg Ser
    1025                1030                1035


Asp Gln  Leu Tyr Gly Ala Thr  Ile Val Thr Ala Lys  Glu Ser Gly
    1040                1045                1050


Lys Leu  Thr Ser Pro Ile Glu  Ile Lys Lys Lys Arg  Pro Val Asp
    1055                1060                1065


Leu Tyr  Gly Ala Tyr Thr Asn  Gly Thr Ser Ala Phe  Met Thr Ile
    1070                1075                1080


Ile Lys  Phe Thr Gly Asn Lys  Pro Lys Tyr Lys Val  Ile Gly Val
    1085                1090                1095


Pro Thr  Thr Ser Ala Val Gly  Leu Lys Arg Val Gly  Lys Pro Gly
    1100                1105                1110


Ser Glu  Ser Tyr Asn Gln Glu  Leu His Arg Ile Ile  Lys Ser Asn
    1115                1120                1125


Pro Lys  Val Lys Lys Asp Phe  Glu Ile Val Val Pro  His Val Ser
    1130                1135                1140


Tyr Ser  Gln Leu Ile Val Asp  Asp Asp Cys Lys Phe  Thr Leu Ala
    1145                1150                1155


Ser Asp  Thr Tyr Gln His Pro  Ala Thr Gln Leu Val  Leu Ser Lys
    1160                1165                1170
```

```
Glu Ser  Met Glu Ile Ile Ala  Asp Asp Phe Lys Phe  Val Lys Glu
    1175                 1180                 1185


Asn Thr  Ala Thr Ala Asp Glu  Gln Leu Val Arg Val  Phe Asp Glu
    1190                 1195                 1200


Ile Val  Asn Gln Met Asn His  Tyr Phe Thr Ile Phe  Asp Gln Arg
    1205                 1210                 1215


Ser Asn  Arg Gln Lys Val Thr  Lys Ala Arg Asp Lys  Phe Val Ser
    1220                 1225                 1230


Leu Pro  Thr Glu Ser Glu Tyr  Glu Gly Ala Lys Lys  Thr Gln Val
    1235                 1240                 1245


Gly Lys  Thr Glu Val Ile Thr  Asn Leu Leu Met Gly  Leu His Ala
    1250                 1255                 1260


Asn Ser  Ala Gln Gly Asp Leu  Lys Val Leu Gly Leu  Ser Thr Phe
    1265                 1270                 1275


Gly Phe  Phe Gln Ser Ser Gly  Gly Leu Asn Leu Ser  Glu Asp Ala
    1280                 1285                 1290


Met Ile  Val Tyr Gln Ser Pro  Thr Gly Leu Phe Glu  Arg Arg Ile
    1295                 1300                 1305


Cys Leu  Lys Asp Ile
    1310
```

<210> 498
<211> 1327
<212> PRT
<213> Lactobacillus florum

<400> 498

```
Met Thr Glu Gln Gln Gln Pro Tyr Asn Ile Gly Leu Asp Ile Gly Thr
1               5                  10                  15
```

```
Ser Ser Ile Gly Trp Ala Val Thr Asp Gln Asn Asp Lys Leu Leu His
            20                  25                  30

Ile Arg Gly His Asn Gly Ile Gly Val Arg Leu Phe Lys Glu Gly Glu
        35                  40                  45

Ser Ala Ala Glu Arg Arg Gly Phe Arg Thr Thr Arg Arg Arg Leu Ser
    50                  55                  60

Arg Arg Arg Trp Arg Leu Arg Phe Leu Asp Arg Ile Phe Asp Ala Glu
65                  70                  75                  80

Leu Ala Lys Val Asp Pro Asn Phe Leu Ala Arg Leu Lys Gln Ser Asn
                85                  90                  95

Ile Ser Pro Leu Asp Pro Asn Lys Gln Met Phe Gly Asn Ile Leu Phe
            100                 105                 110

Asp Asp Pro Gln Phe Asp Asp Gln Lys Phe His Gln Gln Tyr Pro Thr
        115                 120                 125

Ile Tyr His Leu Arg Ser Ala Leu Ala Gln Pro Asp Ala Pro Gln Ala
    130                 135                 140

Asp Val Arg Leu Ile Tyr Leu Ala Leu His His Met Ile Lys Phe Arg
145                 150                 155                 160

Gly His Phe Leu Asn Gly Ala Ala Val Glu Lys Phe His Gly Gly Gln
                165                 170                 175

Leu His Leu Glu Ser Glu Phe Gln Glu Leu Asn Gln Ile Phe Ser Asn
            180                 185                 190

Gln Gln Arg Asp His Val Gln Leu Gln Thr Ser Ser Leu Asp Glu Val
        195                 200                 205

Ala Thr Ile Leu Lys Asp Asn Gln Arg Thr Pro Ser Asp Arg Gln Arg
```

```
    210                 215                 220

Glu Leu Ser Ala Arg Leu Phe Val Pro Val Asp Lys Thr Ile Asp Lys
225                 230                 235                 240

Glu Asn Lys Lys Leu Ala Thr Glu Leu Leu Lys Ala Val Leu Gly Leu
                245                 250                 255

Lys Ala Lys Phe Asp Val Ile Leu Gly Val Glu Ala Thr Asp Pro Gln
            260                 265                 270

Ala Phe Lys Leu Gln Phe Ser Ser Asp Asp Phe Asp Asp Lys Ile Ala
        275                 280                 285

Glu Leu Ala Ser Glu Leu Thr Asp Glu Ala Asn Glu Ile Leu Thr Val
    290                 295                 300

Leu Gln Arg Leu Tyr Phe Ser Leu Asn Leu Ala Asp Ile Leu Thr Asn
305                 310                 315                 320

Arg Gln Thr Lys Gln Val Ala Asp Ser Ile Ser Thr Ala Met Ile Asn
                325                 330                 335

Arg Tyr Asp Asp His Lys His His Leu Lys Met Leu Lys Glu Leu Glu
            340                 345                 350

Ala Gln Val Thr Gln Glu Gln Arg Asp Gly Leu Lys Lys Ala Tyr Asp
        355                 360                 365

Glu Tyr Ile Asp Gly Asp Lys Pro Thr Ile Asp Thr Phe Tyr Thr Asn
    370                 375                 380

Ile Lys Lys Asn Leu Asp Asp Ser Glu Leu Ala Asn Gln Ile Lys Ser
385                 390                 395                 400

Leu Ile Asp Leu Gln Ala Phe Met Pro Lys Gln Arg Ser Lys Glu Asn
                405                 410                 415
```

```
Gly Ser Ile Pro His Gln Leu His Gln Arg Glu Leu Asp Gln Leu Ile
            420                 425                 430

Glu Val Gln Gly Lys Tyr Tyr Pro Trp Leu Leu Ala Ala Lys Asp Lys
        435                 440                 445

Leu Asp Ala Leu Ile Ala Phe Arg Val Pro Tyr Tyr Val Gly Pro Met
    450                 455                 460

Ile Asp Pro Asn Gln Ser Asp Asp Pro Gln Asn Thr Lys Phe Ala Trp
465                 470                 475                 480

Met Val Arg Lys Glu Ala Gly Glu Ile Thr Pro Trp Asn Phe Glu Glu
                485                 490                 495

Lys Val Asp Lys Thr Ser Ser Ala Thr Asn Phe Ile Lys Arg Met Thr
            500                 505                 510

Thr Thr Asp Thr Tyr Leu Leu Gly Glu Pro Val Leu Pro Lys Asn Ser
        515                 520                 525

Leu Leu Tyr Gln Gln Phe Thr Val Leu Asn Glu Leu Asn Lys Leu Lys
    530                 535                 540

Val Asn Gly Lys Ala Leu Thr Val Asp Gln Lys Lys Tyr Leu Tyr Glu
545                 550                 555                 560

His Val Cys Lys Lys Gln Arg Arg Val Thr Leu Lys Lys Leu Ser Asp
                565                 570                 575

Cys Leu Met Ala Arg Gly Asp Phe Pro Met Gly Ala Ile Phe Thr Gly
            580                 585                 590

Thr Thr Asp Gln Lys Asn Met Asn Asn Thr Leu Lys Thr Tyr Gln Asp
        595                 600                 605

Phe Gln Glu Ile Phe Gly Asp Glu Ile Asp Asn Pro Asp Arg Gln Val
```

```
    610                 615                 620

Asp Phe Glu Lys Met Ile Glu Trp Ser Ala Ile Phe Glu Asp Arg Glu
625                 630                 635                 640

Ile Phe Lys Leu Lys Leu Ala Glu Leu Asn Trp Leu Thr Ser Glu Gln
                645                 650                 655

Leu Glu Arg Val Ser Lys Lys Arg Tyr Gln Gly Trp Gly Arg Leu Ser
            660                 665                 670

Gln Lys Leu Leu Thr His Ile Val Asn Glu Asn Gly Glu Arg Ile Ile
        675                 680                 685

Asp Gln Leu Trp Asn Thr Asn Gln Asn Phe Met Glu Ile Met Gly Gln
    690                 695                 700

Asp Ser Val Lys Gln Ala Ile Gln Glu His Asn Gly Ala Asn Val Ala
705                 710                 715                 720

Gln Thr Gly Ile Asn Glu Thr Ile Asp Glu Leu Tyr Thr Ser Pro Gln
                725                 730                 735

Asn Lys Lys Ala Ile Arg Gln Ile Leu Leu Val Val Asp Asp Ile Lys
            740                 745                 750

Lys Ala Val Gly Tyr Ala Pro Ala Asn Ile Met Met Glu Phe Ala Arg
        755                 760                 765

Glu Asp Arg Asp Asp His Arg Leu Ile Ala Ser Arg Ala Arg Gln Leu
    770                 775                 780

Glu Lys Thr Tyr Gln Glu Ile Ser Lys Asn Trp Phe Asp Asn Glu Ser
785                 790                 795                 800

Val Thr Gln Glu Leu Lys Asp Gln Ile Lys Asn Lys Thr Lys Phe Thr
                805                 810                 815
```

```
Asp Arg Leu Tyr Leu Tyr Phe Ile Gln Gly Gly Ile Asp Leu Tyr Thr
            820                 825                 830

Gly His Pro Leu Asn Ile Asp Gln Leu Ser Ser Tyr Asp Ile Asp His
        835                 840                 845

Ile Leu Pro Gln Ser Phe Leu Leu Asp Asn Ser Leu Asn Asn Arg Val
    850                 855                 860

Leu Thr Ser Gln Ala Glu Asn Arg Val His Lys Glu Asp Arg Leu Pro
865                 870                 875                 880

Gly Glu Thr Val Ala Asn Lys Met Arg Pro Thr Trp Lys Met Met Arg
                885                 890                 895

Glu Gln Gly Leu Met Thr Gln Arg Lys Tyr Asn Asn Leu Thr Leu Lys
            900                 905                 910

Pro Asp Gln Ile Ser Lys Phe Asn Asn Arg Gly Gln Phe Ile Asn Arg
        915                 920                 925

Gln Leu Val Glu Thr Arg Gln Val Ile Lys Leu Ala Ala Asp Ile Met
    930                 935                 940

Ser Gln Lys Tyr Gln Ala Asp Gln Thr Lys Val Val Thr Val Lys Ala
945                 950                 955                 960

Asn Leu Thr His His Met Arg Glu Lys Phe Asn Phe Tyr Lys Ser Arg
                965                 970                 975

Asn Val Asn Asp Tyr His His Ala Phe Asp Ala Tyr Leu Thr Leu Phe
            980                 985                 990

Val Gly Asn Trp Leu Leu Lys Glu  Tyr Pro Lys Leu Gln  Pro Tyr Phe
        995                 1000                1005

Val Tyr  Gly Asp Phe Ala Lys  Thr Gly Thr Asn Asn  Leu Lys Ser
```

```
    1010                1015                1020

Phe Asn  Phe Leu Tyr Arg Phe  Glu Arg Asp His Lys  Leu Asn Asp
    1025                1030                1035

Lys Gly  Ala Ile Asp Thr Asp  Lys Asp Gln Gln Leu  Gly Tyr Met
    1040                1045                1050

Lys Arg  Ile Tyr Arg Phe Lys  Lys Met Leu Val Thr  Lys Gln Leu
    1055                1060                1065

Glu Thr  Asn Glu Gly Ala Leu  Tyr Gly Gln Thr Leu  Tyr Pro Ala
    1070                1075                1080

Pro Lys  Asn Asp Lys Lys Thr  Arg Asn Leu Ile Asn  Ser Lys Lys
    1085                1090                1095

Asn Arg  Pro Ser Asp Ile Tyr  Gly Gly Tyr Ser Asn  Glu Asn Gly
    1100                1105                1110

Ser Phe  Leu Thr Leu Val Lys  Leu Lys Lys Gly Ser  Lys Tyr Asp
    1115                1120                1125

Tyr Arg  Leu Val Ala Val Pro  Val Ser Lys Ile Ser  Glu Ile Lys
    1130                1135                1140

Glu Ser  Glu Leu Ala Thr Ile  Glu Lys Ala Ile Ala  Pro Gln Phe
    1145                1150                1155

Leu Lys  Ser Ser Gly Lys Tyr  Arg Asp Phe Gln Val  Val Leu Ser
    1160                1165                1170

Lys Ile  Leu Ile Asn Gln Lys  Val Ile Asp Asp Gly  Met Ile Phe
    1175                1180                1185

Thr Ile  Gly Ser Lys Ser Tyr  Lys His Asn Ala Lys  Gln Val Val
    1190                1195                1200
```

```
Leu Ser  Asp Asn Ser Ile Gln  Ile Val Ser Thr Leu  Ser Arg Ile
    1205                1210                1215


Ser Asp  Lys Glu Lys Leu Ile  Thr Val Phe Asp Glu  Ile Val Asp
    1220                1225                1230


Ile Thr  Ser Lys Tyr Leu Pro  Trp Tyr Lys Val Asn  Asp Val Glu
    1235                1240                1245


Lys Thr  Lys Met Leu Phe Arg  Gln Met Gln Asp Ile  Asp Glu Met
    1250                1255                1260


Lys Lys  Ile Ile Asp Asn Ser  Leu Ile Gly Leu His  Cys Asn Ala
    1265                1270                1275


Ser Ile  Thr Asp Leu Gly Lys  Val Gly Leu Ser Lys  Tyr Trp Gly
    1280                1285                1290


Arg Phe  Val Leu Thr Ala Gly  Ile Ser Leu Thr Val  Asp Ala Gln
    1295                1300                1305


Leu Ile  Tyr Gln Ser Pro Thr  Gly Leu Phe Glu His  Arg Val Lys
    1310                1315                1320


Val Ser  Asp Leu
    1325
```

<210> 499
<211> 1386
<212> PRT
<213> Lactobacillus hominis

<400> 499

```
Met Thr Lys Ile Thr Glu Asp Tyr Ile Val Gly Leu Asp Ile Gly Thr
1               5                   10                  15


Asn Ser Cys Gly Trp Val Ala Met Asp Ser Lys Asn Thr Ile Leu Arg
            20                  25                  30
```

```
Met His Gly Lys Thr Ala Ile Gly Ser His Leu Phe Asp Ala Gly Asn
        35                  40                  45

Ser Ala Ala Asp Arg Arg Ala Phe Arg Thr Thr Arg Arg Arg Ile Lys
    50                  55                  60

Arg Arg Lys Trp Arg Leu Lys Leu Leu Glu Glu Ile Phe Asp Ser His
65                  70                  75                  80

Leu Ala Lys Val Asp Pro Tyr Phe Phe Ala Arg Leu Lys Glu Ser Gly
                85                  90                  95

Leu Ser Pro Leu Asp Thr Arg Lys Asn Val Ser Ser Ile Ile Tyr Pro
            100                 105                 110

Thr Ser Leu Glu Asp Lys Lys Phe Tyr Val Asp Asn Pro Thr Ile Tyr
        115                 120                 125

His Leu Arg Tyr Lys Leu Met Thr Glu Asp Arg Lys Phe Asp Leu Arg
    130                 135                 140

Glu Val Tyr Leu Ala Ile His His Ile Val Lys Tyr Arg Gly Asn Phe
145                 150                 155                 160

Leu Tyr Asn Thr Pro Val Lys Ala Phe Glu Ala Ser Lys Ile Asp Val
                165                 170                 175

Lys Gly Ser Leu Lys Lys Leu Asn Glu Leu Tyr Glu Gly Leu Asp Ser
            180                 185                 190

Glu Phe Asn Val Glu Leu Asp Ser Asn Asn Ala Leu Glu Ile Glu Asn
        195                 200                 205

Ile Ile Arg Asp Lys Lys Ile Phe Lys Ile Asn Lys Val Lys Glu Ile
    210                 215                 220
```

```
Asn Gln Leu Leu Ser Leu Lys Thr Glu Asp Lys Glu Arg Thr Lys Leu
225                 230                 235                 240

Met Lys Asp Val Ser Lys Gln Ile Val Asn Ala Ile Leu Gly Tyr Lys
                245                 250                 255

Thr Lys Phe Glu Thr Ile Leu Leu Lys Asp Val Ser Lys Asp Glu Ala
            260                 265                 270

Asp Asp Trp Glu Phe Lys Leu Thr Asp Val Asp Ala Asp Asn Lys Phe
        275                 280                 285

Glu Asn Leu Ile Gly Asp Leu Asn Glu Asn Glu Gln Glu Ile Leu Leu
    290                 295                 300

Val Ile Arg Lys Leu Ala Asn Ala Ile Thr Leu Ser Asn Ile Val Glu
305                 310                 315                 320

Glu Gly Lys Thr Leu Ser Glu Ser Met Lys Asp Lys Tyr Lys Lys His
                325                 330                 335

Ser Asp Asp Leu Lys Leu Leu Lys Gln Val Ile Ser Asp His Pro Asp
            340                 345                 350

Arg Asp Lys Ala Lys Lys Leu Ala Leu Ala Tyr Asp Leu Tyr Val Asn
        355                 360                 365

Asn Arg His Gly Lys Ile Leu Gln Ala Lys Asp Ile Leu Glu Lys Lys
    370                 375                 380

Lys Thr Leu Ser Lys Glu Asp Phe Tyr Lys Glu Ile Lys Lys Asn Leu
385                 390                 395                 400

Asp Asp Ser Lys Glu Ser Gln Glu Ile Leu Asp Ala Ile Ser Leu Asp
                405                 410                 415

Ser Phe Met Pro Lys Gln Arg Thr Asn Glu Asn Gly Val Ile Pro Tyr
            420                 425                 430
```

```
Gln Leu His Gln Leu Glu Leu Asp Lys Ile Ile Glu Asn Gln Gly Lys
        435                 440                 445

Tyr Tyr Pro Phe Leu Lys Glu Val Asn Pro Val Ser Ser His Leu Lys
    450                 455                 460

Gln Ala Pro Tyr Lys Leu Asp Glu Leu Ile Arg Phe Arg Val Pro Tyr
465                 470                 475                 480

Tyr Val Gly Pro Leu Ile Ser Pro Asn Glu Ser Thr Lys Asn Lys Gln
                485                 490                 495

Thr Lys Lys Asn Gln Asn Phe Ala Trp Met Ile Arg Lys Glu Gln Gly
            500                 505                 510

Gln Ile Thr Pro Trp Asn Phe Asp Gln Lys Val Asp Arg Met Ala Ser
        515                 520                 525

Ala Asn Lys Phe Ile Lys Arg Met Thr Thr Ile Asp Thr Tyr Leu Leu
    530                 535                 540

Gly Glu Asp Val Leu Pro Ala Asn Ser Leu Leu Tyr Gln Lys Phe Thr
545                 550                 555                 560

Val Leu Asn Glu Leu Asn Asn Val Lys Ile Asn Gly Lys Arg Ile Ser
                565                 570                 575

Val Pro Leu Lys Gln Glu Leu Tyr Asn Asn Leu Phe Lys Lys Asn Ser
            580                 585                 590

Thr Val Thr Thr Asn Lys Leu Lys Ser Tyr Leu Lys Glu Asn Tyr Lys
        595                 600                 605

Leu Ile Lys Val Glu Ile Lys Gly Leu Ser Asp Glu Lys Lys Phe Asn
    610                 615                 620
```

```
Ser Gly Leu Thr Thr Tyr Asn Lys Leu Lys Asn Leu Lys Ile Phe Asp
625                 630                 635                 640


Gln Gln Ile Asp Asp Pro Asn Tyr Asn Lys Asp Phe Glu Arg Ile Ile
                645                 650                 655


Glu Trp Ser Thr Ile Phe Glu Asp Lys Ala Ile Tyr Lys Glu Lys Leu
            660                 665                 670


Lys Thr Ile Asp Trp Leu Ser Asp Arg Gln Ile Asp Lys Leu Ser Lys
        675                 680                 685


Ile Arg Met Gln Gly Trp Gly Gln Leu Ser Lys Lys Leu Leu Ser Gln
    690                 695                 700


Leu Thr Asp Asn Asn Gly Gln Thr Ile Ile Glu Gln Leu Trp Asp Ser
705                 710                 715                 720


Gln Asn Asn Phe Met Gln Ile Val Asn Gln Ala Asp Phe Lys Asp Ala
                725                 730                 735


Ile Ala Val Ala Asn Gln Asn Leu Leu Val Asp Thr Ser Val Glu Asp
            740                 745                 750


Ile Leu Asn Glu Ala Tyr Thr Ser Pro Ala Asn Lys Lys Ala Ile Arg
        755                 760                 765


Gln Val Val Lys Val Val Asp Asp Ile Val Lys Ala Thr Ser Gly Lys
    770                 775                 780


Val Pro Lys Gln Ile Ala Ile Glu Phe Thr Arg Asp Ala Asp Asp Asn
785                 790                 795                 800


Ala Lys Ile Ser Gln Ser Arg Ala Asn Lys Leu Arg Lys Val Tyr Lys
                805                 810                 815


Glu Met Ser Asn Glu Leu Ala Ser Glu Thr Ile Arg Asn Glu Leu Glu
            820                 825                 830
```

```
Arg Val Ala Lys Asp Gln Lys Leu Leu Lys Asp Lys His Tyr Leu Tyr
        835                 840                 845

Phe Met Gln Leu Gly Arg Asp Ala Tyr Thr Gly Glu Leu Ile Asp Ile
    850                 855                 860

Asp Asn Leu Glu Gln Tyr Asp Ile Asp His Val Leu Pro Gln Ser Phe
865                 870                 875                 880

Ile Lys Asp Asp Ser Leu Glu Asn Arg Val Leu Val Lys Lys Ala Val
                885                 890                 895

Asn Asn Gly Lys Ser Asp Asn Val Pro Val Lys Leu Tyr Gly Asn Arg
            900                 905                 910

Met Ala Thr Asp Leu Gly Met Thr Ile Arg His Met Trp Glu Lys Trp
        915                 920                 925

Lys Glu Gln Gly Leu Ile Thr Lys Thr Lys Tyr Asn Asn Leu Ile Ile
    930                 935                 940

Asp Pro Asp Lys Ile Asn Lys Tyr Glu Ser Ser Gly Phe Ile His Arg
945                 950                 955                 960

Gln Leu Val Glu Thr Ser Gln Ile Ile Lys Leu Val Ser Thr Ile Leu
                965                 970                 975

Gln Ser Lys Tyr Pro Asp Thr Glu Ile Ile Val Val Lys Ala Arg Tyr
            980                 985                 990

Asn His Tyr Leu Arg Lys Arg Leu  Asn Leu Tyr Lys Ser  Arg Glu Val
        995                 1000                1005

Asn Asp  Tyr His His Ala Ile  Asp Ala Tyr Leu Ser  Ala Ile Cys
    1010                1015                1020
```

```
Gly Asn  Leu Leu Tyr Gln Val  Tyr Pro Tyr Leu Arg  Pro Phe Phe
    1025                1030                1035

Val Tyr  Gly Gln Tyr Lys Lys  Phe Ser Ser Glu Pro  Glu Lys Glu
    1040                1045                1050

Lys Ile  Ile Tyr Asp Lys Thr  Arg Arg Tyr Asn Phe  Ile Ser Gln
    1055                1060                1065

Ile Phe  Glu Asn Lys Asp Asn  Asp Ile Ile Ser Arg  Glu Thr Lys
    1070                1075                1080

Lys Lys  Val Phe Asp Lys Lys  Asp Ile Ile Glu Lys  Leu Lys Arg
    1085                1090                1095

Ala Tyr  Asn Tyr Lys Tyr Met  Leu Val Ser Arg Glu  Thr Glu Thr
    1100                1105                1110

His Asp  Gln Glu Met Phe Lys  Met Thr Val Tyr Pro  Arg Leu Ser
    1115                1120                1125

Arg Asp  Thr Lys Lys Ser Arg  Asn Leu Ile Pro Lys  Lys Lys Asp
    1130                1135                1140

Met Pro  Thr Glu Ile Tyr Gly  Gly Tyr Thr Asn Asn  Ser Asp Ala
    1145                1150                1155

Tyr Met  Ile Ile Ala Arg Ile  Asn Lys Lys Lys Gly  Pro Glu Tyr
    1160                1165                1170

Arg Val  Phe Gly Val Pro Met  Arg Glu Leu Val Asn  Leu Arg Lys
    1175                1180                1185

Ala Glu  Lys Asn Gly His Tyr  Lys Ala Tyr Leu Lys  Gln Val Leu
    1190                1195                1200

Glu Pro  Glu Ile Met Tyr Ser  Lys Asn Gly Lys Lys  Asn Lys Thr
    1205                1210                1215
```

```
Ile Ser  Ser Phe Glu Ile Val  Lys Ala Lys Val Pro  Tyr Lys Gln
    1220                1225                1230

Val Ile  Leu Asp Gly Asp Lys  Lys Phe Met Leu Ala  Ser Ser Thr
    1235                1240                1245

Tyr Val  Gln Asn Ala Lys Gln  Leu Thr Leu Ser Gln  Tyr Ser Met
    1250                1255                1260

Gln Ala  Ile Thr Asp Asn Cys  Glu Asn Asp Thr Glu  Glu Glu Lys
    1265                1270                1275

Ala Leu  Val Glu Ala Tyr Asp  Glu Ile Leu Thr Asn  Ile Asp Lys
    1280                1285                1290

Tyr Leu  Pro Leu Phe Asp Ile  Asn Lys Phe Arg Glu  Lys Leu His
    1295                1300                1305

Ala Gly  Arg Glu Lys Phe Val  Asp Leu Pro Leu Ala  Glu Lys Lys
    1310                1315                1320

Glu Thr  Ile Leu Gln Val Leu  Asn Gly Leu His Asp  Asn Ala Val
    1325                1330                1335

Met Pro  Lys Ile Lys Ser Leu  Gly Leu Ser Thr Pro  Leu Gly Phe
    1340                1345                1350

Met Gln  Phe His Thr Gly Val  Ser Leu Ser Glu Asn  Ala Lys Leu
    1355                1360                1365

Ile Tyr  Gln Ser Pro Thr Gly  Leu Phe Glu Lys Arg  Leu Lys Ile
    1370                1375                1380

Ser Asp  Leu
    1385
```

<210> 500
<211> 270
<212> PRT
<213> Lactobacillus iners

<400> 500

Met Ile Thr Tyr Leu Lys Asp Asn Asp Asp Ile Thr Leu Ser Phe Pro
1 5 10 15

Lys Asp Gln Leu Ile Asn Ile Phe Lys Asn Ser Asn Leu Asn Ser Thr
20 25 30

Glu Lys Ser Asp Gln Leu Lys Pro Phe Phe Gly Arg Thr Asn Leu Glu
35 40 45

Lys Gly Ile Ile Lys Leu Leu Ser Gly Gly Lys Gln Asp Leu Ser Asn
50 55 60

Met Phe Arg Asp Glu Thr Leu Lys Asn Ser Asn Tyr Lys Asn Leu Lys
65 70 75 80

Phe Ser Asp Asn Arg Phe Asp Asp Glu Arg Asp Gly Tyr Ala Ala Asp
85 90 95

Leu Gly Asp Arg Ile Asp Leu Leu Ile Leu Leu Lys Gln Ile Tyr Asp
100 105 110

Ala Ser Ile Leu Glu Ser Met Met Ser Gln Ala Arg Val Ser Ile Asp
115 120 125

Gly His Lys Tyr Ile Ser Ser Ala Lys Val Cys Ala Tyr Glu Lys His
130 135 140

Lys Ser Asp Leu Lys Arg Leu Lys Ser Leu Ile Lys Lys Tyr Leu Pro
145 150 155 160

Ser Glu Tyr Asn Asn Ile Phe Arg Lys Ile Thr Glu Lys Asp Asn Tyr
165 170 175

```
Val Ala Tyr Ser Lys Ser Asn Ile Thr Asn Asn Lys Arg Glu Lys Ala
            180                 185                 190


Leu Lys Tyr Val Lys Tyr Val Asp Phe Thr Lys Tyr Leu Thr Lys Lys
        195                 200                 205


Leu Lys Thr Ile Lys Thr Gln Asp Ala Glu Asp Asp Gln Glu Ile Phe
    210                 215                 220


Glu Ile Lys Gly Glu Leu Glu Lys Gln Ser Phe Leu Pro Lys Gln Arg
225                 230                 235                 240


Thr Leu Asp Asn Ser Ile Ile Pro Tyr Gln Leu His Leu Met Glu Leu
                245                 250                 255


Lys Lys Tyr Leu Ile Ile Asn Leu Asn Ile Met Thr Phe Cys
            260                 265                 270
```

<210> 501
<211> 255
<212> PRT
<213> Lactobacillus iners

<400> 501

```
Met Ile Thr Tyr Leu Lys Asp Asn Asp Asp Ile Thr Leu Ser Phe Pro
1               5                   10                  15


Lys Asp Gln Leu Ile Asn Ile Phe Lys Asn Ser Asn Leu Asn Ser Thr
            20                  25                  30


Glu Lys Ser Asp Gln Leu Lys Pro Phe Phe Gly Arg Thr Asn Leu Glu
        35                  40                  45


Lys Gly Ile Ile Lys Leu Leu Ser Gly Gly Lys Gln Asp Leu Ser Asn
    50                  55                  60


Met Phe Arg Asp Glu Thr Leu Lys Asn Ser Asn Tyr Lys Asn Leu Lys
65                  70                  75                  80
```

```
Phe Ser Asp Asn Thr Phe Asp Asp Glu Arg Asp Gly Tyr Ala Ala Asp
                85                  90                  95

Leu Gly Asp Arg Ile Asn Leu Leu Ile Leu Leu Lys Gln Ile Tyr Asp
            100                 105                 110

Ala Ser Ile Leu Glu Ser Met Met Ser Gln Ala Arg Val Ser Ile Asp
        115                 120                 125

Gly His Lys Tyr Ile Ser Ser Ala Lys Val Cys Ala Tyr Glu Lys His
    130                 135                 140

Lys Ser Asp Leu Lys Arg Leu Lys Ser Leu Ile Lys Lys Tyr Leu Pro
145                 150                 155                 160

Ser Glu Tyr Asn Asn Ile Phe Arg Lys Ile Thr Glu Lys Asp Asn Tyr
                165                 170                 175

Val Ala Tyr Ser Lys Ser Asn Ile Thr Asn Asn Lys Arg Glu Lys Ala
            180                 185                 190

Leu Lys Tyr Val Glu Tyr Val Asp Phe Thr Lys Tyr Leu Thr Lys Lys
        195                 200                 205

Leu Lys Thr Ile Lys Thr Gln Asp Ala Glu Asp Asp Lys Glu Ile Phe
    210                 215                 220

Glu Ile Lys Gly Glu Leu Glu Lys Gln Ser Phe Leu Pro Lys Gln Arg
225                 230                 235                 240

Thr Leu Asp Asn Ser Ile Ile Pro Tyr Gln Leu His Leu Met Glu
                245                 250                 255
```

<210> 502
<211> 343
<212> PRT
<213> Lactobacillus iners

<400> 502

```
Met Leu Ala Lys Asp Asp Gln Glu Gly Ile Thr Val Lys Asp Lys Ile
1               5                  10                  15

Ile Ser Leu Leu Thr Phe Arg Leu Pro Tyr Tyr Ile Gly Pro Val Asn
            20                  25                  30

Pro Ala Val His Gly Lys Phe Ala Trp Val Lys Arg Leu Ala Asn Gly
        35                  40                  45

Lys Val Thr Pro Trp Asn Tyr Lys Glu Lys Ile Asp Ile Asp Ala Ser
    50                  55                  60

His Glu Glu Phe Ile Lys Thr Lys Leu Ser Lys Cys Ser Phe Leu Ile
65                  70                  75                  80

Gly Cys Asp Val Leu Pro Lys Asn Ser Leu Leu Tyr Gln Lys Tyr Met
                85                  90                  95

Val Leu Ser Glu Leu Asn Thr Ile Lys Phe Asn Gly Val Asn Ile Ser
            100                 105                 110

Glu Lys Leu Lys Asp Asp Ile Tyr Gln Asn Leu Phe Lys Asn Ile Gln
        115                 120                 125

Lys Val Thr Lys Lys Arg Leu Gln Asn Tyr Ile Lys Glu His Glu Asn
    130                 135                 140

Ile Ile Gly Asp Val Ile Val Thr Gly Ile Asp Asn Ala Phe Lys Gln
145                 150                 155                 160

Gly Leu Val Ser Tyr Leu Lys Phe Lys Lys Ile Ile Gly Asp Lys Ile
                165                 170                 175

Asp Asp Asp Arg Tyr Gln Lys Val Leu Glu Lys Ile Ile Arg Asp Ile
            180                 185                 190
```

```
Thr Leu Tyr Asp Glu Cys Ala Gly Lys Lys Ile Lys Lys Glu Tyr Lys
        195                 200                 205

Asp Ser Asp Leu Phe Thr Glu Asp Glu Leu Asn Lys Ile Val Lys Leu
    210                 215                 220

Thr Phe Asn Asp Trp Gly Arg Leu Ser Ala Glu Leu Leu Asp Gln Leu
225                 230                 235                 240

Glu Gly Glu Asp Thr Val Ser Gly Glu Thr Gly Lys Ile Ile Glu Phe
                245                 250                 255

Met Gln Lys His Asn Tyr Asn Leu Met Gln Leu Met Ser Lys Lys Phe
            260                 265                 270

Thr Phe Lys Tyr Lys Ile Asp Glu Ile Asn Lys Ser Tyr Tyr Gln His
        275                 280                 285

Asp Lys Phe Asn Tyr Lys Ser Met Ile Asp Ser Leu Tyr Val Ser Pro
    290                 295                 300

Ala Thr Lys Arg Ile Leu Trp Gln Ser Leu Lys Val Val His Glu Ile
305                 310                 315                 320

Ser Lys Ile Met Lys His Asp Pro Glu Lys Ile Phe Tyr Arg Asn Gly
                325                 330                 335

Thr Phe Gln Arg Arg Ser Ser
            340
```

<210> 503
<211> 447
<212> PRT
<213> Lactobacillus iners

<400> 503

```
Met Leu Tyr Asp His Lys Leu Ile Gly Asp Lys Lys Tyr Ala Arg Leu
1               5                   10                  15
```

```
Ile Arg Ser Lys Ala Phe Thr Asp Asp Glu Leu Ala Gly Phe Ile Ala
            20                  25                  30

Arg Gln Leu Val Glu Thr Arg Gln Ala Thr Lys Glu Thr Ala Asp Leu
        35                  40                  45

Leu Lys Arg Leu Cys Pro Lys Ser Arg Ile Val Tyr Ala Lys Ala Gln
    50                  55                  60

Asn Ala Ser Ile Phe Arg Gln Lys Phe Asp Ile Pro Lys Ser Arg Thr
65                  70                  75                  80

Ile Asn Asp Leu His His Ala Gln Asp Ala Tyr Leu Asn Ile Val Val
                85                  90                  95

Gly Asn Ile Phe Asp Thr Lys Phe Thr Gln Asp Pro Arg Asn Phe Ile
            100                 105                 110

Lys Asn Thr Lys Asp Ser Arg Asn Tyr Asn Leu Glu Lys Ile Tyr Asp
        115                 120                 125

Tyr Asn Val Glu Arg Asn Asn Tyr Val Ala Trp Ile Ala Pro Asp Ser
    130                 135                 140

Lys Thr Asn Gly Thr Ile Ala Asn Val Lys Cys Asn Leu Ser Thr Lys
145                 150                 155                 160

Asp Phe Arg Val Thr Arg Pro Ser Phe Tyr Lys Lys Gly Ala Leu Phe
                165                 170                 175

Asn Gln Asn Leu Ser Arg Lys Gly Ser Asn Leu Ala Pro Ile Lys Glu
            180                 185                 190

His Ser Pro Lys Ser Asn Pro Leu Lys Tyr Gly Gly Tyr Ser Gly Lys
        195                 200                 205
```

```
Asn Asn Ser Phe Phe Val Val Val Ala Gly Lys Asp Asn Lys Gly Lys
    210                 215                 220

Asp Ile Val Lys Leu Ile Pro Val Asn Thr Leu Ile Tyr Asn Lys Met
225                 230                 235                 240

Leu His Cys Asp Tyr Lys Ala Lys Gln Glu Leu Leu Thr Ser Tyr Val
                245                 250                 255

Ala Asn Asn Phe Ala Ile Asn Asn Phe Arg Ile Val Lys Asp Asp Ile
            260                 265                 270

Lys Met Tyr Ser Leu Val Lys Ile Asp Gly Ala Tyr Tyr Tyr Leu Val
        275                 280                 285

Gly Gly Thr Asp Glu Arg Ile Glu Val Lys Asn Ala Met Gln Leu Leu
    290                 295                 300

Leu Ser Lys Asp Ser Ile Lys Ala Val Lys Ile Leu Glu Lys Glu Ser
305                 310                 315                 320

Lys Asp Gln Phe Ala Asn Ile Lys Asn Tyr Lys Asp Ile Asp Ile Lys
                325                 330                 335

Leu Gly Arg Thr Phe Asn Glu Val Ile Ser Lys Tyr Thr Asn Ser Val
            340                 345                 350

Phe Gly Lys Ser Met Leu Ile Ser Asp Lys Tyr Arg Lys Asp Ile Phe
        355                 360                 365

Lys Ser Val Asp Lys Ser Ile Leu Glu Phe Asn Ser Leu Asn Thr Ile
    370                 375                 380

Ala Lys Ala Asp Asn Leu Leu Lys Phe Val Thr Ser Met Arg Pro Ala
385                 390                 395                 400

Gly Ser Val Asp Ala Leu Lys Met Val Gly Leu Ile Glu Arg Ile Arg
                405                 410                 415
```

Lys Ser Asn Val Ile Ser Asn Phe Asn Glu Phe Lys Leu Ile Asn Gln
420 425 430

Ser Val Thr Gly Leu Phe Glu Asn Glu Glu Asp Leu Leu Lys Leu
435 440 445

<210> 504
<211> 667
<212> PRT
<213> Lactobacillus iners

<400> 504

Met Gln Lys His Asn Tyr Asn Leu Met Gln Leu Met Ser Lys Lys Phe
1 5 10 15

Thr Phe Lys Ser Lys Ile Asp Glu Ile Asn Lys Ser Tyr Tyr Gln His
20 25 30

Asp Lys Phe Asn Tyr Lys Ser Met Ile Asp Ser Leu Tyr Val Ser Pro
35 40 45

Ala Thr Lys Arg Ile Leu Trp Gln Ser Leu Lys Val Val His Glu Ile
50 55 60

Ser Lys Ile Met Lys His Asp Pro Glu Lys Ile Phe Ile Glu Met Ala
65 70 75 80

Arg Ser Lys Glu Asp His Pro Lys Arg Lys Leu Ser Arg Lys Ala Asp
85 90 95

Leu Lys Gln Val Tyr Lys Asp Ser Lys Lys Gln Ile Ile Ser Ile Ile
100 105 110

Gly Lys Asp Lys Tyr Gln Asp Leu Ser Asn Glu Leu Asp Asn Lys Asp
115 120 125

Asp Arg Asp Leu Arg Trp Asp Asn Leu Tyr Leu Tyr Tyr Thr Gln Leu

```
    130                 135                 140

Gly Arg Ser Met Tyr Ser Leu Lys Pro Ile Asp Ile Ser Glu Leu Met
145                 150                 155                 160

Asn Lys Asn Leu Tyr Asp Gln Asp His Ile Phe Pro Lys Ser Lys Lys
                165                 170                 175

Tyr Asp Asp Ser Ile Glu Asn Arg Val Leu Val Glu Lys Glu Leu Asn
            180                 185                 190

Val Lys Lys Ser Asp Ile Tyr Pro Ile Ser Asp Ala Asn Ile Ile Pro
        195                 200                 205

Gln Lys Ile Lys Gly Gln Val Glu Ser Phe Trp Lys Met Leu Tyr Asp
    210                 215                 220

His Lys Leu Ile Gly Asp Lys Lys Tyr Ala Arg Leu Ile Arg Ser Lys
225                 230                 235                 240

Ala Phe Thr Asp Asp Glu Leu Ala Gly Phe Ile Ala Arg Gln Leu Val
                245                 250                 255

Glu Thr Arg Gln Ala Thr Lys Glu Thr Ala Asp Leu Leu Lys Arg Leu
            260                 265                 270

Cys Pro Lys Ser Arg Ile Val Tyr Ala Lys Ala Gln Asn Ala Ser Ile
        275                 280                 285

Phe Arg Gln Lys Phe Asp Ile Pro Lys Ser Arg Thr Ile Asn Asp Leu
    290                 295                 300

His His Ala Gln Asp Ala Tyr Leu Asn Ile Val Val Gly Asn Ile Phe
305                 310                 315                 320

Asp Thr Lys Phe Thr Gln Asp Pro Arg Asn Phe Ile Lys Asn Thr Lys
                325                 330                 335
```

```
Asp Ser Arg Asn Tyr Asn Leu Glu Lys Ile Tyr Asp Tyr Asn Val Glu
            340                 345                 350

Arg Asn Asn Tyr Val Ala Trp Ile Ala Pro Asp Gly Glu Thr Asn Gly
        355                 360                 365

Thr Ile Ala Asn Val Lys Cys Asn Leu Ser Thr Lys Asp Phe Arg Val
    370                 375                 380

Thr Arg Pro Ser Phe Tyr Lys Lys Gly Ala Leu Phe Asn Gln Asn Leu
385                 390                 395                 400

Ser Arg Lys Gly Ser Asn Leu Ala Pro Ile Lys Glu His Ser Pro Lys
                405                 410                 415

Ser Asn Pro Leu Lys Tyr Gly Gly Tyr Ser Gly Lys Asn Asn Ser Phe
            420                 425                 430

Phe Val Val Val Ala Gly Lys Asp Asn Lys Gly Lys Asp Ile Val Lys
        435                 440                 445

Leu Ile Pro Val Asn Thr Leu Ile Tyr Asn Lys Met Leu His Cys Asp
    450                 455                 460

Tyr Lys Ala Lys Gln Glu Leu Leu Thr Ser Tyr Val Ala Asn Asn Phe
465                 470                 475                 480

Ala Ile Asn Asn Phe Arg Ile Val Lys Asp Asp Ile Lys Met Tyr Ser
                485                 490                 495

Leu Val Lys Ile Asp Gly Ala Tyr Tyr Tyr Leu Val Gly Gly Thr Asp
            500                 505                 510

Glu Arg Ile Glu Val Lys Asn Ala Met Gln Leu Leu Leu Ser Lys Asp
        515                 520                 525

Ser Ile Lys Ala Val Lys Ile Leu Glu Lys Glu Ser Lys Asp Gln Phe
```

```
    530                 535                 540

Ala Asn Ile Lys Asn Tyr Lys Asp Ile Asp Ile Lys Leu Gly Arg Thr
545                 550                 555                 560

Phe Asn Glu Val Val Ser Lys Tyr Thr Asn Ser Val Phe Gly Lys Ser
                565                 570                 575

Met Leu Ile Ser Asp Lys Tyr Arg Lys Asp Ile Phe Lys Ser Val Glu
            580                 585                 590

Lys Ser Ile Leu Glu Phe Asn His Leu Asp Thr Ile Gly Lys Ala Asp
        595                 600                 605

Asn Leu Leu Lys Phe Val Thr Leu Met Arg Pro Ser Gly Ser Ala His
    610                 615                 620

Ser Leu Lys Met Val Gly Leu Ile Glu Arg Ile Arg Lys Ser Asn Val
625                 630                 635                 640

Ile Ser Asn Phe Asn Glu Phe Lys Leu Ile Asn Gln Ser Val Thr Gly
                645                 650                 655

Leu Phe Glu Asn Glu Glu Asp Leu Leu Lys Leu
            660                 665


<210>  505
<211>  1395
<212>  PRT
<213>  Lactobacillus jensenii

<400>  505

Met Lys Glu Ile Lys Asp Tyr Ile Ile Gly Leu Asp Ile Gly Thr Asn
1               5                   10                  15

Ser Cys Gly Tyr Val Val Thr Asp Lys Gln Asn Asn Ile Leu Lys Leu
            20                  25                  30
```

```
Lys Gly Lys Thr Ala Ile Gly Ala Arg Leu Phe Lys Glu Gly Gln Ala
        35                  40                  45

Ala Ala Asp Arg Arg Ser Phe Arg Thr Thr Arg Arg Arg Leu Ala Arg
    50                  55                  60

Arg His Trp Arg Leu Gly Leu Leu Glu Glu Ile Phe Asp Pro Glu Met
65                  70                  75                  80

Glu Lys Ile Asp Pro Asn Phe Phe Arg Arg Leu Lys Glu Ser Asp Tyr
                85                  90                  95

Ser Pro Lys Asp Ser Arg Lys Gln Phe Asn Ala Ile Val Phe Lys Ser
            100                 105                 110

Ile Lys Ala Asp Lys Arg Phe Tyr Lys Lys Tyr Pro Thr Ile Tyr His
        115                 120                 125

Leu Arg Asn Ala Leu Met His Asp Asn Gln Lys His Asp Leu Arg Glu
    130                 135                 140

Ile Phe Met Ala Val His His Ile Val Lys Tyr Arg Gly Asn Phe Leu
145                 150                 155                 160

Arg Glu Asp Ser Val Asn Ala Phe Lys Ala Ala Lys Phe Ser Leu Arg
                165                 170                 175

Gly Glu Asp Gly Ile Gly Pro Val Asp Lys Leu Asn Asp Leu Leu Lys
            180                 185                 190

Glu Ile Tyr Ser Glu Tyr Ser Pro Glu Leu Ala Thr Asn Asn Leu Ser
        195                 200                 205

Lys Ile Glu Asp Ile Ile Lys Asp Lys Asn Leu Tyr Lys Gln Asp Lys
    210                 215                 220

Leu Lys Gln Val Ala Thr Leu Leu Ile Lys Glu Ala Asp Ser Lys Asp
225                 230                 235                 240
```

```
Lys Ala Lys Leu Asn Lys Asp Ile Ala Lys Gln Val Ala Asn Ser Phe
               245                 250                 255

Met Gly Tyr Met Phe Arg Leu Asp Thr Leu Phe Ser Leu Thr Asp Val
            260                 265                 270

Asp Val Lys Asp Tyr Lys Leu Lys Phe Ser Asp Ala Asn Ile Asp Glu
        275                 280                 285

Ser Leu Asp Asp Leu Thr Ser Leu Leu Thr Asp Ala Gln Ile Glu Phe
    290                 295                 300

Val Leu Glu Leu Gln Ser Ile Tyr Asn Thr Ile Val Leu Asn Glu Ile
305                 310                 315                 320

Val Pro Asp Gly Met Ser Leu Ser Glu Ser Met Ile Lys Lys Tyr Asp
               325                 330                 335

Asp His Lys Glu Asp Leu Lys Ile Phe Lys Glu Tyr Ile Asp Ser Leu
            340                 345                 350

Ser Asp Gln Lys Lys Ala Lys Lys Leu Leu Ser Ala Tyr Asn Leu Tyr
        355                 360                 365

Val Asn Tyr Arg Lys Ser Asp Leu Val Glu Ala Lys Asn Leu Phe Lys
    370                 375                 380

Asn Lys Lys Val Gly Asp Lys Asn Phe Ala Asp Val Ile Ser Asn Phe
385                 390                 395                 400

Glu Val Phe Gly Lys Phe Val Ser Asp Asn Leu Asp Asp Ser Glu Leu
               405                 410                 415

Ala Asn Lys Ile Lys Ala Arg Leu Asp Leu Gly Glu Phe Leu Pro Lys
            420                 425                 430
```

```
Gln Arg Thr Asn Gln Asn Gly Val Ile Pro Tyr Gln Leu His Gln Val
        435                 440                 445

Glu Leu Thr Gln Ile Leu Glu Lys Gln Gly Lys Tyr Tyr Pro Phe Leu
    450                 455                 460

Ile Thr Pro Asn Pro Val Glu Ser His Arg Asn Asn Ala Pro Tyr Glu
465                 470                 475                 480

Ile Ser Glu Leu Val Ser Phe Arg Val Pro Tyr Tyr Val Gly Pro Leu
                485                 490                 495

Ile Asp Asn Gln Ser Ile Lys Asp Lys Gln Asn Lys Asn Lys Phe Ala
            500                 505                 510

Trp Met Val Arg Gln Lys Gln Gly Gln Ile Thr Pro Trp Asn Leu Glu
        515                 520                 525

Glu Met Val Asp Thr Thr Glu Ser Ala Asn Gln Phe Ile Lys Arg Met
    530                 535                 540

Thr Arg Lys Asp Thr Tyr Leu Leu Ala Glu Asp Val Leu Pro Lys Ser
545                 550                 555                 560

Ser Leu Val Tyr Gln Lys Phe Met Ile Leu Asp Glu Leu Asn Arg Ile
                565                 570                 575

Lys Ile Asp Gly Lys Lys Leu Thr Ser Glu Leu Lys His Asp Ile Phe
            580                 585                 590

Glu Lys Leu Phe Lys Lys Gln Lys Ser Ile Asn Leu Asp Asn Leu Lys
        595                 600                 605

Asn Tyr Leu Leu Val Glu Gly Asn Ile Pro Gly Leu Ile Glu Gly Leu
    610                 615                 620

Ser Asp Gly Ile Asn Phe Asn Asn Ser Phe Ser Thr Tyr Ile Asp Tyr
625                 630                 635                 640
```

```
Arg Asn Ile Phe Gly Asp Glu Ile Asp Asn Pro Asn Lys Gln Ala Asp
                645                 650                 655

Phe Glu Lys Met Ile Glu Trp Ser Thr Val Phe Glu Asp Arg Lys Ile
            660                 665                 670

Phe Lys Arg Lys Leu Lys Glu Ile Thr Trp Leu Thr Ser Glu Gln Ile
        675                 680                 685

Lys Gln Val Ser Ser Lys Arg Tyr Ser Gly Trp Gly Arg Leu Ser Lys
    690                 695                 700

Lys Leu Leu Thr Gln Ile Thr Asp Glu Asn Gly Val Asn Ile Leu Gln
705                 710                 715                 720

Arg Leu Trp Asn Glu Pro Glu Thr Leu Thr Glu Val Leu Ala Asn Pro
                725                 730                 735

Val Ile Lys Arg Lys Ile Val Glu Ala Asn Ser Ser Phe Thr Lys Ala
            740                 745                 750

Lys Asp Met Lys Asp Ile Leu Val Glu Ala Tyr Thr Ser Pro Gln Asn
        755                 760                 765

Lys Lys Ala Ile Arg Gln Val Met Arg Val Val Asp Asp Ile Ile Ala
    770                 775                 780

Ala Ala His Gly Lys Lys Pro Ser Gln Ile Ala Ile Glu Phe Ala Arg
785                 790                 795                 800

Glu Asp Gln Asp Asn Pro Gln Met Thr Lys Ser Arg Lys Ala Gln Leu
                805                 810                 815

Asp Gln Ile Tyr Ala Lys Ile Ser Asp Glu Phe Leu Asp Asp Ala Val
            820                 825                 830
```

```
Lys Asn Glu Leu Lys Asn Met Lys Asp Asn Lys Pro Leu Ala Lys Asp
        835                 840                 845

Lys Val Phe Leu Tyr Phe Lys Gln Met Gly Arg Asp Ala Tyr Ser Gly
    850                 855                 860

Glu Lys Leu Ser Leu Asp Asn Leu Gln Asp Tyr Asp Ile Asp His Ile
865                 870                 875                 880

Tyr Pro Gln Ser Phe Ile Lys Asp Asp Ser Phe Asp Asn Arg Val Leu
                885                 890                 895

Val Gln Arg Ala Tyr Asn Asn Gly Lys Ser Asp Asn Val Pro Val Leu
            900                 905                 910

Leu Phe Gly Asn Lys Ile Ala Ala Gly Leu Gly Ile Thr Ile Arg Gln
        915                 920                 925

Met Trp Lys Lys Trp Leu Glu Leu Gly Leu Ile Ser Lys Arg Lys Phe
    930                 935                 940

Asn Asn Leu Ile Thr Asp Pro Glu Lys Ile Ser Arg Asn Met Ala Ser
945                 950                 955                 960

Gly Phe Val Asn Arg Gln Leu Val Glu Thr Ser Gln Val Ile Lys Leu
                965                 970                 975

Val Ala Asn Ile Leu Gln Ala Lys Leu Pro Asp Thr Glu Ile Ile Glu
            980                 985                 990

Val Lys Ala Ser Tyr Asn Ser Ile  Leu Arg Lys Glu Phe  Asn Leu Tyr
        995                 1000                1005

Lys Ser  Arg Glu Val Asn Asp  Tyr His His Ala Ile  Asp Ala Tyr
    1010                1015                1020

Leu Thr  Thr Ile Val Gly Asn  Tyr Leu Tyr Gln Val  Tyr Pro Lys
    1025                1030                1035
```

```
Leu Arg  Pro Tyr Phe Val Tyr  Gly Gln Phe Lys Lys  Phe Gly Lys
    1040                1045                1050

Ala Glu  Asn Gln Glu Asp Asp  Pro Val Lys Lys Ile  Lys Lys Phe
    1055                1060                1065

Asn Phe  Ile Tyr Gln Leu Ile  Trp Gly Lys Asp Asp  Ala Ile Cys
    1070                1075                1080

Ile Ser  His Thr Asn Gln Gln  Val Phe Ser Lys Lys  Asp Ile Ile
    1085                1090                1095

Asp Lys  Leu Thr Thr Ala Tyr  Asn Phe Lys Tyr Met  Asn Ile Ser
    1100                1105                1110

His Ala  Val Tyr Thr Arg Asn  Asn Asn Met Phe Lys  Gln Thr Leu
    1115                1120                1125

Phe Pro  Ile Ile Glu Arg Thr  Thr Ala Lys Thr Lys  Ser Leu Ile
    1130                1135                1140

Pro Lys  Lys Leu Asp Arg Pro  Thr Asp Ile Tyr Gly  Gly Tyr Ser
    1145                1150                1155

Asn Asn  Asn Asp Ala Tyr Leu  Ala Leu Val Lys Val  Asp Lys Lys
    1160                1165                1170

Arg Gly  Ser Glu Tyr Arg Val  Val Gly Ile Pro Met  Arg Ala Ala
    1175                1180                1185

Ala Met  Leu Lys Ala Ser Lys  Asn Tyr Asp Glu Asp  Leu Arg Lys
    1190                1195                1200

Val Ile  Glu Pro Met Val Met  Phe Asp Lys Asn Gly  Lys Ala Lys
    1205                1210                1215
```

```
Arg Gly  Ile Glu Gly Phe Arg  Val Leu Val Gly Lys  Met Pro Phe
    1220                 1225                 1230

Lys Gln  Ala Val Leu Asp Gly  Asn Lys Lys Phe Met  Leu Thr Gly
    1235                 1240                 1245

Thr Val  Asp Thr Pro Asn Leu  Lys Gln Leu Val Leu  Ser Gln Gln
    1250                 1255                 1260

Asn Met  Lys Tyr Ile Leu Asp  Tyr Ile Glu Asp Val  Asp Cys Arg
    1265                 1270                 1275

Lys His  Lys Phe Gly Asp Lys  Val Gln Asn Pro Asp  Lys Cys Leu
    1280                 1285                 1290

Leu Glu  Val Phe Asp Glu Ile  Ile Glu Ile Val Asp  Lys Tyr Phe
    1295                 1300                 1305

Glu Leu  Phe Asp Ser Arg Asp  Phe Arg Glu Lys Leu  Arg Asn Ser
    1310                 1315                 1320

Arg Asn  Lys Phe Ile Lys Leu  Glu Ala Ser Lys Lys  Ala Asp Thr
    1325                 1330                 1335

Ile Leu  Ala Ile Leu Lys Gly  Leu Gln Ala Lys Ser  Thr Arg Ala
    1340                 1345                 1350

Thr Ile  Lys Glu Leu Asn Ile  Ser Asp Phe Gly Arg  Ile Ile Thr
    1355                 1360                 1365

Ser Ser  Ile Ser Pro Glu Ala  Gln Leu Ile Tyr Gln  Ser Pro Thr
    1370                 1375                 1380

Gly Leu  Phe Glu Arg Arg Val  Lys Val Lys Asp Leu
    1385                 1390                 1395
```

<210> 506
<211> 1382

<212> PRT
<213> Lactobacillus mucosae

<400> 506

```
Met Asp Ile Gly Thr Asn Ser Ile Gly Trp Thr Ala Ile Asp Asp His
1               5                  10                  15


Phe Ser Leu Leu Arg Val Lys Gly Lys Asn Ala Ile Gly Val Arg Thr
            20                  25                  30


Phe Lys Glu Gly Glu Thr Ala Ala Asp Arg Arg Gly Phe Arg Thr Ala
        35                  40                  45


Arg Arg Arg Leu Ser Arg Arg Arg Trp Arg Leu Gln Phe Leu Asp Glu
    50                  55                  60


Phe Phe Ala Pro Tyr Leu Ala Glu Val Asp Pro Asn Phe Leu Ala Arg
65                  70                  75                  80


Leu Lys Gln Ser Asp Ile Ser Ala Lys Asp Pro Ala Lys Asn Gln Glu
                85                  90                  95


Tyr Met Gly Lys Leu Leu Phe Pro Asp Gln Glu Ala Ala Ser Asp Gly
            100                 105                 110


Asn Gly Tyr Pro Thr Leu Ile Gln Met Arg Lys Ala Met Pro Ala Glu
        115                 120                 125


Lys Ala Ala Asp Phe Pro Val Phe Asn Ile Tyr Gln Leu Arg Tyr Ala
    130                 135                 140


Leu Met Asn Glu Lys Arg Lys Phe Asp Leu Arg Glu Ile Tyr Leu Ala
145                 150                 155                 160


Val His His Ile Val Lys Tyr Arg Gly Asn Phe Leu Asn Asn Thr Ser
                165                 170                 175


Val Asp Lys Phe Lys Ala Asp Gln Ile Asp Phe Asn Lys Ser Phe Glu
```

```
            180                 185                 190

Thr Leu Asn Asp Leu Phe Arg Gln Val Gln Pro Ile Ala Pro Phe Gln
        195                 200                 205

Ile Asp Leu Thr Lys Val Asp Glu Leu Gly Lys Leu Leu Leu Asp Thr
    210                 215                 220

Lys Gln Lys Lys Leu Asp Arg Gln Lys Ala Val Ala Lys Leu Leu Pro
225                 230                 235                 240

Leu Ile Glu Asp Gly Thr Asp Lys Glu Ile Val Lys Ala His Gln Gln
                245                 250                 255

Thr Ala Arg Glu Ile Ser Lys Leu Ile Leu Gly Tyr Lys Ala Lys Val
            260                 265                 270

Gly Leu Ile Leu Gln Asn Asn Leu Asp Gln Thr Leu Asp Met Ser Thr
        275                 280                 285

Glu Asn Ser Asp Asp Gln Leu Met Gln Ile Ala Glu Glu Leu Asp Asp
    290                 295                 300

Tyr Gln Met Glu Leu Ile Asn Gln Leu Ser Leu Leu Tyr Ser Gln Ile
305                 310                 315                 320

Met Leu Asn Glu Ile Val Pro Asn Gly Glu Thr Val Ser Ala Ser Met
                325                 330                 335

Leu Asn Arg Tyr Tyr Lys His Arg Cys Gln Leu Lys Glu Leu Lys Asp
            340                 345                 350

Tyr Gly Ala Ala Gln Asp Lys Lys Thr Arg Glu Gln Leu Asp His Leu
        355                 360                 365

Tyr Ala Glu Tyr Ile Gly Gln Ile Pro Lys Asp Ser Lys Phe Asp Phe
    370                 375                 380
```

```
Thr Lys Asp Leu Lys Lys Leu Met Asp Lys Ser Asp Leu Gly Gln Lys
385                 390                 395                 400

Ile Lys Asp Glu Ile Glu Ala Gly Asp Tyr Leu Pro Lys Gln Arg Thr
                405                 410                 415

Ser Ala Asn Gly Val Ile Pro His Gln Met His Gln Gln Glu Leu Asp
            420                 425                 430

Gln Ile Ile Glu Asn Gln Lys Glu Tyr Tyr Pro Trp Leu Ala Glu Pro
        435                 440                 445

Asn Pro Val Glu Lys Asn Ile Lys Asn Ala Lys Tyr Lys Leu Asp Gln
    450                 455                 460

Leu Val Ser Phe Arg Val Pro Tyr Tyr Val Gly Pro Met Ile Thr Leu
465                 470                 475                 480

Ala Asp Gln Gln Lys Thr Ser Lys Ala Ser Phe Ala Trp Ala Val Arg
                485                 490                 495

Lys Lys Ala Gly Lys Ile Thr Pro Trp Asn Phe Tyr Asp Met Ile Asp
            500                 505                 510

Arg Glu Lys Ser Ala Asn Asn Phe Ile Lys Arg Met Thr Asn Lys Asp
        515                 520                 525

Thr Tyr Leu Leu Ser Glu Asp Val Leu Pro Ala Ser Ser Leu Leu Tyr
    530                 535                 540

Gln Lys Phe Thr Val Leu Asn Glu Leu Asn Asn Ile Arg Val Asn Gly
545                 550                 555                 560

Arg Lys Leu Gln Pro Ala Leu Lys Gln Ala Ile Tyr Thr Asp Leu Phe
                565                 570                 575

Gln Lys Arg Lys Thr Val Asn Leu Lys Thr Leu Thr Asn Phe Leu Ala
```

```
            580                 585                 590

Ile His Glu Pro Thr Leu Thr Lys Pro Lys Ile Glu Gly Leu Ser Asn
        595                 600                 605

Gly Arg Ser Phe Asn Ser Ser Leu Gly Thr Tyr Ile Asp Met Ser Lys
    610                 615                 620

Ile Leu Gly Asp Ser Leu Asp Asp Leu Asn Tyr Arg Asp Asp Ile Glu
625                 630                 635                 640

Lys Ile Ile Glu Trp Ser Thr Val Phe Glu Asp Ser Glu Ile Tyr Gly
                645                 650                 655

Val Lys Leu Gln Glu Ile Gln Trp Leu Thr Asn Glu Gln Arg Glu Lys
            660                 665                 670

Leu Val Arg Lys Arg Tyr Gln Gly Trp Gly Arg Leu Ser Lys Lys Leu
        675                 680                 685

Leu Thr Gly Ile Thr Asp Glu Asn Gly Gln Arg Ile Ile Asp Leu Met
    690                 695                 700

Trp Asp Thr Ser Lys Asn Phe Met Gln Ile Val His Gln Pro Val Phe
705                 710                 715                 720

Glu Glu Gln Ile Ala Glu Leu Asn Gln Gln Leu Leu Gln Asp Ala Asp
                725                 730                 735

Lys Ala Pro Leu Glu Val Val Asp Asp Ile Leu Ala Asp Ala Tyr Thr
            740                 745                 750

Ser Pro Gln Asn Lys Lys Ala Ile Arg Gln Val Val Lys Val Val Ala
        755                 760                 765

Asp Val Val Lys Ala Val Gly Asn Ala Pro Ala Ser Ile Ser Ile Glu
    770                 775                 780
```

```
Phe Ala Arg Asn Glu Asp Arg Asn Lys Glu Leu Lys Asn Ser Arg Arg
785                 790                 795                 800

His Ser Ile Glu Lys Leu Tyr His Glu Thr Ala Glu Lys Leu Val Lys
                805                 810                 815

Gln Thr Asn Leu Leu Glu Glu Leu Gly Asn Val Lys Asp Leu Asn Asp
            820                 825                 830

Arg Tyr Tyr Leu Tyr Phe Thr Gln Ala Gly Arg Asp Met Tyr Asp Gly
        835                 840                 845

Thr Pro Ile Asn Ile Asp Glu Ile Ser Thr His Tyr Glu Ile Asp His
    850                 855                 860

Ile Leu Pro Gln Ser Phe Leu Lys Asp Asn Ser Leu Asp Asn Arg Val
865                 870                 875                 880

Leu Val Lys Lys Ser Glu Asn Ala Ala Lys Ser Asp Arg Val Pro Ala
                885                 890                 895

Lys Leu Tyr Gly Ala Lys Met Arg Ala Phe Trp Lys Gln Leu Lys Glu
            900                 905                 910

Ser Gln Leu Ile Ser Asn Arg Lys Tyr Leu Asn Leu Thr Thr Asp Pro
        915                 920                 925

Glu Gln Val Asp Lys Tyr Gln Met Gln Gly Phe Val His Arg Gln Leu
    930                 935                 940

Val Glu Thr Arg Gln Ile Ile Lys Leu Ala Ala Asn Ile Phe Gly Ser
945                 950                 955                 960

Leu Tyr Pro Asp Ser Ala Val Ile Glu Thr Arg Ala Glu Leu Thr Lys
                965                 970                 975

Gln Leu Arg Glu Lys Phe Ser Leu Tyr Lys Val Arg Asp Val Asn Asp
```

```
           980                 985                 990

Tyr His His Ala Val Asp Ala Tyr  Leu Thr Ala Phe Ala  Gly His Tyr
        995                1000                1005

Leu Tyr  Gln Arg Tyr Pro Lys  Leu Arg Pro Met Phe  Val Tyr Gly
    1010                1015                1020

Asp Tyr  Ala Lys Ile Tyr Ala  Asp Asp Leu Lys Arg  Leu Arg Ser
    1025                1030                1035

Val Asn  Leu Phe His Asp Leu  Glu Lys Asp Gln Tyr  Asn Ser Gly
    1040                1045                1050

Thr Ala  Val Asn Pro Glu Thr  Lys Glu Lys Ile Val  Asp Val Asp
    1055                1060                1065

Trp Leu  Ser Asp Tyr Val Ser  Lys Ile Gln His Phe  Lys Tyr Met
    1070                1075                1080

Leu Ile  Ser Lys Ala Val Tyr  Thr Gln His Gly Gln  Leu Tyr Gly
    1085                1090                1095

Ala Thr  Ile Leu Pro Val Ala  Gln Val Asp Lys Ile  Ser Ala Pro
    1100                1105                1110

Ile Gly  Ile Lys Asp Asp Lys  Pro Val Asp Ile Tyr  Gly Ala Tyr
    1115                1120                1125

Thr Asn  Glu Val Ala Ala Tyr  Met Ala Ile Val Arg  Val Asn Gly
    1130                1135                1140

Lys Lys  Pro Lys Tyr Lys Val  Val Ser Val Pro Val  Arg Met Leu
    1145                1150                1155

Gln Arg  Leu Lys Met Ala Glu  Gln Lys Gly His Asp  Gln Tyr Met
    1160                1165                1170
```

```
Gln Thr  Leu His Asp Val Leu  Leu Arg Asn Phe Thr  Ser Leu Lys
    1175                1180                1185

Lys Asn  Arg Lys Thr Gly Leu  Lys Glu Ala Val Val  Lys Asp Phe
    1190                1195                1200

Asp Val  Leu Val Pro Cys Val  Arg Tyr Asn Gln Leu  Val Ile Asp
    1205                1210                1215

Gly Asp  Thr Lys Phe Thr Leu  Gly Ser Ala Thr Tyr  Gln His Asn
    1220                1225                1230

Ala Lys  Gln Leu Val Leu Cys  Asn His Ser Leu Glu  Thr Leu Ala
    1235                1240                1245

Asn Asn  Phe Glu Tyr Val Arg  Lys His Pro Asp Glu  Ala Asp Glu
    1250                1255                1260

Arg Met  Ile Met Leu Tyr Asp  Asp Ile Leu Asp Gln  Val Asn His
    1265                1270                1275

Tyr Phe  Thr Leu Tyr Asp Lys  Asn Lys Phe Arg Glu  Lys Leu Asn
    1280                1285                1290

Ala Gly  Arg Asp Lys Tyr Leu  Lys Leu Pro Thr Phe  Ser Gln Phe
    1295                1300                1305

Glu Asn  Asn Lys Lys Thr Ala  Ile Gly Lys Ser Glu  Ala Ile Ile
    1310                1315                1320

Asn Ile  Leu Arg Gly Leu His  Ala Asn Ala Ala Ile  Thr Asn Leu
    1325                1330                1335

Lys Cys  Leu Gly Val Ser Thr  Pro Phe Gly Gln Leu  Gln Ser Pro
    1340                1345                1350

Ser Gly  Ile Glu Leu Ser Glu  Asn Ala Lys Leu Val  Tyr Gln Ser
```

```
    1355                1360                1365

Pro Thr  Gly Leu Phe Ser Arg  Glu Val Leu Leu Lys  Asp Leu
    1370                1375                1380
```

<210> 507
<211> 1382
<212> PRT
<213> Lactobacillus pentosus

<400> 507

```
Met Lys Lys Ile Val Asn Tyr Asn Leu Gly Leu Asp Ile Gly Thr Ser
1               5                   10                  15

Ser Ile Gly Tyr Ala Ala Ile Asp Asp Gln Gly Arg Pro Val Arg His
            20                  25                  30

Gln Asn Lys Thr Val Met Gly Val Arg Leu Phe Lys Glu Gly Lys Thr
        35                  40                  45

Ala Glu Ser Thr Arg Ile Phe Arg Gly Thr Arg Arg Arg Leu Ser His
    50                  55                  60

Arg His Trp Arg Leu Gly Tyr Leu Asp Arg Ile Phe Asp Asn Glu Ile
65                  70                  75                  80

Ala Lys Val Asp Glu Asn Phe Leu Pro Arg Leu Lys Ala Ser Lys Arg
                85                  90                  95

Ala Arg Ser Asp Glu Lys Arg Ser Phe Arg Gly Ser Leu Leu Phe Pro
            100                 105                 110

Glu Thr Gly Asp Asp Ala Tyr Tyr Gln Lys Tyr Pro Thr Ile Tyr His
        115                 120                 125

Leu Arg Tyr Ala Leu Ile Thr Gln Lys Lys Gln Phe Asp Ile Arg Leu
    130                 135                 140
```

```
Ile Tyr Leu Ala Leu His His Met Ile Lys Tyr Arg Gly Asn Phe Leu
145                 150                 155                 160

Asp Thr Thr Pro Val Ser Ala Phe Asn Ile His Asp Ile Asp Leu Thr
                165                 170                 175

Asp Gln Phe Ala Ser Leu Asn Asp Cys Tyr Gln Leu Leu Asp Met Asp
            180                 185                 190

Phe Glu Phe Gln Phe Asp Leu Asn Asn Ile Glu Gln Val Gln Lys Leu
        195                 200                 205

Leu Leu Asp Glu Thr Leu Ser Lys Thr Lys Arg Gln Ala Ala Val Ser
    210                 215                 220

Lys Val Leu Val Met Ser Thr Gly Asn Lys Ala Phe Asp Asp Gln Gln
225                 230                 235                 240

Asn Gly Ile Ala Ser Glu Phe Ile Lys Ala Leu Leu Gly Gly Pro Phe
                245                 250                 255

Asp Leu Ser Lys Ile Leu Asn Leu Ser Val Ala Asp Val Lys Ser Trp
            260                 265                 270

Lys Leu His Met Thr Asp Lys Asp Val Asp Asp Thr Leu Asn Ser Leu
        275                 280                 285

Val Glu Glu Leu Asp Glu Asn His Lys Gln Ile Val Asn Leu Leu Gln
    290                 295                 300

Met Ile Tyr Ser Gln Val Met Met Leu Gly Leu Leu Asn Gly Gln Gln
305                 310                 315                 320

Ser Ile Ser Ala Ser Met Ile Glu Arg Tyr Asp Asp His Ala Lys His
                325                 330                 335

Trp Ala Ala Leu Lys Lys Leu Leu Pro Ala Leu Gly Glu Gln Glu Gln
            340                 345                 350
```

```
Ser Thr Ile Ile His Ala Tyr Thr Ala Tyr Thr Gly His Ser Arg Thr
        355                 360                 365

Lys Gln Leu Ser Arg Ala Glu Phe Tyr Thr Lys Val Asn Ser Ile Leu
    370                 375                 380

Lys Lys His Glu Asn Ile Ala Glu Ala Thr Gly Leu Ile Glu Leu Ile
385                 390                 395                 400

Asp Arg Asn Glu Phe Met Pro Lys Gln Arg Asp Ala Val Asn Gly Val
                405                 410                 415

Ile Pro His Gln Leu His Gln Arg Glu Leu Gln Leu Ile Ile Gln Asn
            420                 425                 430

Gln Gln Lys Tyr Tyr Pro Phe Leu Ala Ala Lys Ala Tyr Pro Asp Ala
        435                 440                 445

Asp Glu Thr Met Ile Glu Gln Leu Leu Ser Phe Arg Val Pro Tyr Tyr
    450                 455                 460

Ala Gly Pro Leu Val Asp Arg Asp Phe Ile Asn Glu Ser Ser Asp Gln
465                 470                 475                 480

Glu Gln Ala Met Gln Asn Thr Lys Phe Ser Trp Leu Lys Arg Arg Glu
                485                 490                 495

Ala Gly Glu Ile Thr Pro Trp Asn Phe Glu Gln Lys Val Asp Val Gln
            500                 505                 510

Glu Thr Ala Asn Arg Phe Ile Lys Arg Leu Thr Thr Lys Asp Thr Tyr
        515                 520                 525

Leu Met Thr Glu Asp Val Leu Pro Lys Glu Ser Leu Ile Tyr Gln Arg
    530                 535                 540
```

```
Phe Glu Val Leu Asn Glu Leu Asn Ala Ile Arg Ile Asn Asp Arg Arg
545                 550                 555                 560

Leu Thr Ala Glu Asn Lys Gln Leu Ala Phe Gln Gln Leu Phe Met Ala
                565                 570                 575

Gly Asn Thr Lys Asn Val Ser Ile Lys Lys Phe Arg Asn Phe Val Phe
            580                 585                 590

Asp Ser Leu Lys Phe Pro Glu Lys Val Lys Ile Thr Gly Phe Ala Gly
        595                 600                 605

Gln His Asn Phe Leu Ala Lys Leu Ser Thr Tyr His Asp Phe Lys Lys
    610                 615                 620

Ile Phe Gly Glu Arg Val Asp His Thr Asp Leu Gln Pro Asp Phe Glu
625                 630                 635                 640

Arg Ile Val Glu Trp Cys Thr Ile Phe Glu Asp Arg His Ile Tyr Arg
                645                 650                 655

Glu Lys Leu Lys Glu Ile Gln Trp Leu Ser Gln Ser Glu Ile Asp Gln
            660                 665                 670

Leu Val Leu Ile Arg Asn His Gly Trp Gly Arg Leu Ser Lys Arg Leu
        675                 680                 685

Leu Thr Gly Ile Arg Asp Ser Asp Gly Arg Thr Val Met Asp Gln Leu
    690                 695                 700

Trp Phe Gly Thr Asp Asn Phe Met Arg Ile Ile Ser Gln Ser Asp Phe
705                 710                 715                 720

Ala Ala Ala Ile Ala Asn Glu Asn Arg Thr Gln Leu Asn Gln His Gly
                725                 730                 735

Leu Glu Asp Val Leu Asp Ser Ala Phe Met Ser Pro Gln Asn Lys Lys
            740                 745                 750
```

```
Ala Ile Arg Gln Val Leu Lys Val Val Asp Asp Ile Glu Gln Thr Leu
        755                 760                 765

Gly Cys Pro Pro Lys Lys Val Met Ile Glu Phe Thr Arg Ser Pro Asp
    770                 775                 780

Lys Lys Lys Gln Arg Thr Val Thr Arg Leu Glu Lys Val Gln Gln Ala
785                 790                 795                 800

Tyr Lys Ala Val Ala Asp Gln Leu Ala Gly Gln Ser Ile Val Ser Glu
                805                 810                 815

Leu Asp Gln Tyr Ala Asn Thr His Ser Lys Leu Ser Asp Thr Tyr Tyr
            820                 825                 830

Leu Tyr Phe Met Gln Leu Gly Arg Asp Leu Tyr Ser Gly Lys Pro Ile
        835                 840                 845

Asp Ile Asp Ser Pro Met Leu Asp Asp Asp His Ile Leu Pro Arg Ala
    850                 855                 860

Phe Met Lys Asp Asn Ser Leu Asp Asn Arg Ala Leu Thr Glu Lys Pro
865                 870                 875                 880

Ile Asn Asn Thr Lys Ala Ala Lys Phe Pro Ser Lys Val Phe Gly Gln
                885                 890                 895

Gln Lys Glu Val Thr Asp Phe Trp Lys Leu Leu Arg Arg Cys Gly Leu
            900                 905                 910

Met Ser Asn Ile Lys Glu Lys His Leu Tyr Leu Asp Pro Asp Asn Val
        915                 920                 925

Asp Lys Trp Thr Arg Arg Gly Phe Ile His Arg Gln Leu Val Glu Thr
    930                 935                 940
```

```
Ser Gln Val Ile Lys Ile Val Ala Asn Ile Leu Asn Asp Arg Tyr Gln
945                 950                 955                 960


Gln Ser Gln Thr Glu Val Leu Glu Val Pro Ala Arg Leu Gly Thr Glu
                965                 970                 975


Leu Arg Glu Cys Phe Gly Trp Tyr Lys Val Arg Glu Val Asn Asp Tyr
            980                 985                 990


His His Val Phe Asp Ala Tyr Leu  Ala Ala Phe Ile Gly  Asn Tyr Leu
        995                 1000                1005


Tyr Arg  Arg Tyr Pro Lys Leu  Gln Pro Tyr Phe Val  Tyr Gly Asn
    1010                1015                1020


Phe Ala  Glu Leu Asn Lys Ala  Gln Leu Lys Asn Ile  Lys Ser Phe
    1025                1030                1035


Asn Phe  Leu Tyr Asn Ile Thr  Asp Asn Lys Arg Val  Val Lys Asp
    1040                1045                1050


Ile Glu  Thr Gly Gln Thr Leu  Trp Asp Asp Gln Ile  Arg Gln Gln
    1055                1060                1065


Ile Gln  His Ile Tyr Glu Tyr  Lys Tyr Met Leu Thr  Ser His Glu
    1070                1075                1080


Ala Phe  Thr Gln His Lys Glu  Leu Tyr Gly Gln Thr  Ile Tyr Pro
    1085                1090                1095


Arg Arg  Glu Phe Lys Pro Gly  Thr Leu Lys Ala Ile  Lys Gln Asp
    1100                1105                1110


Gln Pro  Gln Glu Leu Tyr Gly  Gly Tyr Lys Asn Leu  Thr Ala Ala
    1115                1120                1125


Tyr Met  Cys Ile Val Lys Ile  Gln Ala Arg Lys Arg  Arg Ala Ala
    1130                1135                1140
```

```
Glu Tyr  Arg Val Val Arg Val  Ala Thr Glu Ser Leu  Ser Ala Leu
    1145                1150                1155

Gln Gln  Ala Lys Arg Leu Gly  Val Gln Ala Tyr Glu  Arg Cys Leu
    1160                1165                1170

Arg Gln  Glu Leu Val Arg Asn  Asn Glu Ile Leu Arg  Thr Asn Ala
    1175                1180                1185

Asp Pro  Asn Ser Ala Pro Arg  Glu Phe Glu Val Leu  Leu Asp Arg
    1190                1195                1200

Val Leu  Cys His Gln Met Ile  Ile Ser Asp Gly Gln  Lys Tyr Leu
    1205                1210                1215

Leu Gly  Ser His Ala Tyr Lys  Ile Asn Cys Met Gln  Leu Val Leu
    1220                1225                1230

Ser Asn  Asn Ser Met Lys Ile  Leu Ser Thr Ser Ile  Val Lys Leu
    1235                1240                1245

Lys Gln  Met Thr Asn Glu Pro  Leu Val Gln Val Tyr  Arg Glu Ile
    1250                1255                1260

Leu Asp  Val Val Asn Lys Tyr  Phe Thr Leu Tyr Asp  Val Asn Ser
    1265                1270                1275

Phe Arg  Glu Asn Leu Asn Gln  Phe Phe Asp Lys Phe  Arg Thr Leu
    1280                1285                1290

Pro Ile  Thr Asn Glu Tyr Glu  Ser Ser Lys Ser Gly  Lys Lys Leu
    1295                1300                1305

Ile His  Arg Gly Gln Leu Glu  Thr Leu Thr Leu Ile  Leu Arg Gly
    1310                1315                1320
```

```
Leu His  Ala Asn Ser Asp Lys  Val Gln Tyr Gly Asp  Gln Ser Thr
    1325                1330                1335


Leu Leu  Gly Gly Phe Gln Thr  Lys Asp Gly Ile Lys  Leu Ser Lys
    1340                1345                1350


Asp Ser  Val Ile Gln Tyr Thr  Ser Pro Ala Gly Leu  Asn Val Arg
    1355                1360                1365


Thr Val  Lys Leu Arg Asp Leu  Glu Gln Lys Glu Ala  Gln Lys
    1370                1375                1380
```

<210> 508
<211> 1361
<212> PRT
<213> Lactobacillus pentosus

<400> 508

```
Met Asn Glu Pro Tyr Gly Val Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Thr Val Val Asp Met Asn Gly Arg Val Arg Lys Val Lys Gly
            20                  25                  30


Lys Thr Ala Leu Gly Ala Arg Leu Phe Lys Glu Gly Ala Thr Ala Glu
        35                  40                  45


Asp Arg Arg Gly Phe Arg Thr Thr Arg Arg Arg Leu Lys Arg Val Lys
    50                  55                  60


Trp Arg Leu Arg Leu Leu Arg Glu Phe Phe Asp Gln Pro Ile Ser Lys
65                  70                  75                  80


Ile Asp Pro Asn Phe Phe Ala Arg Arg Lys Tyr Ser Asp Ile Ser Pro
                85                  90                  95


Arg Asp Pro Asn Tyr Asn Gly Leu Ala Lys Thr Leu Phe Asn Asp Arg
            100                 105                 110
```

```
Thr Asp Lys Glu Phe Tyr Asp Asp Tyr Ala Thr Ile Tyr His Leu Arg
        115                 120                 125

Asp Lys Leu Met Thr Ser Asn Arg Lys Phe Asp Ile Arg Glu Ile Tyr
    130                 135                 140

Leu Ala Ile His His Ile Val Lys Tyr Arg Gly Asn Phe Leu Arg Thr
145                 150                 155                 160

Gly Pro Ala Ser Gln Tyr Gly Ser Ala Ser Leu His Leu Ala Thr Ser
                165                 170                 175

Phe Gln Lys Leu Asn Asp Leu Phe Ala Gln Ser Glu Glu Thr Leu Asn
            180                 185                 190

Leu Lys Leu Val Thr Asp Glu Ala Leu Leu Gln Gln Ile Gln Gln Ile
        195                 200                 205

Leu Val Arg Thr Asp Leu Ser Arg Ser Glu Gln Gln Arg Gln Ile Trp
    210                 215                 220

Pro Leu Met Ala Val Leu Thr Gly Ala Ser Ala Ala Glu Lys Lys Arg
225                 230                 235                 240

Gln Lys Asn Val Val Val Glu Leu Ser Lys Ala Leu Val Gly Leu Lys
                245                 250                 255

Ala Lys Met Asn Val Val Thr Leu Thr Glu Val Asp Ala Ala Val Val
            260                 265                 270

Lys Asp Trp Thr Phe Thr Met Glu Glu Ser Gln Asp Lys Leu Pro Glu
        275                 280                 285

Ile Glu Glu Gln Leu Ser Glu Val Gly Gln Gln Ile Met Asp Glu Val
    290                 295                 300

Ile Gln Leu Tyr Ala Ser Val Asn Leu Ala Gln Leu Ile Pro Ala Gly
```

```
305                 310                 315                 320

Lys Arg Phe Ser Gln His Met Val Glu Lys Tyr Lys His His Glu Lys
                325                 330                 335

Asn Leu Glu Leu Leu Lys Ala Tyr Ile His Ser Gln Ser Asp Ser Lys
            340                 345                 350

Arg Gly Arg Glu Ile Arg Ala Thr Tyr Asp Arg Tyr Ile Asp Gly Val
        355                 360                 365

Asp Ser Lys Pro Val Thr Gln Glu Met Phe Tyr Lys Asp Leu Met Lys
    370                 375                 380

Tyr Val Glu Ala Asp Ala Thr Ser Asn His Leu Ala Ala Glu Ile Lys
385                 390                 395                 400

Asp Glu Ile Asp Ser Glu Gln Phe Met Pro Lys Leu Arg Thr Lys Gln
                405                 410                 415

Asn Gly Ser Ile Pro Tyr Gln Val Gln Gln Tyr Glu Leu Asp Gln Ile
            420                 425                 430

Ile Ser His Gln Lys Lys Tyr Tyr Pro Trp Leu Gly Glu Glu Asn Pro
        435                 440                 445

Val Ala Glu Arg Arg Gly Lys Phe Pro Tyr Lys Leu Asp Glu Leu Val
    450                 455                 460

Gly Phe Arg Val Pro Tyr Tyr Val Gly Pro Leu Ile Thr Lys Glu Asp
465                 470                 475                 480

Gln Gln Ala Thr Ser Gly Ala Gly Phe Ala Trp Met Val Arg Lys Ala
                485                 490                 495

Asp Gly Pro Ile Thr Pro Trp Asn Phe Asp Gln Lys Val Asp Arg Ile
            500                 505                 510
```

```
Ala Ser Ala Thr Ala Phe Ile Gln Arg Met Gln Thr Thr Asp Thr Tyr
        515                 520                 525

Leu Ile Gly Glu Asp Val Leu Pro Ala Arg Ser Leu Ile Tyr Gln Arg
    530                 535                 540

Phe Met Val Leu Asn Glu Leu Asn Asn Met Arg Val Glu Asp Arg Lys
545                 550                 555                 560

Leu Ala Pro Gln Gln Lys Gln Arg Leu Tyr Asn Gln Val Phe Lys Gln
                565                 570                 575

His Gln His Val Ser Val Lys Asn Ile Gln Gln Asn Leu Met Asp Ala
            580                 585                 590

Gly Glu Tyr Arg Lys Thr Pro Gln Ile Thr Gly Leu Ala Asp Pro Lys
        595                 600                 605

Gly Phe Asn Ser Ser Leu Ser Thr Tyr His Asp Phe Lys Lys Ile Leu
    610                 615                 620

Leu Glu Ala Ile Ala Asp Glu His Lys Arg Ala Asp Ile Glu Lys Ile
625                 630                 635                 640

Ile Leu Trp Ser Thr Thr Phe Glu Asp Ser Ala Ile Phe Lys Gln Lys
                645                 650                 655

Leu Glu Glu Val Ala Trp Leu Thr Asp Ala Gln Arg Lys Gln Leu Ser
            660                 665                 670

Gly Leu Arg Tyr Arg Gly Trp Gly Gln Leu Ser His Lys Leu Leu Thr
        675                 680                 685

Ala Phe Lys Asp Asp Lys Gly Arg Ser Ile Met Asp Gly Leu Trp Glu
    690                 695                 700

Thr Ser Asp Asn Phe Met Gln Leu Arg Lys Gln Pro Ala Ile Glu Thr
```

```
705                 710                 715                 720

Gln Ile Lys Glu Ala Asn Gln Ala Asn Leu Thr Asp Ala Asp Ile Gln
                725                 730                 735

Asp Thr Ile Asn Glu Leu Tyr Thr Ser Pro Gln Asn Lys Lys Ala Ile
            740                 745                 750

Arg Glu Val Met Leu Val Leu Asp Asp Ile Lys Asn Ala Met His Gly
        755                 760                 765

Gln Thr Pro Ser Trp Ile Phe Val Glu Ala Ala Arg Gly Gly Gly Val
    770                 775                 780

Ala Gly Arg Arg Thr Gln Ser Arg Ser Ser Gln Ile Val Glu Ala Tyr
785                 790                 795                 800

Lys Gly Thr Ala Lys Glu Ile Val Ser Glu Lys Val Gln His Glu Leu
                805                 810                 815

Asn Glu Lys Ile Lys Ala Lys Ala Asp Phe Asn Thr Arg Leu Val Leu
            820                 825                 830

Tyr Phe Leu Gln Asn Gly Arg Asp Leu Tyr Thr Asn Glu Ala Ile Asn
        835                 840                 845

Ile Asp Arg Leu Ser Glu Tyr Asp Ile Asp His Ile Leu Pro Gln Ser
    850                 855                 860

Leu Val Lys Asp Asp Ser Leu Asp Asn Arg Val Leu Thr Ser Ala Arg
865                 870                 875                 880

Ile Asn Arg Glu Lys Asn Asp Thr Phe Ala Ser Glu Lys Phe Gly Arg
                885                 890                 895

Lys Met Gly Ala Gln Trp Arg Glu Leu His Arg Asn Gly Leu Met Thr
            900                 905                 910
```

```
Gln Arg Lys Leu Lys His Leu Leu Met Arg Pro Asp Glu Ile Ser Lys
        915                 920                 925


His Ala Thr Asp Phe Ile Asn Arg Gln Leu Val Glu Thr Arg Gln Val
    930                 935                 940


Ile Lys Leu Val Glu Glu Leu Ile Ser Ser Glu Tyr Pro Ala Ala Ser
945                 950                 955                 960


Ile Val Ala Val Lys Ala Asn Leu Thr His Gln Phe Arg Gln Thr Phe
                965                 970                 975


Asn Phe Pro Lys Leu Arg Glu Val Asn Asp Tyr His His Ala Phe Asp
            980                 985                 990


Ala Ser Leu Thr Ala Phe Ile Gly  Met Tyr Leu Leu Lys  Gln Tyr Pro
        995                 1000                1005


Lys Leu  Glu Arg Phe Phe Val  Tyr Gly Lys Phe Ala  Lys Gln Pro
    1010                1015                1020


Ile Asn  Leu Thr Arg Phe Asn  Ile Ile Arg Lys Leu  Ala Val Ala
    1025                1030                1035


Glu Lys  Pro Ile Ala Asn Ile  Glu Thr Gly Glu Ile  Leu Trp Asp
    1040                1045                1050


Lys Thr  Ala Asp Ile Lys Tyr  Phe Glu Lys Leu Tyr  Asn Tyr Lys
    1055                1060                1065


Arg Leu  Leu Val Thr His Glu  Val Arg Glu Asn Tyr  Gly Ala Met
    1070                1075                1080


Phe Lys  Gln Thr Leu Phe Lys  Ala Ser Tyr Asn Lys  Ser Lys Thr
    1085                1090                1095


Leu Val  Pro Lys Lys Asn His  Met Glu Thr Ser Val  Tyr Gly Gly
```

```
    1100                1105                1110

Tyr Ser  Asn Gln Glu Thr Ala  Tyr Leu Ala Ile Val  Arg Ile Pro
    1115                1120                1125

Phe Lys  Ser Gly Phe Lys Phe  Ile Val Val Gly Ile  Pro Thr Arg
    1130                1135                1140

Met Val  Ala Lys Ile Lys His  Tyr Gln Ser Leu Gly  Ala Thr Leu
    1145                1150                1155

Asn Gln  Ala Thr His Lys Val  Ile Glu Pro Lys Phe  Thr Lys Ile
    1160                1165                1170

Ser Arg  Lys Thr Lys Gln Thr  Val Ile Ser Asp Tyr  Glu Val Val
    1175                1180                1185

Leu Pro  Lys Val Tyr Leu Asp  Gln Val Val Arg Asp  Gln Val Lys
    1190                1195                1200

Gly Gln  Met Tyr Arg Phe Ser  Leu Gly Ser Asp Lys  Glu Tyr His
    1205                1210                1215

Asn Val  Gln Glu Leu Tyr Leu  Pro Leu Ser Ile Gln  Gln Ala Phe
    1220                1225                1230

Val Gly  His Tyr Asp Glu Ser  Asp Asp Gln Arg Ser  Asn Asp Leu
    1235                1240                1245

Val Lys  Val Tyr Asp Ala Ala  Leu Lys Gln Leu Gln  Arg Tyr Phe
    1250                1255                1260

Pro Leu  His Leu Ser Arg Asn  Phe Asp Gln Val Ala  Ser Gln Ala
    1265                1270                1275

His Gln  Ser Phe Glu Gly Leu  Lys Asn Asn Val Gln  Thr Ser Asp
    1280                1285                1290
```

```
Lys Gln  Leu Gly Lys Lys Glu  Val Leu Asn Ser Leu  Phe Val Gly
    1295                1300                1305


Leu His  Ala Asn Ala Thr Arg  Ser Asn Leu Ser Val  Leu Gly Met
    1310                1315                1320


Ser Lys  Asp Phe Gly Arg Ile  Lys Ser Asn Gly Ile  Thr Leu Thr
    1325                1330                1335


Asp Gln  Ala Glu Ile Ile Tyr  Gln Ser Pro Thr Gly  Leu Phe Glu
    1340                1345                1350


Arg Lys  Val Ala Leu Lys Asp  Leu
    1355                1360


<210>  509
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<212>  PRT
<213>  Lactobacillus pentosus

<400>  509

Met Asn Glu Pro Tyr Gly Val Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Thr Val Val Asp Met Asn Gly Arg Val Arg Lys Val Lys Gly
            20                  25                  30


Lys Thr Ala Leu Gly Ala Arg Leu Phe Lys Glu Gly Ala Thr Ala Glu
        35                  40                  45


Asp Arg Arg Gly Phe Arg Thr Thr Arg Arg Arg Leu Lys Arg Val Lys
    50                  55                  60


Trp Arg Leu Arg Leu Leu Arg Glu Phe Phe Asp Gln Pro Ile Ser Lys
65                  70                  75                  80


Ile Asp Pro Asn Phe Phe Ala Arg Arg Lys Tyr Ser Asp Ile Ser Pro
                85                  90                  95
```

```
Arg Asp Pro Asn Tyr Asn Gly Leu Ala Lys Thr Leu Phe Asn Asp Arg
            100                 105                 110

Thr Asp Gln Glu Phe Tyr His Asp Tyr Pro Thr Ile Tyr His Leu Arg
        115                 120                 125

Asp Lys Leu Met Thr Ser Asp Arg Lys Phe Asp Ile Arg Glu Ile Tyr
    130                 135                 140

Leu Ala Ile His His Ile Val Lys Tyr Arg Gly Asn Phe Leu Arg Thr
145                 150                 155                 160

Gly Pro Ala Ser Gln Tyr Gly Ser Ala Ser Leu His Leu Ala Thr Ser
                165                 170                 175

Phe Gln Lys Leu Asn Asp Leu Phe Ala Gln Ser Glu Glu Ser Leu Asn
            180                 185                 190

Phe Lys Leu Val Thr Asp Glu Ala Gln Leu Gln Gln Ile Gln Gln Ile
        195                 200                 205

Leu Val Arg Thr Asp Leu Ser Arg Ser Glu Gln Gln Arg Gln Ile Trp
    210                 215                 220

Pro Leu Met Val Val Leu Met Gly Ala Thr Ala Ala Glu Lys Lys Arg
225                 230                 235                 240

Gln Lys Asp Phe Ala Lys Glu Leu Ala Asn Ala Leu Val Gly Leu Lys
                245                 250                 255

Ala Lys Leu Asn Val Val Thr Leu Thr Asn Val Asp Thr Thr Val Val
            260                 265                 270

Lys Asp Trp Thr Phe Thr Leu Glu Glu Ser Gln Asp Lys Leu Pro Glu
        275                 280                 285
```

```
Ile Glu Glu Gln Leu Ser Glu Val Gly Gln Gln Ile Met Asp Glu Val
    290                 295                 300

Ile Gln Leu Tyr Ala Ser Val Asn Leu Ala Gln Leu Ile Pro Ala Gly
305                 310                 315                 320

Lys Arg Phe Ser Gln His Met Val Glu Lys Tyr Asn His His Glu Lys
                325                 330                 335

Asn Leu Glu Leu Leu Lys Ala Tyr Ile His Ser Gln Ser Asp Ser Lys
            340                 345                 350

Arg Gly Arg Glu Ile Arg Ala Thr Tyr Asp Arg Tyr Ile Asp Gly Val
        355                 360                 365

Lys Ser Lys Pro Val Thr Gln Glu Met Phe Tyr Lys Asp Leu Met Lys
    370                 375                 380

Tyr Val Glu Ala Asp Ala Thr Ser Asn His Leu Ala Ala Glu Ile Lys
385                 390                 395                 400

Asp Glu Ile Asp Ser Glu Gln Phe Met Pro Lys Leu Arg Thr Lys Gln
                405                 410                 415

Asn Gly Ser Ile Pro Tyr Gln Val Gln Gln Tyr Glu Leu Asp Gln Ile
            420                 425                 430

Ile Ser His Gln Lys Lys Tyr Tyr Pro Trp Leu Gly Glu Glu Asn Pro
        435                 440                 445

Val Ala Glu Arg Arg Gly Lys Phe Pro Tyr Lys Leu Asp Glu Leu Val
    450                 455                 460

Gly Phe Arg Val Pro Tyr Tyr Val Gly Pro Leu Ile Thr Lys Glu Asp
465                 470                 475                 480

Gln Gln Ala Thr Ser Gly Ala Gly Phe Ala Trp Met Val Arg Lys Ala
                485                 490                 495
```

```
Asp Gly Pro Ile Thr Pro Trp Asn Phe Asp Gln Lys Val Asp Arg Ile
            500                 505                 510

Ala Ser Ala Thr Ala Phe Ile Gln Arg Met Gln Thr Thr Asp Thr Tyr
        515                 520                 525

Leu Ile Gly Glu Asp Val Leu Pro Ala Arg Ser Leu Ile Tyr Gln Arg
    530                 535                 540

Phe Met Val Leu Asn Glu Leu Asn Asn Met Arg Val Glu Asp Gln Lys
545                 550                 555                 560

Leu Ala Pro Arg Gln Lys Gln Arg Leu Tyr Asn Gln Val Phe Lys Gln
                565                 570                 575

His Gln His Val Ser Val Lys Asn Ile Gln Gln Asn Leu Met Asp Ala
            580                 585                 590

Gly Glu Tyr Arg Glu Thr Pro Lys Ile Thr Gly Leu Ala Asp Pro Lys
        595                 600                 605

Gly Phe Asn Ser Ser Leu Ser Thr Tyr His Asp Phe Lys Lys Ile Leu
    610                 615                 620

Pro Glu Ala Ile Ala Asp Glu His Lys Arg Ala Asp Ile Glu Lys Ile
625                 630                 635                 640

Ile Leu Trp Ser Thr Thr Phe Glu Asp Ser Ala Ile Phe Lys Gln Lys
                645                 650                 655

Leu Glu Glu Val Ala Trp Leu Thr Asp Ala Gln Arg Lys Gln Leu Ser
            660                 665                 670

Gly Leu Arg Tyr Arg Gly Trp Gly Gln Leu Ser His Lys Leu Leu Thr
        675                 680                 685
```

```
Ala Phe Lys Asp Asp Asn Gly Arg Ser Val Met Asp Gly Leu Trp Glu
    690                 695                 700

Thr Ser Asp Asn Phe Met Gln Leu Arg Lys Gln Pro Ala Ile Glu Thr
705                 710                 715                 720

Gln Ile Lys Glu Ala Asn Gln Ala Asn Leu Thr Asp Ala Asp Ile Gln
                725                 730                 735

Asp Thr Ile Asn Glu Leu Tyr Thr Ser Pro Gln Asn Lys Lys Ala Ile
            740                 745                 750

Arg Glu Val Met Leu Val Leu Asp Asp Ile Lys Asn Ala Met His Gly
        755                 760                 765

Gln Thr Pro Ser Trp Ile Phe Ile Glu Ala Ala Arg Gly Gly Gly Val
    770                 775                 780

Ala Gly Arg Arg Thr Gln Ser Arg Ser Lys Gln Ile Val Glu Ala Tyr
785                 790                 795                 800

Lys Ser Thr Ala Lys Glu Ile Val Ser Glu Lys Val Gln His Glu Leu
                805                 810                 815

Asn Glu Lys Ile Lys Ala Lys Ala Asp Phe Asn Thr Arg Leu Val Leu
            820                 825                 830

Tyr Phe Leu Gln Asn Gly Arg Asp Leu Tyr Thr Asn Glu Ala Ile Asn
        835                 840                 845

Ile Asp Arg Leu Ser Glu Tyr Asp Ile Asp His Ile Leu Pro Gln Ser
    850                 855                 860

Leu Val Lys Asp Asp Ser Leu Asp Asn Arg Val Leu Thr Ser Ala Arg
865                 870                 875                 880

Ile Asn Arg Glu Lys Asn Asp Thr Phe Ala Ser Glu Lys Phe Gly Arg
                885                 890                 895
```

```
Lys Met Gly Ala Gln Trp Arg Glu Leu His Arg Asn Gly Leu Met Thr
            900                 905                 910

Gln Arg Lys Leu Lys His Leu Leu Met Arg Pro Asp Glu Ile Ser Lys
        915                 920                 925

His Ala Thr Asp Phe Ile Asn Arg Gln Leu Val Glu Thr Arg Gln Val
    930                 935                 940

Ile Lys Leu Val Glu Glu Leu Ile Ser Ser Glu Tyr Pro Ser Ala Ser
945                 950                 955                 960

Ile Val Ala Val Lys Ala Asn Leu Thr His Gln Phe Arg Gln Thr Phe
                965                 970                 975

Asn Phe Pro Lys Leu Arg Glu Val Asn Asp Tyr His His Ala Phe Asp
            980                 985                 990

Ala Ser Leu Thr Ala Phe Ile Gly  Met Tyr Leu Leu Lys  Gln Tyr Pro
        995                 1000                1005

Lys Leu  Glu Arg Phe Phe Val  Tyr Gly Lys Phe Ala  Lys Gln Pro
    1010                1015                1020

Ile Asn  Leu Thr Arg Phe Asn  Val Ile Arg Lys Leu  Ala Val Ala
    1025                1030                1035

Glu Glu  Pro Ile Ala Asn Ile  Glu Thr Gly Glu Ile  Leu Trp Asp
    1040                1045                1050

Lys Thr  Ala Asp Ile Lys Cys  Phe Glu Lys Leu Tyr  Asn Tyr Lys
    1055                1060                1065

Arg Leu  Leu Val Thr His Glu  Val Arg Glu Asn Tyr  Gly Ala Met
    1070                1075                1080
```

```
Phe Asp  Gln Thr Ile Phe Lys  Ala Thr Asp Ser Arg  Lys Arg Leu
    1085                1090                1095

Ile Gln  Lys Lys Lys Gly Phe  Ala Thr Glu Thr Tyr  Gly Gly Tyr
    1100                1105                1110

Thr Gly  Arg Thr Leu Ala Tyr  Leu Ala Ile Val Lys  Val Val Thr
    1115                1120                1125

Asn Lys  Asp Thr Gln Tyr Gln  Val Val Gly Ile Pro  Thr Thr Met
    1130                1135                1140

Val Thr  Gln Ile Gln Gln Leu  Glu Ala Ser Gly Leu  Thr Ser Lys
    1145                1150                1155

Gln Ala  Val Thr Lys Ala Ile  Gly Ala Met Ile Asn  Glu Asn Asn
    1160                1165                1170

Lys Lys  Leu Gln Ser Tyr Glu  Val Leu Leu Pro Lys  Val Arg Phe
    1175                1180                1185

Glu Gln  Val Val Arg Asp Glu  Val Lys Gly His Ile  His Arg Phe
    1190                1195                1200

Ala Leu  Gly Thr Asp Thr Tyr  Tyr His Asn Ile Gln  Glu Leu Tyr
    1205                1210                1215

Leu Pro  Leu Thr Ile Gln Arg  Ala Phe Leu Gly Lys  Arg Asn Asp
    1220                1225                1230

Thr Asp  Ala Gln Thr Glu Gln  Asn Leu Leu Thr Val  Phe Glu Thr
    1235                1240                1245

Thr Leu  Ala Gln Val Asn Arg  Tyr Phe Pro Leu Tyr  Glu Met Asn
    1250                1255                1260

Lys Phe  Lys Gln Ile Leu Asn  Ser Ala Gln Glu Lys  Phe Ala Ala
    1265                1270                1275
```

```
Leu Pro  Thr Lys Asn Lys Thr  Val Lys Asn Lys Leu  Val Thr Gly
    1280                1285                1290


Lys Asp  Gly Val Leu Asn Asn  Leu Phe Ile Gly Leu  His Ala Asn
    1295                1300                1305


Ala Ser  Leu Gly Asp Leu Lys  Ile Leu Gly Met Lys  Ile Gly Phe
    1310                1315                1320


Gly Lys  Leu Gln Val Pro Gly  Gly Leu Lys Leu Thr  Asp Gln Ala
    1325                1330                1335


Glu Ile  Ile Tyr Gln Ser Pro  Thr Gly Leu Phe Glu  Arg Lys Val
    1340                1345                1350


Ala Leu  Lys Asp Leu
    1355
```

<210> 510
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<212> PRT
<213> Lactobacillus plantarum

<400> 510

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Met Lys Glu Pro Tyr Gly Val Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Thr Val Val Asp Ala Ser Gly His Val Arg Lys Ile Lys Gly
            20                  25                  30


Gln Thr Gly Ile Gly Val Arg Leu Phe Lys Glu Gly Ala Ala Ala Ala
        35                  40                  45


Asp Arg Arg Gly Phe Arg Thr Thr Arg Arg Arg Leu Lys Arg Val Lys
    50                  55                  60


Trp Arg Leu Arg Leu Leu Arg Glu Phe Phe Asp Gln Pro Ile Ser Lys
```

```
65                  70                  75                  80

Val Asp Ile Asn Phe Phe Ala Arg Arg Lys Tyr Ser Asp Val Ser Pro
                85                  90                  95

Arg Asp Pro Asn Tyr Asn Gly Leu Glu Lys Thr Leu Phe Asn Asp Arg
            100                 105                 110

Ser Asp Gln Asp Phe Tyr His Asp Tyr Pro Thr Ile Tyr His Leu Arg
        115                 120                 125

Glu Ala Leu Met Thr Gln His Arg Lys Phe Asp Val Arg Glu Ile Tyr
    130                 135                 140

Leu Ala Ile His His Ile Val Lys Tyr Arg Gly Asn Phe Leu Arg Asn
145                 150                 155                 160

Asp Ala Ala Thr Ala Tyr Arg Ser Gly Thr Leu Asp Leu Gln Gln His
                165                 170                 175

Phe Glu Thr Leu Asn His Leu Phe Ser Gln Ala Asp Leu Glu Leu Asn
            180                 185                 190

Leu Asn Leu Thr Thr Asp Val Ala Leu Leu Asp Ser Ile Lys Gln Thr
        195                 200                 205

Leu Val Arg Thr Asp Ile Ser Arg Ser Asp Arg Gln Lys Leu Ile Met
    210                 215                 220

Pro Leu Leu Ala Val Leu Thr Gly Ala Thr Thr Ala Glu Lys Lys Arg
225                 230                 235                 240

Gln Lys Ala Val Val Thr Glu Phe Ala Lys Ala Leu Val Gly Asn Lys
                245                 250                 255

Thr Lys Ile Asp Val Leu Thr Leu Thr Asp Ile Asp Ala Thr Glu Ala
            260                 265                 270
```

```
Lys Asp Trp Ala Phe Ser Leu Glu Glu Asn Gln Asp Lys Leu Pro Gly
        275                 280                 285

Ile Glu Asp Arg Phe Ser Glu Val Gly Gln Gln Ile Ile Asp Glu Val
    290                 295                 300

Ile Arg Leu Tyr Ala Ser Val Asn Leu Ala Gln Leu Ile Pro Glu Gly
305                 310                 315                 320

Lys Arg Phe Ser Gln Ser Met Val Glu Lys Tyr Lys Arg His Gly Glu
                325                 330                 335

Asp Leu Lys Leu Leu Lys Ala Tyr Ile Arg Ser Gln Ser Asp Ala Lys
            340                 345                 350

Arg Gly Arg Ala Ile Arg Ala Thr Tyr Asp Gln Tyr Ile Asp Gly Val
        355                 360                 365

Lys Ser Lys Gln Val Thr Gln Glu Ala Phe Gln Lys Ala Leu Gly Lys
    370                 375                 380

Phe Val Asp Ala Asp Val Asp Leu Asn Ser Trp Ala Ala Gln Ile Lys
385                 390                 395                 400

Gln Ala Ile Asp Ser Glu Gln Phe Met Pro Lys Leu Arg Thr Lys Gln
                405                 410                 415

Asn Gly Ala Ile Pro Tyr Gln Val Gln Gln Asn Glu Leu Asp Gln Ile
            420                 425                 430

Ile Ser Asn Gln Lys Glu Tyr Tyr Pro Trp Leu Gly Glu Glu Asn Pro
        435                 440                 445

Val Ile Lys Arg Arg Gly Lys Phe Pro Tyr Lys Leu Asp Glu Leu Phe
    450                 455                 460

Gly Phe Arg Val Pro Tyr Tyr Val Gly Pro Leu Ile Thr Lys Glu Met
```

```
465                 470                 475                 480

Gln Ala Ala Thr Ala Asn Ala Gly Phe Ala Trp Met Val Arg Lys Ala
                485                 490                 495

Asp Gly Pro Ile Thr Pro Trp Asn Phe Asp Asp Lys Val Asp Arg Val
            500                 505                 510

Ala Ser Ala Thr Ala Phe Ile Gln Arg Met Gln Thr Thr Asp Thr Tyr
        515                 520                 525

Leu Ile Gly Glu Glu Val Leu Pro Ala Arg Ser Leu Ile Tyr Gln Arg
    530                 535                 540

Phe Met Val Leu Asn Glu Leu Asn Asn Ile Arg Val Asp Asp Gly Gln
545                 550                 555                 560

Leu Thr Pro Arg Gln Lys Gln Arg Leu Tyr Asn Gln Val Phe Lys Lys
                565                 570                 575

His Lys Arg Val Thr Ala Lys Asn Ile Gln Asp Asn Leu Val Ala Ala
            580                 585                 590

Arg Glu Phe Pro Thr Ala Pro Arg Ile Thr Gly Leu Ala Asp Pro Lys
        595                 600                 605

Val Phe Asn Ser Ser Leu Ser Thr Tyr His Asp Leu Lys Gln Val Leu
    610                 615                 620

Pro Glu Ala Met Ser Asp Val Arg Lys Gln Ala Asp Ile Glu Lys Ile
625                 630                 635                 640

Ile Leu Trp Ser Thr Ile Phe Glu Asp Ser Thr Ile Phe Lys Gln Lys
                645                 650                 655

Leu Thr Glu Ile Ser Trp Leu Thr Ala Ala Gln Leu Lys Gln Leu Gly
            660                 665                 670
```

```
Gln Leu Arg Tyr Arg Gly Trp Gly Gln Leu Leu Arg Lys Leu Leu Thr
        675                 680                 685

Gly Leu Lys Asp Asp Asn Asn Arg Ser Ile Met Asp Gly Leu Trp Glu
    690                 695                 700

Thr Asn Ala Asn Phe Met Gln Leu Arg Ser Gln Pro Ala Ile Glu Asn
705                 710                 715                 720

Gln Ile Lys Ser Ala Asn Gln Ala Asn Leu Thr Thr Ala Asp Leu Gln
                725                 730                 735

Asp Thr Ile Asn Glu Leu Tyr Thr Ser Pro Gln Asn Lys Lys Ala Ile
            740                 745                 750

Arg Glu Val Met Val Val Leu Ala Asp Ile Lys Asp Ala Met His Gly
        755                 760                 765

Gln Thr Pro Asn Trp Ile Phe Val Glu Ala Ala Arg Gly Gly Gly Val
    770                 775                 780

Ala Gly Arg Arg Thr Gln Ser Arg Ser Lys Gln Ile Val Ala Ala Tyr
785                 790                 795                 800

Gln Gly Thr Ala Gln Ala Ile Val Arg Asp Gln Val Gln Arg Glu Leu
                805                 810                 815

Lys Glu Lys Ile Lys Asn Lys Ala Asn Phe Asn Thr Arg Leu Val Leu
            820                 825                 830

Tyr Phe Leu Gln Asn Gly Arg Asp Leu Tyr Thr Gly Asp Ala Ile Asn
        835                 840                 845

Ile Asp Arg Leu Ser Glu Tyr Asp Ile Asp His Ile Leu Pro Gln Ser
    850                 855                 860

Leu Val Lys Asp Asp Ser Leu Asp Asn Arg Val Leu Thr Asn Ala Arg
```

```
865                 870                 875                 880

Ile Asn Arg Glu Lys Asn Asp Thr Phe Ala Ser Glu Lys Phe Gly Lys
                885                 890                 895

Lys Met Gly Ala Lys Trp Lys Glu Met His Arg Met Gly Leu Met Thr
            900                 905                 910

Lys Arg Lys Leu Asp His Leu Leu Met Arg Pro Asp Glu Ile Ser Lys
        915                 920                 925

Tyr Ala Thr Gly Phe Ile Asn Arg Gln Leu Val Glu Thr Arg Gln Val
    930                 935                 940

Ile Lys Leu Val Glu Glu Leu Ile Asn Ala Glu Tyr Pro Ser Thr Ala
945                 950                 955                 960

Ile Val Ser Val Lys Ala Asn Leu Thr His Gln Phe Arg Gln Thr Phe
                965                 970                 975

Asp Phe Pro Lys Ile Arg Glu Val Asn Asp Tyr His His Ala Phe Asp
            980                 985                 990

Ala Ala Leu Thr Ala Phe Ile Gly  Thr Tyr Leu Leu Lys  Arg Tyr Pro
        995                 1000                1005

Lys Leu  Glu Arg Phe Phe Val  Tyr Gly Lys Phe Ala  Lys Gln Pro
    1010                1015                1020

Val Asn  Leu Thr Arg Phe Asn  Val Ile Arg Lys Leu  Ala Lys Thr
    1025                1030                1035

Asp Thr  Pro Ile Thr Asp Ile  Asp Thr Gly Glu Val  Leu Trp Asp
    1040                1045                1050

Lys Leu  Thr Asp Ile Lys Tyr  Phe Glu Thr Leu Tyr  Asp Tyr Lys
    1055                1060                1065
```

```
Arg Leu  Leu Val Thr Arg Glu  Val Ser Glu Asn Tyr  Gly Ala Met
    1070                1075                1080

Phe Asp  Gln Thr Leu Leu Lys  Ala Ser Asp Asn Gly  Lys Arg Leu
    1085                1090                1095

Ile Arg  Lys Lys Gln Ser Phe  Asp Thr Ala Ile Tyr  Gly Gly Tyr
    1100                1105                1110

Thr Gly  Lys Thr Leu Ala Tyr  Met Ala Ile Val Lys  Val Ser Thr
    1115                1120                1125

Lys Lys  Asp Val Gln Tyr Gln  Val Val Gly Val Pro  Thr Thr Met
    1130                1135                1140

Val Thr  Gln Ile Glu Gln Leu  Glu Gln Gln Gly Met  Thr Asn Lys
    1145                1150                1155

Gln Ala  Val Thr Lys Val Ile  Glu Pro Leu Ile Ala  Ala Asn Asn
    1160                1165                1170

Lys Lys  Met Leu Thr Tyr Glu  Val Leu Leu Pro Lys  Val Arg Phe
    1175                1180                1185

Glu Gln  Val Val Arg Asp Arg  Ile Lys Gly Gln Thr  His Arg Phe
    1190                1195                1200

Ala Leu  Gly Thr Asp Thr Tyr  Tyr His Asn Ile Gln  Glu Leu Tyr
    1205                1210                1215

Leu Pro  Leu Thr Leu Gln Arg  Ala Phe Leu Gly Lys  Gln Asn Glu
    1220                1225                1230

Ser Glu  Val Gln Leu Asn Gln  Asn Leu Leu Thr Val  Phe Asp Ala
    1235                1240                1245

Thr Leu  Ala Gln Val Asn Arg  Tyr Phe Pro Leu Tyr  Glu Met Asn
```

```
    1250                1255                1260

Lys Phe  Lys Lys Ile Leu Asn  Ser Ala Arg Asp Gln  Ile Glu Leu
    1265                1270                1275

Leu Glu  Ala Lys Asn Gln Phe  Val Lys Asn Lys Leu  Val Leu Gly
    1280                1285                1290

Lys Gln  Gly Ile Leu Thr Asn  Met Phe Ile Gly Leu  His Ala Asn
    1295                1300                1305

Ala Ser  Tyr Gly Asp Leu Lys  Val Leu Gly Val Lys  Ile Asp Phe
    1310                1315                1320

Gly Lys  Leu Gln Val Pro Gly  Gly Ile Lys Leu Thr  Gly Asp Ala
    1325                1330                1335

Glu Ile  Ile Tyr Gln Ser Pro  Thr Gly Leu Phe Glu  Arg Lys Ile
    1340                1345                1350

Ala Leu  Lys Asp Leu
    1355
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<211> 1361
<212> PRT
<213> Lactobacillus rhamnosus

<400> 511

```
Met Thr Lys Leu Asn Gln Pro Tyr Gly Ile Gly Leu Asp Ile Gly Ser
1               5                   10                  15

Asn Ser Ile Gly Phe Ala Val Val Asp Ala Asn Ser His Leu Leu Arg
            20                  25                  30

Leu Lys Gly Glu Thr Ala Ile Gly Ala Arg Leu Phe Arg Glu Gly Gln
        35                  40                  45
```

```
Ser Ala Ala Glu Arg Arg Glu Ser Arg Thr Thr Arg Arg Arg Leu Ser
    50                  55                  60

Arg Thr Arg Trp Arg Leu Ser Phe Leu Arg Asp Phe Phe Ala Pro His
65                  70                  75                  80

Ile Thr Lys Ile Asp Pro Asp Phe Phe Leu Arg Gln Lys Tyr Ser Glu
                85                  90                  95

Ile Ser Pro Lys Asp Lys Asp Arg Phe Lys Tyr Glu Lys Arg Leu Phe
            100                 105                 110

Asn Asp Arg Thr Asp Ala Glu Phe Tyr Glu Asp Tyr Pro Ser Met Tyr
        115                 120                 125

His Leu Arg Leu His Leu Met Thr His Thr His Lys Ala Asp Pro Arg
    130                 135                 140

Glu Ile Phe Leu Ala Ile His His Ile Leu Lys Ser Arg Gly His Phe
145                 150                 155                 160

Leu Thr Pro Gly Ala Ala Lys Asp Phe Asn Thr Asp Lys Val Asp Leu
                165                 170                 175

Glu Asp Ile Phe Pro Ala Leu Thr Glu Ala Tyr Ala Gln Val Tyr Pro
            180                 185                 190

Asp Leu Glu Leu Thr Phe Asp Leu Ala Lys Ala Asp Asp Phe Lys Ala
        195                 200                 205

Lys Leu Leu Asp Glu Gln Ala Thr Pro Ser Asp Thr Gln Lys Ala Leu
    210                 215                 220

Val Asn Leu Leu Leu Ser Ser Asp Gly Glu Lys Glu Ile Val Lys Lys
225                 230                 235                 240

Arg Lys Gln Val Leu Thr Glu Phe Ala Lys Ala Ile Thr Gly Leu Lys
                245                 250                 255
```

```
Thr Lys Phe Asn Leu Ala Leu Gly Thr Glu Val Asp Glu Ala Asp Ala
            260                 265                 270

Ser Asn Trp Gln Phe Ser Met Gly Gln Leu Asp Asp Lys Trp Ser Asn
        275                 280                 285

Ile Glu Thr Ser Met Thr Asp Gln Gly Thr Glu Ile Phe Glu Gln Ile
    290                 295                 300

Gln Glu His Tyr Arg Ala Arg Leu Leu Asn Gly Ile Val Pro Ala Gly
305                 310                 315                 320

Met Ser Leu Ser Gln Ala Lys Val Ala Asp Tyr Gly Gln His Lys Glu
                325                 330                 335

Asp Leu Glu Leu Phe Lys Thr Tyr Leu Lys Lys Leu Asn Asp His Glu
            340                 345                 350

Leu Ala Lys Thr Ile Arg Gly Leu Tyr Asp Arg Tyr Ile Asn Gly Asp
        355                 360                 365

Asp Ala Lys Pro Phe Leu Arg Glu Asp Phe Val Lys Ala Leu Thr Lys
    370                 375                 380

Glu Val Thr Ala His Pro Asn Glu Val Ser Glu Gln Leu Leu Asn Arg
385                 390                 395                 400

Met Gly Gln Ala Asn Phe Met Leu Lys Gln Arg Thr Lys Ala Asn Gly
                405                 410                 415

Ala Ile Pro Val Gln Leu Gln Gln Arg Glu Leu Asp Gln Ile Ile Ala
            420                 425                 430

Asn Gln Ser Lys Tyr Tyr Asp Trp Leu Ala Lys Pro Asn Pro Val Glu
        435                 440                 445
```

```
Lys His Arg Ala Ser Lys Pro Tyr Gln Leu Asp Glu Leu Leu Thr Phe
    450                 455                 460

Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ile Thr Pro Lys Glu Gln Ala
465                 470                 475                 480

Glu Ser Arg Glu Asn Val Phe Ala Trp Met Ile Arg Lys Asp Pro Ser
                485                 490                 495

Gly Asn Ile Thr Pro Tyr Asn Phe Asp Glu Lys Val Asp Cys Pro Ala
            500                 505                 510

Ser Ala Asn Met Phe Ile Gln Arg Met Lys Asn Thr Asp Thr Tyr Leu
        515                 520                 525

Ile Gly Glu Asp Val Leu Pro Lys Arg Ser Leu Leu Tyr Gln Lys Tyr
    530                 535                 540

Glu Val Leu Asn Glu Leu Asn Asn Val Ser Ile Asp Gly Arg Arg Leu
545                 550                 555                 560

Gly Ala Asp Gln Lys Gln Arg Leu Ile Arg Glu Val Phe Glu Arg His
                565                 570                 575

Ser Ser Val Thr Ile Lys Gln Val Ala Glu Asn Leu Val Ala His Gly
            580                 585                 590

Asp Phe Ala Lys Arg Pro Glu Ile Arg Gly Leu Ala Asp Glu Lys Arg
        595                 600                 605

Phe Leu Ser Ser Leu Ser Thr Tyr His Gln Leu Lys Lys Ile Leu His
    610                 615                 620

Glu Ala Ile Asp Asp Pro Thr Lys Glu His Asp Ile Glu Asn Ile Ile
625                 630                 635                 640

Thr Trp Ser Thr Val Phe Glu Asp Ala Ala Ile Phe Lys Thr Glu Leu
                645                 650                 655
```

```
Ala Lys Ile Ser Trp Leu Asp Ser Asp Thr Ile Lys Ala Leu Ser Asn
            660                 665                 670

Ile Arg Tyr Arg Gly Trp Gly Gln Phe Ser Arg Lys Leu Leu Asp Gly
        675                 680                 685

Leu Lys Leu Gly Asn Gly His Thr Val Ile Gln Glu Leu Met Leu Ser
    690                 695                 700

Asn His Asn Leu Met Gln Ile Leu Thr Asp Glu Thr Leu Lys Thr Thr
705                 710                 715                 720

Met Ala Glu Leu Asn Gln Asp Lys Leu Lys Ala Asp Asp Ile Glu Asp
                725                 730                 735

Val Ile Asn Asp Ala Tyr Thr Ser Pro Ser Asn Lys Lys Ala Leu Arg
            740                 745                 750

Gln Val Leu Arg Val Val Glu Asp Ile Lys His Ala Ala Asn Gly Gln
        755                 760                 765

Asp Pro Ser Trp Leu Tyr Ile Glu Thr Ala Asp Gly Pro Gly Thr Ala
    770                 775                 780

Gly Lys Arg Thr Gln Ser Arg Gln Lys Gln Ile Gln Thr Val Tyr Ala
785                 790                 795                 800

Asn Ala Ala Gln Glu Leu Ile Asp Ser Ala Val Arg Gly Glu Leu Glu
                805                 810                 815

Asp Lys Ile Ala Asp Lys Ala Ser Phe Thr Asp Arg Leu Val Leu Tyr
            820                 825                 830

Phe Met Gln Gly Gly Arg Asp Ile Tyr Thr Gly Ala Pro Leu Asn Ile
        835                 840                 845
```

```
Asp Gln Leu Ser His Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Leu
    850                 855                 860

Ile Lys Asp Asp Ser Leu Asp Asn Arg Val Leu Val Asn Ala Thr Ile
865                 870                 875                 880

Asn Arg Glu Lys Asn Asn Val Phe Ala Ser Thr Leu Phe Ala Ser Lys
                885                 890                 895

Met Ala Ala Thr Trp Arg Lys Trp His Glu Ala Gly Leu Ile Ser Gly
            900                 905                 910

Arg Lys Leu Arg Asn Leu Met Leu Arg Pro Asp Glu Ile Asp Lys Phe
        915                 920                 925

Ala His Gly Phe Val Ala Arg Gln Leu Val Glu Thr Arg Gln Ile Ile
    930                 935                 940

Lys Leu Thr Glu Gln Ile Ala Ala Ala Gln Tyr Pro Asn Thr Lys Ile
945                 950                 955                 960

Ile Ala Val Lys Ala Gly Leu Ser His Gln Leu Arg Glu Glu Leu Asp
                965                 970                 975

Phe Pro Lys Asn Arg Asp Val Asn His Tyr His His Ala Phe Asp Ala
            980                 985                 990

Phe Leu Ala Ala Arg Ile Gly Thr  Tyr Leu Leu Lys Arg  Tyr Pro Lys
        995                 1000                1005

Leu Ala  Pro Phe Phe Thr Tyr  Gly Glu Phe Ala Lys  Val Asp Val
    1010                1015                1020

Lys Lys  Phe Arg Glu Phe Asn  Phe Ile Gly Ala Leu  Thr His Ala
    1025                1030                1035

Lys Lys  Asn Ile Val Ala Lys  Asp Thr Gly Glu Ile  Val Trp Asp
    1040                1045                1050
```

```
Lys Glu  Arg Asp Ile Gln Glu  Leu Asp Arg Ile Tyr  Asn Phe Lys
    1055                1060                1065

Arg Met  Leu Ile Thr His Glu  Val Tyr Phe Glu Thr  Ala Asp Leu
    1070                1075                1080

Phe Lys  Gln Thr Ile Tyr Ala  Ala Lys Asp Ser Lys  Glu Arg Gly
    1085                1090                1095

Gly Ser  Lys Gln Leu Ile Pro  Lys Lys Gln Gly Tyr  Pro Thr Gln
    1100                1105                1110

Val Tyr  Gly Gly Tyr Thr Arg  Glu Asn Thr Ala Tyr  Leu Ala Val
    1115                1120                1125

Val Lys  Thr Val Glu Lys Lys  Ala Asp Val Tyr Arg  Val Val Arg
    1130                1135                1140

Ile Ala  Thr Ser Gln Val Ala  Ala Leu Lys Glu Ala  Arg Ala Gln
    1145                1150                1155

Ser Thr  Val Lys Glu Arg Glu  Leu Leu Lys Lys Phe  Leu Thr Thr
    1160                1165                1170

Lys Phe  Thr Lys Ile Gly Lys  Asn Gly Lys Lys Ala  Ile Thr Pro
    1175                1180                1185

Phe Asp  Ile Val Ile Pro Arg  Val Pro Arg Glu Gln  Leu Phe His
    1190                1195                1200

Asn Lys  Arg Tyr Gly Phe Phe  Met Val Asn Ser Asp  Thr Leu Met
    1205                1210                1215

His Asn  Tyr Gln Glu Leu Trp  Met Ser Arg Ser Asp  Gln Gln Ile
    1220                1225                1230
```

```
Leu Ser  Lys Leu Val Lys Ser  Ala Lys Thr Val Glu  Asn Gly Gln
    1235                 1240                 1245


Val Gly  Arg Leu Phe Glu Asn  Ile Val Glu Gln Ile  Asn Lys Tyr
    1250                 1255                 1260


Phe Pro  Leu Tyr Asp Ile Asn  Gln Phe Arg Lys Lys  Leu Asp Gln
    1265                 1270                 1275


Ser Lys  Asp Ile Phe Ser Lys  Leu Pro Leu Glu Gly  Asn Gly Thr
    1280                 1285                 1290


Thr Ser  Gly Lys Arg Glu Thr  Ile Gln Asn Ile Leu  Thr Gly Ala
    1295                 1300                 1305


Gly Thr  Gly Ala Lys Asn Gly  Asp Leu Lys Asn Leu  Gly Ile Lys
    1310                 1315                 1320


Thr Pro  Phe Gly Phe Leu Gln  Val Pro Ser Gly Ile  Val Leu Asp
    1325                 1330                 1335


Asp Asp  Thr Thr Leu Ile Tyr  Gln Ser Pro Thr Gly  Met Leu Asn
    1340                 1345                 1350


Arg Ile  Val Arg Leu Ser Glu  Leu
    1355                 1360


<210>  512
<211>  1361
<212>  PRT
<213>  Lactobacillus rhamnosus

<400>  512

Met Thr Lys Leu Asn Gln Pro Tyr Gly Ile Gly Leu Asp Ile Gly Ser
1               5                  10                  15


Asn Ser Ile Gly Phe Ala Val Val Asp Ala Asn Ser His Leu Leu Arg
            20                  25                  30
```

```
Leu Lys Gly Glu Thr Ala Ile Gly Ala Arg Leu Phe Arg Glu Gly Gln
        35                  40                  45

Ser Ala Ala Glu Arg Arg Glu Ser Arg Thr Thr Arg Arg Arg Leu Ser
    50                  55                  60

Arg Thr Arg Trp Arg Leu Ser Phe Leu Arg Asp Phe Phe Ala Pro His
65                  70                  75                  80

Ile Thr Lys Ile Asp Pro Asp Phe Phe Leu Arg Gln Lys Tyr Ser Glu
                85                  90                  95

Ile Ser Pro Lys Asp Lys Asp Arg Phe Lys Tyr Glu Lys Arg Leu Phe
            100                 105                 110

Asn Asp Arg Thr Asp Ala Glu Phe Tyr Glu Asp Tyr Pro Ser Met Tyr
        115                 120                 125

His Leu Arg Leu His Leu Met Thr His Thr His Lys Ala Asp Pro Arg
    130                 135                 140

Glu Ile Phe Leu Ala Ile His His Ile Leu Lys Ser Arg Gly His Phe
145                 150                 155                 160

Leu Thr Pro Gly Ala Ala Lys Asp Phe Asn Thr Asp Lys Val Asp Leu
                165                 170                 175

Glu Asp Ile Phe Pro Ala Leu Thr Glu Ala Tyr Ala Gln Val Tyr Pro
            180                 185                 190

Asp Leu Glu Leu Thr Phe Asp Leu Ala Lys Ala Asp Asp Phe Lys Ala
        195                 200                 205

Lys Leu Leu Asp Glu Gln Ala Thr Pro Ser Asp Thr Gln Lys Ala Leu
    210                 215                 220

Val Asn Leu Leu Leu Ser Ser Asp Gly Glu Lys Glu Ile Val Lys Lys
```

```
225                 230                 235                 240

Arg Lys Gln Val Leu Thr Glu Phe Ala Lys Ala Ile Thr Gly Leu Lys
                245                 250                 255

Thr Lys Phe Asn Leu Ala Leu Gly Thr Glu Val Asp Glu Ala Asp Ala
            260                 265                 270

Ser Asn Trp Gln Phe Ser Met Gly Gln Leu Asp Asp Lys Trp Ser Asn
        275                 280                 285

Ile Glu Thr Ser Met Thr Asp Gln Gly Thr Glu Ile Phe Glu Gln Ile
    290                 295                 300

Gln Glu Leu Tyr Arg Ala Arg Leu Leu Asn Gly Ile Val Pro Ala Gly
305                 310                 315                 320

Met Ser Leu Ser Gln Ala Lys Val Ala Asp Tyr Gly Gln His Lys Glu
                325                 330                 335

Asp Leu Glu Leu Phe Lys Thr Tyr Leu Lys Lys Leu Asn Asp His Glu
            340                 345                 350

Leu Ala Lys Thr Ile Arg Gly Leu Tyr Asp Arg Tyr Ile Asn Gly Asp
        355                 360                 365

Asp Ala Lys Pro Phe Leu Arg Glu Asp Phe Val Lys Ala Leu Thr Lys
    370                 375                 380

Glu Val Thr Ala His Pro Asn Glu Val Ser Glu Gln Leu Leu Asn Arg
385                 390                 395                 400

Met Gly Gln Ala Asn Phe Met Leu Lys Gln Arg Thr Lys Ala Asn Gly
                405                 410                 415

Ala Ile Pro Val Gln Leu Gln Gln Arg Glu Leu Asp Gln Ile Ile Ala
            420                 425                 430
```

```
Asn Gln Ser Lys Tyr Tyr Asp Trp Leu Ala Lys Pro Asn Pro Val Glu
        435                 440                 445

Lys His Arg Ala Ser Lys Pro Tyr Gln Leu Asp Glu Leu Leu Thr Phe
    450                 455                 460

Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ile Thr Pro Lys Glu Gln Ala
465                 470                 475                 480

Glu Ser Arg Glu Asn Val Phe Ala Trp Met Ile Arg Lys Asp Pro Ser
                485                 490                 495

Gly Asn Ile Thr Pro Tyr Asn Phe Asp Glu Lys Val Asp Cys Pro Ala
            500                 505                 510

Ser Ala Asn Met Phe Ile Gln Arg Met Lys Asn Thr Asp Thr Tyr Leu
        515                 520                 525

Ile Gly Glu Asp Val Leu Pro Lys Arg Ser Leu Leu Tyr Gln Lys Tyr
    530                 535                 540

Glu Val Leu Asn Glu Leu Asn Asn Val Ser Ile Asp Gly Arg Arg Leu
545                 550                 555                 560

Gly Ala Asp Gln Lys Gln Arg Leu Ile Arg Glu Val Phe Glu Arg His
                565                 570                 575

Ser Ser Val Thr Ile Lys Gln Val Ala Glu Asn Leu Val Ala His Gly
            580                 585                 590

Asp Phe Ala Lys Arg Pro Glu Ile Arg Gly Leu Ala Asp Glu Lys Arg
        595                 600                 605

Phe Leu Ser Ser Leu Ser Thr Tyr His Gln Leu Lys Lys Ile Leu His
    610                 615                 620

Glu Ala Ile Asp Asp Pro Thr Lys Glu His Asp Ile Glu Asn Ile Ile
```

625 630 635 640

Thr Trp Ser Thr Val Phe Glu Asp Ala Ala Ile Phe Lys Thr Glu Leu
645 650 655

Ala Lys Ile Ser Trp Leu Asp Ser Asp Thr Ile Lys Ala Leu Ser Asn
660 665 670

Ile Arg Tyr Arg Gly Trp Gly Gln Phe Ser Arg Lys Leu Leu Asp Gly
675 680 685

Leu Lys Leu Gly Asn Gly His Thr Val Ile Gln Glu Leu Met Leu Ser
690 695 700

Asn His Asn Leu Met Gln Ile Leu Thr Asp Glu Thr Leu Lys Thr Thr
705 710 715 720

Met Ala Glu Leu Asn Gln Asp Lys Leu Lys Ala Asp Asp Ile Glu Asp
725 730 735

Val Ile Asn Asp Ala Tyr Thr Ser Pro Ser Asn Lys Lys Ala Leu Arg
740 745 750

Gln Val Leu Arg Val Val Glu Asp Ile Lys His Ala Ala Asn Gly Gln
755 760 765

Asp Pro Ser Trp Leu Tyr Ile Glu Thr Ala Asp Gly Pro Gly Thr Ala
770 775 780

Gly Lys Arg Thr Gln Ser Arg Gln Lys Gln Ile Gln Thr Val Tyr Ala
785 790 795 800

Asn Ala Ala Gln Glu Leu Ile Asp Ser Ala Val Arg Gly Glu Leu Glu
805 810 815

Asp Lys Ile Ala Asp Lys Ala Ser Phe Thr Asp Arg Leu Val Leu Tyr
820 825 830

```
Phe Met Gln Gly Gly Arg Asp Ile Tyr Thr Gly Ala Pro Leu Asn Ile
        835                 840                 845

Asp Gln Leu Ser His Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Leu
    850                 855                 860

Ile Lys Asp Asp Ser Leu Asp Asn Arg Val Leu Val Asn Ala Thr Ile
865                 870                 875                 880

Asn Arg Glu Lys Asn Asn Val Phe Ala Ser Thr Leu Phe Ala Ser Lys
                885                 890                 895

Met Ala Ala Thr Trp Arg Lys Trp His Glu Ala Gly Leu Ile Ser Gly
            900                 905                 910

Arg Lys Leu Arg Asn Leu Met Leu Arg Pro Asp Glu Ile Asp Lys Phe
        915                 920                 925

Ala His Gly Phe Val Ala Arg Gln Leu Val Glu Thr Arg Gln Ile Ile
    930                 935                 940

Lys Leu Thr Glu Gln Ile Ala Ala Ala Gln Tyr Pro Asn Thr Lys Ile
945                 950                 955                 960

Ile Ala Val Lys Ala Gly Leu Ser His Gln Leu Arg Glu Glu Leu Asp
                965                 970                 975

Phe Pro Lys Asn Arg Asp Val Asn His Tyr His His Ala Phe Asp Ala
            980                 985                 990

Phe Leu Ala Ala Arg Ile Gly Thr  Tyr Leu Leu Lys Arg  Tyr Pro Lys
        995                 1000                1005

Leu Ala  Pro Phe Phe Thr Tyr  Gly Glu Phe Ala Lys  Val Asp Val
    1010                1015                1020

Lys Lys  Phe Arg Glu Phe Asn  Phe Ile Gly Ala Leu  Thr His Ala
```

```
    1025                1030                1035

Lys Lys  Asn Ile Val Ala Lys  Asp Thr Gly Glu Ile  Val Trp Asp
    1040                1045                1050

Lys Glu  Arg Asp Ile Gln Glu  Leu Asp Arg Ile Tyr  Asn Phe Lys
    1055                1060                1065

Arg Met  Leu Ile Thr His Glu  Val Tyr Phe Glu Thr  Ala Asp Leu
    1070                1075                1080

Phe Lys  Gln Thr Ile Tyr Ala  Ala Lys Asp Ser Lys  Glu Arg Gly
    1085                1090                1095

Gly Ser  Lys Gln Leu Ile Pro  Lys Lys Gln Gly Tyr  Pro Thr Gln
    1100                1105                1110

Val Tyr  Gly Gly Tyr Thr Arg  Glu Asn Thr Ala Tyr  Leu Ala Val
    1115                1120                1125

Val Lys  Thr Val Glu Lys Lys  Ala Asp Val Tyr Arg  Val Val Arg
    1130                1135                1140

Ile Ala  Thr Ser Gln Val Ala  Ala Leu Lys Glu Ala  Arg Ala Gln
    1145                1150                1155

Ser Thr  Val Lys Glu Arg Glu  Leu Leu Lys Lys Phe  Leu Thr Thr
    1160                1165                1170

Lys Phe  Thr Lys Ile Gly Lys  Asn Gly Lys Lys Ala  Ile Thr Pro
    1175                1180                1185

Phe Asp  Ile Val Ile Pro Arg  Val Pro Arg Glu Gln  Leu Phe His
    1190                1195                1200

Asn Lys  Arg Tyr Gly Phe Phe  Met Val Asn Ser Asp  Thr Leu Met
    1205                1210                1215
```

```
His Asn  Tyr Gln Glu Leu Trp  Met Ser Arg Ser Asp  Gln Gln Ile
    1220                1225                1230


Leu Ser  Lys Leu Val Lys Ser  Ala Lys Thr Val Glu  Asn Gly Gln
    1235                1240                1245


Val Gly  Arg Leu Phe Glu Asn  Ile Val Glu Gln Ile  Asn Lys Tyr
    1250                1255                1260


Phe Pro  Leu Tyr Asp Ile Asn  Gln Phe Arg Lys Lys  Leu Asp Gln
    1265                1270                1275


Ser Lys  Asp Ile Phe Ser Lys  Leu Pro Leu Glu Gly  Asn Gly Thr
    1280                1285                1290


Thr Ser  Gly Lys Arg Glu Thr  Ile Gln Asn Ile Leu  Thr Gly Ala
    1295                1300                1305


Gly Thr  Gly Ala Lys Asn Gly  Asp Leu Lys Asn Leu  Gly Ile Lys
    1310                1315                1320


Thr Pro  Phe Gly Phe Leu Gln  Val Pro Ser Gly Ile  Val Leu Asp
    1325                1330                1335


Asp Asp  Thr Thr Leu Ile Tyr  Gln Ser Pro Thr Gly  Met Leu Asn
    1340                1345                1350


Arg Ile  Val Arg Leu Ser Glu  Leu
    1355                1360


<210>  513
<211>  1352
<212>  PRT
<213>  Lactobacillus ruminis

<400>  513

Met Asn Asp Asn Phe Asp Leu Met Arg Val Lys Gly Lys Lys Gly Ile
1               5                   10                  15
```

```
Gly Val Arg Leu Tyr Asn Glu Gly Gln Ser Ala Ala Glu Arg Arg Met
            20                  25                  30

His Arg Thr Ala Arg Arg Arg Tyr Gly Arg Arg Lys Trp Arg Leu Arg
        35                  40                  45

Leu Leu Glu Asp Phe Phe Asp Glu His Met Ala Glu Val Asp Asp Thr
    50                  55                  60

Phe Phe Ala Arg Leu Lys Asp Ser Asn Ile Ser Pro Lys Asp Asp Lys
65                  70                  75                  80

Lys Tyr Arg Lys Ser Leu Leu Phe Pro Lys Ser Lys Gly Val Thr Tyr
                85                  90                  95

Gln Asp Asp Gly Glu Phe Tyr Lys Lys Tyr Pro Thr Met Tyr His Leu
            100                 105                 110

Arg Tyr Ala Leu Met Thr Glu His Arg Lys Phe Asp Leu Arg Glu Ile
        115                 120                 125

Tyr Leu Ala Phe His His Met Val Lys Tyr Arg Gly Asn Phe Leu Tyr
    130                 135                 140

Asp Thr Ser Val Asp Ser Phe Glu Ala Lys Asn Leu Asp Ile Lys Gly
145                 150                 155                 160

Lys Phe Asp Glu Ile Asn Asp Leu Leu Ser Ser Tyr Thr Asp Phe Tyr
                165                 170                 175

Val Asp Asn Ser Asn Ala Ala Leu Val Glu Ser Ile Leu Leu Glu Lys
            180                 185                 190

Asn Thr Thr Arg Lys Asp Lys Ser Lys Lys Ile Ala Lys Leu Leu His
        195                 200                 205
```

```
Val Glu Asp Lys Glu Lys Gly Lys Asn Lys Lys Ala Lys Asp Leu Ala
    210                 215                 220

Thr Gln Ile Ser Asn Ala Val Leu Gly Leu Lys Cys Asn Phe His Leu
225                 230                 235                 240

Ile Phe Glu Leu Gln Gln Lys Tyr Ser Phe Asp Leu Cys Ser Glu Lys
                245                 250                 255

Thr Glu Glu Asn Ile Ala Lys Leu Ser Glu Val Leu Asp Glu Asn Gln
            260                 265                 270

Lys Met Leu Leu Met Ile Leu Lys Glu Val Gln Asp Gln Val Met Leu
        275                 280                 285

Asn Ala Phe Val Pro Ser Gly Met Ser Leu Ser Glu Ala Met Met Gln
    290                 295                 300

Lys Tyr Asp Asp Tyr Gly Glu Gln Leu Lys Ile Tyr His Glu Leu Glu
305                 310                 315                 320

His Ser Val Ser Asp Asp Ser Ala Ala Lys Leu Arg Gly Ala Tyr Arg
                325                 330                 335

Asp Tyr Asn Asp Asn Ile Ile Lys Arg Ile Asp Gly Asp Asn Lys Lys
            340                 345                 350

Asp Thr Phe Tyr Lys Arg Val Lys Asn Ile Leu Thr Lys Ile Ser Lys
        355                 360                 365

Glu Tyr Val Asp Gln Asp Val Leu Glu Ser Cys Gly Lys Leu Lys Lys
    370                 375                 380

Leu Ile Asp Glu Asn Lys Leu Phe Ile Arg Gln Arg Thr Ala Ala Asn
385                 390                 395                 400

Gly Val Leu Pro His Gln Leu His Gln Ile Glu Met Arg Lys Ile Ile
                405                 410                 415
```

```
Asp Asn Gln Lys Glu Tyr Tyr Pro Trp Leu Ala Glu Pro Asn Pro Asn
            420                 425                 430

Glu Lys Arg Arg Val Tyr Ser Lys Tyr Lys Val Glu Glu Leu Ile Ala
        435                 440                 445

Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Val Asp Pro Asn Asn Ala
    450                 455                 460

Asp Lys Asn Lys Glu Ala Arg Phe Ser Trp Met Val Arg Lys Lys Asp
465                 470                 475                 480

Gly Glu Ile Thr Pro Trp Asn Phe Tyr Asp Lys Val Asp Trp Ala Glu
                485                 490                 495

Ser Ala Asn Asn Phe Ile Glu Arg Met Lys Ser Lys Asp Thr Tyr Leu
            500                 505                 510

Leu Gly Glu Asp Val Val Pro Lys Glu Ser Met Leu Tyr Gln Lys Tyr
        515                 520                 525

Glu Val Leu Asn Glu Leu Asn Asn Leu Arg Ile Asn Asp Ser Gly Leu
    530                 535                 540

Ser Asp Ser Phe Glu Asp Val Lys Leu Lys Gln Ala Ile Tyr Asn Asp
545                 550                 555                 560

Leu Phe Lys Lys Gln Lys Ile Val Lys Ile Thr Asp Leu Gln Asn Tyr
                565                 570                 575

Leu Val Gln Asn His Lys Tyr Leu Val Lys Pro Lys Ile Ser Gly Leu
            580                 585                 590

Ala Asp Glu Asn Arg Phe Leu Ser Ser Leu Ser Thr Tyr Ser Asp Leu
        595                 600                 605
```

```
Lys Thr Ile Phe Gly Asp Lys Val Asp Asp Arg Thr Tyr Phe Asn Asp
    610                 615                 620

Phe Glu Lys Met Val Glu Tyr Ser Thr Val Phe Glu Asp Gly His Asp
625                 630                 635                 640

Tyr Asn Gln Lys Leu Asp Glu Tyr Thr Trp Leu Thr Lys Glu Glu Lys
                645                 650                 655

Tyr Lys Ile Gly Lys Lys Arg Tyr Arg Gly Trp Gly Lys Leu Ser Lys
            660                 665                 670

Lys Leu Leu Thr Gly Leu Arg Asp Lys Asn Asn His Thr Ile Met Asp
        675                 680                 685

Asn Leu Trp Glu Thr Asn Arg Asn Phe Met Gln Ile Gln Thr Ala Asp
    690                 695                 700

Glu Phe Ser Lys Gln Ile Ala Glu Glu Asn Glu Arg His Leu Lys Gly
705                 710                 715                 720

Ser Val Ser Asp Ala Ile Asn Asp Met Tyr Thr Ser Pro Ala Asn Lys
                725                 730                 735

Lys Ala Ile Arg Gln Val Leu Arg Val Val Asp Asp Ile Gln Lys Ala
            740                 745                 750

Met Gly Tyr Ala Pro Ser Ser Ile Ser Leu Glu Phe Ala Arg Glu Asp
        755                 760                 765

Gly Pro Ser Val Arg Thr Val Ser Arg Ala Asn Arg Met Lys Ser Ile
    770                 775                 780

Tyr Glu Lys Tyr Ala Ser Glu Val Ser Glu Glu Val Met Lys Asp Leu
785                 790                 795                 800

Asp Gly Val Ile Lys Asp Lys Lys Gly Leu Asn Asp Arg Leu Tyr Leu
                805                 810                 815
```

```
Tyr Phe Glu Gln Gln Gly Lys Asp Met Tyr Ser Gly His Pro Leu Asp
            820                 825                 830

Phe Asp Lys Val Ile Ser Gly Gln Glu Tyr Asp Ile Asp His Ile Leu
        835                 840                 845

Pro Gln Ala Val Ile Lys Asp Asp Ser Leu Asp Asn Arg Val Leu Thr
    850                 855                 860

Thr Lys Ala Leu Asn Asn Asp Val Lys Ser Lys Gly Val Pro Cys Arg
865                 870                 875                 880

Met Phe Asn Gly Met His Ser Phe Trp Lys Asn Leu Tyr Asp Lys Gly
                885                 890                 895

Phe Ile Ser Arg Arg Lys Phe Asn Asn Leu Thr Thr Asn Pro Glu Asn
            900                 905                 910

Ile Asp Lys Tyr Lys Met Lys Gly Phe Val Asn Arg Gln Leu Val Glu
        915                 920                 925

Thr Arg Gln Ile Ile Lys Leu Val Ala Asn Val Leu Asn Asp Lys Tyr
    930                 935                 940

Gln Asn Asp Asp Val Asp Ile Ile Glu Val Arg Ala Glu Leu Thr His
945                 950                 955                 960

Asp Val Arg Lys His Phe Lys Phe Tyr Lys Asn Arg Asn Val Asn Asp
                965                 970                 975

Tyr His His Ala Phe Asp Ala Tyr Leu Thr Ser Phe Ile Gly His Tyr
            980                 985                 990

Leu Phe Lys Lys Tyr Pro Asn Leu  Arg Pro Leu Phe Asp  Tyr Asn Asp
        995                 1000                1005
```

```
Phe Met  Lys Val Ser Asp Asn  Val Phe Lys Gln Leu  Arg Gly Asn
    1010                1015                1020

Asn Phe  Leu Gly Glu Phe Leu  Asn Lys Thr Gly Asp  Ile Ile Ser
    1025                1030                1035

Thr Asp  Gly Asn Phe Val Leu  Asn Lys Glu Glu Met  Ile Asn Lys
    1040                1045                1050

Leu Asn  Lys Ala Tyr Ala Phe  Lys Lys Ile Leu Val  Thr Lys Glu
    1055                1060                1065

Val Gly  Gln Arg Thr Gly Ala  Met Phe Asn Glu Thr  Arg Tyr Pro
    1070                1075                1080

Ala Pro  Asn Ser Arg Lys Ala  Ala Leu Lys Tyr Arg  Arg Met Pro
    1085                1090                1095

Lys Pro  Asp Ser Leu Ile Ser  Val Lys Asp Tyr Lys  Asn Thr Asp
    1100                1105                1110

Ile Tyr  Gly Gly Tyr Ser Gly  Lys Asn Asp Ala Tyr  Met Val Ile
    1115                1120                1125

Val Asp  Met Gly Lys Gln Tyr  Met Val Val Gly Val  Pro Val Arg
    1130                1135                1140

Tyr Thr  Glu Lys Leu Asp Lys  Leu Arg Ile Lys His  Ser Glu Leu
    1145                1150                1155

Tyr Arg  Asp Glu Leu Arg Lys  Val Leu Ser Arg Asp  Lys Thr Leu
    1160                1165                1170

Leu Asp  Ser Lys Gly Asn Val  Lys Arg Phe Asp Ile  Val Leu Asp
    1175                1180                1185

Arg Val  Leu Tyr Gly Gln Leu  Ile Glu Asp Gly Asn  Glu Leu Phe
    1190                1195                1200
```

```
Thr Leu  Gly Ser Ser Lys Tyr  Lys Arg Asn Phe Arg  Gln Leu Phe
    1205                1210                1215


Leu Asp  Lys Gln Cys Ile Glu  Ile Leu Asp Ser Ser  Ala Thr Pro
    1220                1225                1230


Gln Pro  Thr Asp Glu Glu Leu  Ile Trp Val Tyr Asp  Gln Ile Leu
    1235                1240                1245


Asp Lys  Val Asp Lys Tyr Phe  Glu Leu Tyr Asp Ile  Asn Arg Gln
    1250                1255                1260


Arg Glu  Thr Leu Arg Lys Gly  Arg Ala Ala Phe Cys  Ser Leu Pro
    1265                1270                1275


Asn Ile  Ser Met Lys Lys Asp  Asp Val Thr Lys Lys  Lys Ile Leu
    1280                1285                1290


Asn Glu  Ile Leu Val Ala Leu  His Ala Asn Glu Ser  Glu Ser Asn
    1295                1300                1305


Cys Glu  Lys Ile Gly Lys Lys  Val Phe Gly Arg Leu  Gln Val Pro
    1310                1315                1320


Gly Gly  Ile Lys Leu Ser Lys  Glu Ala Lys Leu Ile  Tyr Gln Ser
    1325                1330                1335


Pro Thr  Gly Leu Phe Glu Arg  Val Val Tyr Leu Lys  Asp Leu
    1340                1345                1350


<210>  514
<211>  1339
<212>  PRT
<213>  Lactobacillus salivarius

<400>  514

Met Glu Arg Tyr His Ile Gly Leu Asp Ile Gly Thr Ser Ser Ile Gly
```

```
1               5                   10                  15

Trp Ala Val Ile Gly Asp Asp Phe Lys Ile Lys Lys Lys Lys Gly Lys
            20                  25                  30

Asn Leu Ile Gly Thr Arg Leu Phe Asn Glu Gly Ala Thr Ala Ala Glu
        35                  40                  45

Arg Arg Gly Phe Arg Thr Gln Arg Arg Arg Leu Asn Arg Arg Lys Trp
    50                  55                  60

Arg Leu Lys Leu Leu Glu Glu Ile Phe Asp Pro Tyr Met Ala Glu Val
65                  70                  75                  80

Asp Glu Tyr Phe Phe Ala Arg Leu Lys Ser Ser Asn Leu Ser Pro Lys
                85                  90                  95

Asp Ser Asn Lys Lys Tyr Leu Gly Ser Leu Leu Phe Pro Asp Lys Ser
            100                 105                 110

Asp Ser Asn Phe Tyr Asp Lys Tyr Pro Thr Ile Tyr His Leu Arg Arg
        115                 120                 125

Asp Leu Met Glu Lys Asp Glu Lys Phe Asp Leu Arg Glu Ile Tyr Leu
    130                 135                 140

Ala Ile His His Ile Val Lys Tyr Arg Gly Asn Phe Leu Glu Lys Val
145                 150                 155                 160

Pro Ala Lys Asn Tyr Lys Asn Ser Gly Ala Ser Ile Gly Phe Leu Leu
                165                 170                 175

Glu Glu Val Asn Ser Leu Tyr Lys Asp Ile Ile Gly Asp Glu Ser Ile
            180                 185                 190

Ala Ile Leu Asn Ser Glu Lys Phe Glu Asp Val Glu Lys Ile Ile Leu
        195                 200                 205
```

```
Asp Glu Glu Thr Arg Asn Leu Asp Lys Gln Lys Ser Val Gly Lys Leu
    210                 215                 220

Leu Val Glu Asp Lys Lys Lys Lys Asn Ile Val Thr Ala Phe Ser Lys
225                 230                 235                 240

Ala Ile Phe Gly Tyr Lys Phe Asn Ile Glu Asp Leu Leu Leu Ile Glu
                245                 250                 255

Asn Asp Glu Lys Asn Lys Leu Thr Phe Asn Asp Glu Asn Ile Asp Asp
            260                 265                 270

Ile Phe Asn Glu Leu Ser His Ser Leu Asp Asp Lys Gln Met Asp Leu
        275                 280                 285

Leu Thr Lys Thr Arg Glu Ile Tyr Phe Lys Phe Lys Leu Asn Met Ile
    290                 295                 300

Val Pro Thr Gly Tyr Thr Leu Ser Glu Ser Met Ile Glu Lys Tyr Glu
305                 310                 315                 320

Met His Lys Ala His Leu Lys Met Tyr Lys Glu Phe Ile Asn Thr Leu
                325                 330                 335

Asn Thr Lys Asp Arg Lys Ile Leu Lys Asn Ala Tyr Ser Asp Tyr Ile
            340                 345                 350

Asn Thr Glu Lys Ala Lys Ala Ala Asn Ala Gln Glu Asn Phe Tyr Lys
        355                 360                 365

Thr Val Lys Lys Ile Ile Lys Asp Asn Asn Ser Asp Thr Ala Lys Lys
    370                 375                 380

Ile Ile Val Leu Ile Asp Glu Gly Asn Phe Met Pro Lys Gln Arg Thr
385                 390                 395                 400

Gly Glu Asn Gly Val Ile Pro His Gln Leu His Gln Ile Glu Leu Asp
```

```
                405                 410                 415

Arg Ile Ile Glu Asn Gln Ala Lys Tyr Tyr Pro Trp Leu Ala Glu Ala
            420                 425                 430

Asn Pro Val Glu Lys Asn Arg Lys Phe Ala Lys Tyr Lys Leu Asp Glu
        435                 440                 445

Leu Val Thr Phe Arg Val Pro Tyr Tyr Val Gly Pro Leu Ile Asp Lys
    450                 455                 460

Thr Glu Ser Asn Lys Asn Glu Lys Glu Thr Lys Phe Ala Trp Met Val
465                 470                 475                 480

Arg Lys Ala Lys Gly Thr Ile Thr Pro Trp Asn Phe Glu Asn Leu Val
                485                 490                 495

Asp Arg Thr Glu Ser Ala Asn Arg Phe Ile Lys Arg Met Thr Ser Lys
            500                 505                 510

Asp Thr Tyr Ile Ile Gly Glu Asp Val Leu Pro Ala Ser Ser Leu Leu
        515                 520                 525

Tyr Glu Lys Phe Lys Val Leu Asn Glu Leu Asn Asn Ile Lys Val Asn
    530                 535                 540

Glu Lys Lys Leu Asp Ile Glu Gln Lys Gln Asp Ile Tyr Leu Asn Leu
545                 550                 555                 560

Phe Thr Thr Ala Lys Asn Val Thr Lys Lys Ser Leu Ala Thr Tyr Leu
                565                 570                 575

Asn Cys Ser Ala Asp Ser Ile Ser Gly Leu Ser Asp Gly Glu Lys Phe
            580                 585                 590

Asn Ser Ser Leu Ser Ser Tyr Ile Asp Leu Lys Ala Ile Leu Gly Asn
        595                 600                 605
```

```
Ile Val Asp Asp Cys Asn Lys Asn Glu Asp Leu Glu Lys Ile Ile Glu
    610                 615                 620

Tyr Ser Thr Val Phe Glu Asp Gly Asn Ile Tyr Lys Glu Lys Leu Ser
625                 630                 635                 640

Glu Ile Ser Trp Leu Thr Asp Glu Gln Ile Glu Lys Leu Ser Asn Ile
                645                 650                 655

His Phe Lys Gly Trp Gly Arg Leu Ser Lys Lys Leu Leu Thr Gln Ile
            660                 665                 670

Thr Asn Glu Asn Gly Glu Arg Ile Ile Asp Ala Leu Trp Asn Thr Ser
        675                 680                 685

Asn Asn Phe Met Gln Ile Ile Asn Asp Glu Ser Ile Gln Ala Lys Leu
    690                 695                 700

Ala Glu Ile Asn Gly Lys Tyr Ala Gly Lys Ser Asp Leu Glu Asp Ile
705                 710                 715                 720

Leu Ser Glu Ala Tyr Thr Ser Pro Gln Asn Lys Lys Ala Ile Arg Gln
                725                 730                 735

Val Met Lys Val Val Glu Asp Ile Glu Lys Ala Met Gln Cys Glu Pro
            740                 745                 750

Thr Ser Ile Ser Ile Glu Phe Thr Arg Lys Lys Gln Lys Ser Arg Leu
        755                 760                 765

Thr Asn Thr Arg Tyr Lys Lys Ile Ser Asp Val Tyr Glu Lys Ile Ala
    770                 775                 780

Asp Glu Val Ile Ser Glu Tyr Glu Leu Arg Lys Leu Gln Ser Glu Leu
785                 790                 795                 800

Asp Ser Asn Ala Asn Asn Met Arg Asp Arg Tyr Tyr Leu Tyr Phe Met
```

```
                805                 810                 815

Gln Leu Gly Arg Asp Met Tyr Thr Gly Glu Lys Ile Asn Ile Asp Glu
            820                 825                 830

Leu His Gln Arg Tyr Asp Ile Asp His Ile Leu Pro Gln Ser Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asn Asn Arg Val Leu Thr Arg Lys Asp Val Asn
    850                 855                 860

Asn Lys Glu Lys Ser Asp Lys Thr Ala Ala Asp Leu Tyr Ala Val Glu
865                 870                 875                 880

Met Ser Asp Phe Trp Arg Lys Leu Arg Lys Gln Gly Leu Ile Thr Glu
                885                 890                 895

Gln Lys Tyr Lys Asn Leu Leu Thr Lys Ser Asp Ser Ile Asp Lys Tyr
            900                 905                 910

Ala Lys Lys Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Ser Gln Val
        915                 920                 925

Val Lys Leu Val Ala Asn Ile Leu Gln Asp Lys Tyr Ser Asp Thr Lys
    930                 935                 940

Ile Ile Glu Val Arg Ala Lys Leu Asn Ser Asn Leu Arg Glu Glu Tyr
945                 950                 955                 960

Lys Leu Ile Lys Asn Arg Ala Val Asn Asp Tyr His His Ala Ile Asp
                965                 970                 975

Gly Tyr Leu Thr Thr Phe Ile Gly Gln Tyr Leu Tyr Lys Thr Tyr Pro
            980                 985                 990

Lys Leu Arg Ser Tyr Phe Val Tyr  Asn Asp Phe Lys Lys  Leu Asp Ser
        995                 1000                1005
```

```
Asn Tyr  Leu Lys His Met Lys  Lys Phe Asn Phe Leu  Trp Gln Leu
    1010                1015                1020

Gln Asp  Asp Lys Thr Ile Asp  Ile Tyr Asp Asn Val  Asn Asn Lys
    1025                1030                1035

Phe Val  Leu Asn Val Pro Glu  Met Lys Lys Tyr Ile  Gln Lys Ile
    1040                1045                1050

Tyr Asn  Tyr Lys Tyr Met Leu  Val Ser Lys Glu Val  Thr Thr Lys
    1055                1060                1065

Asn Gly  Ala Phe Tyr Asp Gln  Thr Lys Tyr Asn Ala  Lys Thr Val
    1070                1075                1080

Asn Leu  Ile Pro Ile Lys Lys  Asn Lys Pro Thr Asn  Ile Tyr Gly
    1085                1090                1095

Gly Tyr  Lys Gly Lys Val Ser  Ser Tyr Met Met Leu  Val Lys Ile
    1100                1105                1110

Arg Lys  Lys Lys Glu Val Ile  Tyr Lys Phe Val Gly  Val Pro Arg
    1115                1120                1125

Leu Trp  Thr Asp Glu Leu Asp  Arg Leu Lys Asp Thr  Thr Glu Arg
    1130                1135                1140

Lys Ile  Leu Leu Asn Glu Ile  Ala Lys Asn Ser Leu  Ser Lys Thr
    1145                1150                1155

Glu Gln  Asp Phe Glu Val Ile  Leu Asp Lys Val Tyr  Tyr Gly Gln
    1160                1165                1170

Leu Ile  Ile Asp Gly Asn Gln  Lys Tyr Thr Leu Gly  Ser Ser Glu
    1175                1180                1185

Tyr Lys  Tyr Asn Ala Met Gln  Leu His Leu Ser Lys  His Ala Leu
```

```
    1190                1195                1200

Glu Val  Leu Ala Lys Glu Asn  Val Lys Asp Ala Glu  Ile Thr Asp
    1205                1210                1215

Lys Asp  Leu Val Ser Val Tyr  Glu Glu Ile Leu Ser  Val Val Asn
    1220                1225                1230

Lys Tyr  Phe Glu Leu Tyr Asp  Ile Asn Lys Phe Arg  Gln Lys Leu
    1235                1240                1245

Asn Glu  Gly Leu Glu Ile Phe  Arg Lys Leu Pro Val  Tyr Asn Val
    1250                1255                1260

Tyr Glu  Ser Asn Lys Ile Lys  Gln Val Gly Lys Phe  Glu Val Leu
    1265                1270                1275

Asn Arg  Ile Leu Met Gly Leu  His Ala Asn Ala Met  Ile Thr Asp
    1280                1285                1290

Leu Lys  Val Leu Gly Ile Lys  Thr Lys Leu Gly Gln  Met Gln Val
    1295                1300                1305

Asn Gly  Gly Ile Lys Leu Ser  Pro Asp Ala Lys Leu  Ile Tyr Gln
    1310                1315                1320

Ser Pro  Thr Gly Ile Phe Ser  Arg Ala Val Arg Val  Lys Asp Leu
    1325                1330                1335

Gly
```

<210> 515
<211> 629
<212> PRT
<213> Lactobacillus salivarius

<400> 515

```
Met Glu Arg Tyr His Ile Gly Leu Asp Ile Gly Thr Ser Ser Ile Gly
1               5                  10                  15

Trp Ala Val Thr Gly Asp Asp Phe Lys Ile Lys Arg Lys Lys Gly Lys
            20                  25                  30

Asn Leu Ile Gly Thr Arg Leu Phe Lys Glu Gly Asn Thr Ala Ala Glu
        35                  40                  45

Arg Arg Gly Phe Arg Thr Gln Arg Arg Arg Leu Asn Arg Arg Lys Trp
    50                  55                  60

Arg Leu Lys Leu Leu Glu Glu Ile Phe Asp Pro Tyr Met Ala Glu Val
65                  70                  75                  80

Asp Glu Tyr Phe Phe Ala Arg Leu Lys Asp Ser Asn Leu Ser Pro Lys
                85                  90                  95

Asp Ser Asn Lys Lys Tyr Leu Gly Ser Leu Leu Phe Pro Asp Ile Ser
            100                 105                 110

Asp Ser Asn Phe Tyr Asp Lys Tyr Pro Thr Ile Tyr His Leu Arg Arg
        115                 120                 125

Asp Leu Met Glu Lys Asp Glu Lys Phe Asp Leu Arg Glu Ile Tyr Leu
    130                 135                 140

Ala Ile His His Ile Val Lys Tyr Arg Gly Asn Phe Leu Glu Asn Val
145                 150                 155                 160

Pro Ala Lys Asn Tyr Lys Asn Ser Gly Ala Ser Ile Gly Phe Leu Leu
                165                 170                 175

Glu Glu Val Asn Asn Leu Tyr Lys Asp Ile Val Gly Asp Glu Asn Val
            180                 185                 190

Thr Ile Leu Asn Ser Glu Lys Phe Glu Asp Val Glu Lys Ile Ile Leu
        195                 200                 205
```

```
Asp Asp Gly Ile Arg Asn Leu Asp Lys Gln Lys Gly Val Gly Lys Leu
    210                 215                 220

Leu Val Glu Asp Lys Lys Asn Lys Asn Leu Val Thr Ala Phe Ser Lys
225                 230                 235                 240

Ala Ile Phe Gly Tyr Lys Phe Asn Ile Glu Asp Leu Leu Leu Val Glu
                245                 250                 255

Gly Asp Glu Lys Ser Lys Leu Thr Phe Asn Asp Glu Asn Ile Asp Asp
            260                 265                 270

Ile Phe Asn Glu Leu Ser His Ser Leu Asp Asp Arg Arg Met Asp Leu
        275                 280                 285

Leu Thr Lys Thr Arg Glu Ile Tyr Phe Lys Phe Lys Leu Asn Met Ile
    290                 295                 300

Val Pro Thr Gly Tyr Thr Leu Ser Glu Ser Met Ile Glu Lys Tyr Glu
305                 310                 315                 320

Ile His Lys Ala His Leu Lys Met Tyr Lys Glu Phe Ile Asn Thr Leu
                325                 330                 335

Asn Ser Lys Asp Arg Lys Ile Leu Lys Asn Ala Tyr Thr Asp Tyr Ile
            340                 345                 350

Asn Asn Glu Lys Ala Lys Ala Ala Asn Ala Gln Glu Asn Phe Tyr Lys
        355                 360                 365

Thr Val Lys Lys Thr Ile Lys Asp Asn Asp Ser Asp Ile Val Lys Lys
    370                 375                 380

Ile Ile Asp Leu Ile Asp Glu Gly Asn Phe Met Pro Lys Gln Arg Thr
385                 390                 395                 400
```

```
Gly Glu Asn Gly Val Ile Pro His Gln Leu His Gln Ile Glu Leu Asp
                405                 410                 415

Arg Ile Ile Glu Asn Gln Ala Lys Tyr Tyr Pro Trp Leu Ala Glu Glu
            420                 425                 430

Asn Pro Val Glu Lys Asn Arg Lys Phe Ala Lys Tyr Lys Leu Asp Glu
        435                 440                 445

Leu Val Thr Phe Arg Val Pro Tyr Tyr Val Gly Pro Leu Val Asp Lys
    450                 455                 460

Thr Glu Ser Asn Lys Asn Glu Lys Glu Thr Lys Phe Ala Trp Met Val
465                 470                 475                 480

Arg Lys Ser Lys Gly Thr Ile Thr Pro Trp Asn Phe Glu Asn Leu Val
                485                 490                 495

Asp Arg Thr Glu Ser Ala Asn Arg Phe Ile Lys Arg Met Thr Ser Lys
            500                 505                 510

Asp Thr Tyr Ile Ile Gly Glu Asp Val Leu Pro Ala Ser Ser Leu Leu
        515                 520                 525

Tyr Glu Lys Phe Lys Val Leu Asn Glu Leu Asn Asn Ile Lys Val Asn
    530                 535                 540

Glu Lys Lys Leu Asp Ile Glu Gln Lys Gln Asn Ile Tyr Leu Lys Leu
545                 550                 555                 560

Phe Thr Thr Thr Lys Asn Val Thr Lys Lys Asn Leu Ala Thr Phe Leu
                565                 570                 575

Asn Cys Ser Ile Glu Ser Ile Ser Gly Leu Ser Asp Asp Lys Lys Phe
            580                 585                 590

Asn Ser Ser Leu Ser Ser Tyr Ile Asp Leu Lys Val Ile Leu Gly Asp
        595                 600                 605
```

```
Ile Val Asp Asp Tyr Ser Lys Asn Glu Asp Leu Glu Lys Ile Ile Glu
    610                 615                 620


Tyr Ser Thr Ile Phe
625


<210>  516
<211>  897
<212>  PRT
<213>  Lactobacillus salivarius


<220>
<221>  misc_feature
<222>  (822)..(822)
<223>  Xaa can be any naturally occurring amino acid

<400>  516

Met Leu Ile Glu Ser Asp Glu Lys Asn Lys Leu Thr Phe Asn Asp Glu
1               5                   10                  15


Asn Ile Asp Asp Ile Phe Asn Glu Leu Ser His Ser Leu Asp Asp Asn
            20                  25                  30


Gln Met Asp Leu Leu Thr Lys Thr Arg Glu Ile Tyr Phe Lys Phe Lys
        35                  40                  45


Leu Asn Met Ile Val Pro Thr Gly Tyr Thr Leu Ser Glu Ser Met Ile
    50                  55                  60


Glu Lys Tyr Glu Met His Lys Ala His Leu Lys Met Tyr Lys Glu Phe
65                  70                  75                  80


Ile Asn Thr Leu Asn Ala Lys Asp Arg Lys Ile Leu Lys Asn Ala Tyr
                85                  90                  95


Ser Asp Tyr Ile Asn Asn Glu Lys Ala Lys Ala Ala Asn Ala Gln Glu
            100                 105                 110
```

```
Asn Phe Tyr Lys Thr Ile Lys Lys Thr Ile Lys Asp Asn Asn Ser Asp
        115                 120                 125

Thr Ala Lys Lys Ile Ile Gly Leu Ile Asp Glu Gly Asn Phe Met Pro
    130                 135                 140

Lys Gln Arg Thr Gly Glu Asn Gly Val Ile Pro His Gln Leu His Gln
145                 150                 155                 160

Ile Glu Leu Asp Arg Ile Ile Glu Asn Gln Ala Lys Tyr Tyr Pro Trp
                165                 170                 175

Leu Ala Glu Glu Asn Pro Val Glu Lys Asn Arg Lys Phe Ala Lys Tyr
            180                 185                 190

Lys Leu Asp Glu Leu Val Thr Phe Arg Val Pro Tyr Tyr Val Gly Pro
        195                 200                 205

Leu Val Asp Lys Thr Glu Ser Asn Lys Asn Glu Lys Glu Thr Lys Phe
    210                 215                 220

Ala Trp Met Val Arg Lys Ala Lys Gly Thr Ile Thr Pro Trp Asn Phe
225                 230                 235                 240

Glu Asn Leu Val Asp Arg Thr Glu Ser Ala Asn Arg Phe Ile Lys Arg
                245                 250                 255

Met Thr Ser Lys Asp Thr Tyr Ile Ile Gly Glu Asp Val Leu Pro Ala
            260                 265                 270

Ser Ser Leu Leu Tyr Glu Lys Phe Lys Val Leu Asn Glu Leu Asn Asn
        275                 280                 285

Ile Lys Val Asn Lys Lys Lys Leu Asp Val Glu Gln Lys Gln His Val
    290                 295                 300

Tyr Leu Asp Leu Phe Thr Thr Arg Lys Asn Val Thr Lys Asp Asn Leu
```

```
305                 310                 315                 320

Ala Thr Ser Leu Asn Cys Asp Val Glu Ser Ile Thr Gly Leu Ser Asp
                325                 330                 335

Asn Glu Lys Phe Asn Ser Ser Leu Ser Ser Tyr Ile Asp Leu Lys Ala
            340                 345                 350

Ile Leu Gly Asn Ala Val Asp Asp Cys Asn Lys Asn Lys Asp Leu Glu
        355                 360                 365

Lys Ile Ile Glu Tyr Ser Thr Ile Phe Glu Asp Gly Asn Ile Tyr Lys
    370                 375                 380

Glu Lys Leu Ser Glu Ile Ser Trp Leu Thr Asp Glu Gln Ile Glu Lys
385                 390                 395                 400

Leu Ser Asn Ile His Phe Lys Gly Trp Gly Arg Leu Ser Lys Lys Leu
                405                 410                 415

Leu Thr Gln Ile Thr Asn Glu Asn Gly Glu Arg Ile Ile Asp Ala Leu
            420                 425                 430

Trp Asn Thr Ser Asn Asn Phe Ile Gln Ile Ile Ser Asp Glu Ser Ile
        435                 440                 445

Gln Ala Lys Leu Ala Glu Ile Asn Gly Glu Tyr Ala Asp Lys Ser Asn
    450                 455                 460

Leu Glu Asp Ile Leu Asp Glu Ala Tyr Thr Ser Pro Gln Asn Lys Lys
465                 470                 475                 480

Ala Ile Arg Gln Val Met Lys Val Val Glu Asp Ile Glu Lys Ala Met
                485                 490                 495

Lys Cys Lys Pro Thr Ser Ile Ala Ile Glu Phe Thr Arg Arg Lys Gly
            500                 505                 510
```

```
Lys Ser Lys Leu Thr Asn Thr Arg Tyr Lys Lys Ile Ser Glu Thr Tyr
        515                 520                 525

Glu Lys Ile Thr Asp Glu Leu Ile Ser Glu Tyr Glu Leu Gly Lys Leu
    530                 535                 540

Gln Ser Lys Leu Asp Ser Lys Ala Asn Asn Met Arg Asp Ile Tyr Tyr
545                 550                 555                 560

Leu Tyr Phe Met Gln Leu Gly Arg Asp Met Tyr Thr Gly Glu Lys Ile
                565                 570                 575

Asn Ile Asp Glu Leu His Gln Tyr Tyr Asp Ile Asp His Ile Phe Pro
            580                 585                 590

Arg Ser Phe Ile Lys Asp Asn Ser Leu Asn Asn Arg Val Leu Thr Arg
        595                 600                 605

Lys Glu Ile Asn Asn Asn Glu Lys Ala Asp Arg Thr Ala Ala Asp Leu
    610                 615                 620

Tyr Ala Val Lys Met Gly Asp Phe Trp Arg Lys Leu Arg Lys Gln Gly
625                 630                 635                 640

Leu Ile Thr Glu Lys Lys Tyr Lys Asn Leu Leu Thr Arg Thr Asp Ser
                645                 650                 655

Ile Asp Lys Tyr Thr Lys Gln Ser Phe Ile Lys Arg Gln Leu Val Glu
            660                 665                 670

Thr Ser Gln Val Val Lys Met Ala Ala Asn Ile Leu Gln Asp Lys Tyr
        675                 680                 685

Ser Asn Thr Lys Ile Ile Glu Val Arg Ala Arg Leu Asn Ser Asp Leu
    690                 695                 700

Arg Lys Glu Tyr Glu Leu Ile Lys Asn Arg Glu Val Asn Asp Tyr His
```

```
705                 710                 715                 720

His Ala Ile Asp Gly Tyr Leu Thr Ile Phe Ile Gly Gln Tyr Leu Tyr
                725                 730                 735

Lys Thr Tyr Pro Lys Leu Arg Ser Tyr Phe Val Tyr Asp Asp Phe Lys
            740                 745                 750

Lys Leu Asp Ser Asn Tyr Leu Lys His Met Asp Lys Phe Asn Phe Ile
        755                 760                 765

Trp Lys Leu Glu Asp Lys Lys Ala Glu Asp Val Tyr Asp Asn Val Asn
    770                 775                 780

Asn Glu Phe Ile Leu Asn Val Pro Lys Met Lys Asp Tyr Ile Gln Lys
785                 790                 795                 800

Ile Tyr Asn Tyr Lys Tyr Met Leu Ile Ser Lys Glu Val Thr Thr Glu
                805                 810                 815

Ser Gly Ala Phe Tyr Xaa Glx Thr Lys Tyr Asn Ala Lys Thr Ile Asn
            820                 825                 830

Leu Ile Pro Ile Lys Lys Asp Lys Pro Thr Asn Ile Tyr Gly Gly Tyr
        835                 840                 845

Lys Gly Lys Val Ser Ser Tyr Met Met Leu Val Lys Ile Gln Lys Lys
    850                 855                 860

Lys Glu Val Ile Tyr Lys Phe Val Gly Val Pro Arg Leu Trp Thr Asp
865                 870                 875                 880

Glu Leu Asp Arg Leu Ile Asp Thr Asp Glu Lys Lys Ala Leu Leu Lys
                885                 890                 895

Lys
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<210> 517
<211> 1419
<212> PRT
<213> Lactobacillus sp.

<400> 517

```
Met Ala Lys Pro Gln Asn Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn
1               5                   10                  15


Ser Val Gly Trp Thr Val Thr Asp Asp Gln Asn Asn Ile Leu Arg Ile
            20                  25                  30


Lys Ser Lys Lys Ala Ile Gly Ala Arg Leu Phe Glu Glu Gly Lys Val
        35                  40                  45


Ala Ala Glu Arg Arg Ser Phe Arg Thr Thr Arg Arg Arg Leu Ser Arg
    50                  55                  60


Arg Lys Trp Arg Ile Lys Leu Leu Glu Glu Leu Phe Asp Glu Glu Ile
65                  70                  75                  80


Ser Lys Val Asp Pro Asn Phe Phe Ala Arg Ser His Glu Ser Trp Ile
                85                  90                  95


Ser Pro Lys Asp Lys Arg Glu Arg Tyr Ser Ala Ile Val Phe Pro Thr
            100                 105                 110


Pro Glu Glu Asp Lys Lys Phe His Asn Glu Tyr Pro Thr Ile Tyr His
        115                 120                 125


Leu Arg Asp Arg Leu Met Lys Asp Asp Gln Lys His Asp Ile Arg Glu
    130                 135                 140


Ile Tyr Val Ala Ile His His Ile Met Lys Tyr Arg Gly Asn Phe Leu
145                 150                 155                 160


His Asp Glu Ser Ile Glu Thr Tyr Arg Ser Gly Met Ser Ser Leu Gly
                165                 170                 175
```

```
Gly Gly Asp Glu Arg Thr Ile Leu Asn Thr Lys Ile Leu Asp Asp Leu
            180                 185                 190

Asn Asp Ala Phe Ala Asp Asn Leu Ala Thr Gln Gly Ile Ser Val Asn
        195                 200                 205

Ser Ala Ser Ala Asp Gln Ile Asn Glu Ile Val Thr Ser Gly His Leu
    210                 215                 220

Asn Val Asp Ser Gln Lys Ala Ile Ala Lys Leu Leu Leu Pro Thr Thr
225                 230                 235                 240

Leu Ser Ser Asp Asp Lys Lys Gln Asp Lys Lys Ile Lys Lys Leu Ala
                245                 250                 255

Thr Asp Ala Ala Lys Asn Val Ala Ser Ala Trp Leu Gly Tyr Lys Ala
            260                 265                 270

Asn Phe Ala Ala Ile Leu Asn Ile Gln Glu Val Asp Lys Asp Lys Lys
        275                 280                 285

Lys Ile Tyr Ser Phe Ala Leu Gln Gly Ala Asp Glu Glu Asp Lys Val
    290                 295                 300

Glu Thr Leu Glu Ser Val Leu Ser Gln Asp Gln Ile Glu Ile Val Asp
305                 310                 315                 320

Arg Ile Ile Arg Ile Arg His Ala Ile Val Leu Gly Glu Ile Ile Pro
                325                 330                 335

Val Gly Met Thr Leu Ser Glu Ala Met Ile Glu Lys Tyr Asp Gln His
            340                 345                 350

Ala Lys Asp Leu Lys Asn Leu Lys Thr Val Ile Arg Asn Leu Lys Asp
        355                 360                 365
```

```
Arg Lys Asn Ala Val Lys Leu Gln Ala Ile Tyr Asp Leu Tyr Val Asn
    370                 375                 380

Asn Arg His Ala Asp Thr Ala Lys Ala Met Lys Leu Ala Gly Val Lys
385                 390                 395                 400

Lys Arg Thr Glu Leu Leu Glu Pro Glu Glu Phe Asn Lys Ser Ile Glu
                405                 410                 415

Lys Leu Leu Asp Asp Ser Pro Val Ser Ala Glu Ile Lys Lys Arg Ile
            420                 425                 430

Ala Glu Lys Asp Phe Leu Pro Leu Gln Arg Ser Asn Ser Asn Gly Val
        435                 440                 445

Ile Pro Asn Gln Leu His Gln Ile Glu Leu Asp Glu Ile Ile Lys Lys
    450                 455                 460

Gln Ser Lys Tyr Tyr Pro Phe Leu Gly Glu Thr Asn Glu His Ala Ser
465                 470                 475                 480

Ala Asp Val Ala Arg Lys Ala Pro Thr Lys Leu Asp Gln Leu Leu Thr
                485                 490                 495

Phe Arg Val Pro Tyr Tyr Val Gly Pro Leu Ile Thr Lys Glu Glu Gln
            500                 505                 510

Glu Glu Gln Asp Gly His Ser Phe Ala Trp Met Ile Arg Lys Asn Pro
        515                 520                 525

Lys Asp His Glu Lys Ile Thr Pro Trp Asn Phe Asp Glu Lys Val Asp
    530                 535                 540

Arg Met Ala Ser Ala Thr Gln Phe Ile Lys Arg Met Thr Thr Lys Asp
545                 550                 555                 560

Thr Tyr Leu Leu Gly Glu Asp Val Leu Pro Ser Ser Ser Leu Lys Tyr
                565                 570                 575
```

```
Gln Leu Phe Thr Val Leu Asn Glu Leu Asn Asn Leu Arg Ile Asn His
            580                 585                 590

Lys Lys Leu Thr Arg Glu Glu Lys Glu Gln Val Ile Glu Asp Leu Phe
        595                 600                 605

Lys Lys Tyr Lys Thr Val Lys Ala Asp Lys Phe Lys Asn Tyr Trp Gln
    610                 615                 620

Lys Gly His Ala Gly Leu Asp Val Lys Ile Gln Gly Met Ala Asp Pro
625                 630                 635                 640

Glu Lys Phe Asn Ser Thr Met Ser Thr Tyr Ile Asp Leu Gln Lys Ile
                645                 650                 655

Phe Gly Asp Gln Leu Asp Asp Ala Gln Arg Gln Asn Asp Phe Glu Lys
            660                 665                 670

Ile Ile Glu Tyr Ser Thr Ile Phe Glu Asp Arg Lys Ile Leu Gly Glu
        675                 680                 685

Lys Leu Arg Ala Asp Phe Val Trp Leu Ser Glu Asp Gln Ile Lys Arg
    690                 695                 700

Leu Cys Arg Leu Arg Leu Gln Gly Trp Gly Arg Leu Ser Leu Lys Leu
705                 710                 715                 720

Leu Thr Arg Leu Thr Asp Ala Asp Gly Gln Asn Val Leu Glu Arg Leu
                725                 730                 735

Leu Asn Ser Asn Asp Asn Phe Met Gln Ile Val Lys Asp Pro Val Ile
            740                 745                 750

Lys Ala Lys Ile Glu Gln Lys Asn Gln Lys Leu Leu Arg Ala Asp Trp
        755                 760                 765
```

```
Ser Glu Asn Ala Thr Glu Ser Ile Leu Asp Glu Ala Tyr Thr Ser Pro
    770                 775                 780

Gln Asn Lys Lys Ala Ile Arg Gln Val Met Arg Val Val His Asp Ile
785                 790                 795                 800

Val Lys Ala Cys Asp Gly Asn Leu Pro Ala Lys Phe Ala Ile Glu Phe
                805                 810                 815

Ala Arg Ser Gln Asp Asp Asp Pro Lys Arg Thr Val Ala Arg Ala Asp
            820                 825                 830

Arg Leu Gln Lys Ile Tyr Ala Gln Ile Ser Asp Glu Val Val Ser Gln
        835                 840                 845

Gly Val Lys Asp Gln Leu Ser Gly Met Lys Ser Leu Lys Asp Arg Tyr
    850                 855                 860

Tyr Leu Tyr Phe Met Gln Gly Gly Arg Asp Ala Tyr Thr Gly Lys Pro
865                 870                 875                 880

Leu Asn Ile Asp Arg Leu Ser Asp Tyr Asp Ile Asp His Ile Met Pro
                885                 890                 895

Gln Ser Phe Ile Lys Asp Asp Ser Leu Asp Asn Arg Val Leu Val Thr
            900                 905                 910

Arg Ala Val Asn Asn Gln Lys Ser Asp Asn Val Pro Val Leu Leu Tyr
        915                 920                 925

Gly Asn His Leu Val Ala Asp Leu Gly Ile Thr Ile Arg Glu Met Trp
    930                 935                 940

Asp Arg Trp Gln Lys Ser Gly Met Ile Ser Lys Arg Lys Leu Ala Asn
945                 950                 955                 960

Leu Leu Thr Asp Pro Ala Thr Leu Ser Glu Tyr Arg Ala Glu Gly Phe
                965                 970                 975
```

```
Ile Asn Arg Gln Leu Val Glu Thr Ser Gln Val Ile Lys Leu Thr Ala
            980                 985                 990

Thr Ile Leu Gln Ser Glu Phe Pro  Asp Ser Lys Ile Ile  Glu Val Pro
        995                 1000                1005

Ala Lys  Tyr Asn Ser Ile Leu  Arg Lys Gln Phe Asp  Leu Tyr Lys
    1010                1015                1020

Ser Arg  Glu Val Asn Asp Tyr  His His Ala Ile Asp  Ala Tyr Leu
    1025                1030                1035

Ser Thr  Ile Val Gly Asn Tyr  Leu Tyr Gln Val Tyr  Pro Asn Leu
    1040                1045                1050

Arg Arg  Leu Phe Val Tyr Gly  Glu Phe Lys Lys Phe  Ser His Gly
    1055                1060                1065

Glu Glu  Glu Ser Ser His Gln  Ala Val Arg Arg Val  Lys Ser Met
    1070                1075                1080

Asn Phe  Leu Asp Asp Leu Leu  Arg Gly Lys His Gly  Asp Asp Ile
    1085                1090                1095

Tyr Cys  Arg Val Thr Gly Glu  Val Ile Phe Ser Arg  Lys Asp Ile
    1100                1105                1110

Ile Ser  Lys Leu Lys Gln Ala  Tyr Ser Phe Lys Gln  Met Leu Val
    1115                1120                1125

Thr Gln  Glu Val Phe Thr Lys  Lys Ser Ala Leu Phe  Asp Gln Thr
    1130                1135                1140

Val Tyr  Pro Ser Pro Ala Arg  Asp Ser Lys Thr Arg  Ser Gly Leu
    1145                1150                1155
```

```
Ile Pro  Arg Lys Gln Gly Met  Asp Thr Glu Ile Tyr  Gly Gly Tyr
    1160                1165                1170

Ser Gly  Asn Lys Asp Ala Tyr  Phe Val Leu Ala Gln  Val Val Lys
    1175                1180                1185

Ser Lys  Gly His Thr Leu Gln  Val Val Gly Val Pro  Ile Arg Ala
    1190                1195                1200

Leu Arg  Ala Leu Ala Asn Cys  Ser Asn Tyr Ser Glu  Gln Leu Leu
    1205                1210                1215

Lys Ile  Val Lys Ala Gln Val  Leu Phe Asn Lys Lys  Thr Gly Lys
    1220                1225                1230

Ala Lys  Lys Gly Ile Ser Asp  Val Arg Ile Leu Leu  Asp Lys Ile
    1235                1240                1245

Pro Tyr  Arg Gln Pro Val Leu  Asp Gly Ser Ala Phe  Tyr Met Leu
    1250                1255                1260

Gly Ser  Ser Thr Tyr Lys Tyr  Asn Leu Lys Gln Ile  Ser Leu Ser
    1265                1270                1275

Gln Gln  Ser Met Lys Tyr Ile  Leu Asp Tyr Ile Asp  Asp Pro Asn
    1280                1285                1290

Phe Asn  Lys His Glu Met Thr  Lys Ile Asp Gln Gln  Asn Glu Lys
    1295                1300                1305

Glu Cys  Leu Leu Ser Val Tyr  Asp Glu Ile Leu Asp  Lys Met Asp
    1310                1315                1320

Lys Tyr  Leu Ser Leu Tyr Asp  Ile Asn Gly Phe Arg  Lys Lys Leu
    1325                1330                1335

His Val  Gly Arg Asp Lys Phe  Ile Lys Leu Glu Val  Glu Lys Gln
    1340                1345                1350
```

```
Ala Glu  Ala Ile Lys Asn Val  Leu Arg Gly Phe His  Ala Asn Ser
    1355                1360                1365


Asp Met  Thr Lys Leu Ser Asp  Leu Gly Leu Ser Thr  Ser Leu Gly
    1370                1375                1380


Phe Met  Gln Ala Ser Asp Gly  Ile Lys Leu Ser Asp  Asn Ala Val
    1385                1390                1395


Phe Ile  Tyr Gln Ser Pro Thr  Gly Leu Phe Glu Arg  Arg Val Lys
    1400                1405                1410


Val Ser  Asp Leu Leu Lys
    1415
```

<210> 518
<211> 1289
<212> PRT
<213> Lactobacillus versmoldensis

<400> 518

```
Met Arg Arg Arg Tyr Arg Arg Arg Arg Asn Arg Leu Asn Trp Leu Asp
1               5                   10                  15


Glu Leu Phe Ala Asp Glu Leu Ala Lys Ile Asp Pro Ser Phe Leu Leu
            20                  25                  30


Arg Met Lys Asn Ser Trp Val Ser Lys Lys Glu Ser Thr Arg Lys Arg
        35                  40                  45


Asp Pro Tyr Asn Leu Phe Ile Asp Glu Lys Tyr Asn Asp Val Asp Tyr
    50                  55                  60


Phe Asn Gln Tyr Pro Thr Ile Phe His Leu Arg Lys Glu Leu Ile Thr
65                  70                  75                  80


Glu Asp Lys Lys Val Asp Ile Arg Leu Ile Tyr Leu Ala Ile His Asn
```

```
                85                  90                  95

Ile Ile Lys Tyr Arg Gly Asn Phe Thr Leu Glu Asn Gln Asn Phe Asp
            100                 105                 110

Ile Ser Gln Leu Ser Ser Asn Phe Ser Gln Gln Ile Ser Asp Phe Phe
        115                 120                 125

Ala Leu Phe Ser Asp Phe Gly Val Ile Met Pro Glu Asp Phe Asp Pro
    130                 135                 140

Asp Lys Ile Ser Asp Ile Leu Leu Asn Pro Asn Leu Ser Pro Ser Gly
145                 150                 155                 160

Lys Val Ser Glu Ala Ile Ala Thr Ile Ser Pro Lys Thr Asn Val Lys
                165                 170                 175

Ala Lys Ile Lys Ile Ile Leu Leu Leu Leu Val Gly Asn Asn Gly Asp
            180                 185                 190

Leu Lys Lys Leu Phe Asp Leu Glu Thr Thr Glu Lys Ile Ala Val Lys
        195                 200                 205

Leu Ser Ser Arg His Ile Asp Ser Glu Leu Pro Ile Ile Leu Ser Glu
    210                 215                 220

Leu Asn Glu Gln Gln Glu Asn Ile Ile Thr Ile Ala Asn Ser Ile Phe
225                 230                 235                 240

Gly Ser Ile Ile Leu Lys Asp Phe Leu Gly Asp Glu Thr Ser Ile Ser
                245                 250                 255

Ala Ala Lys Val Ile Ser Phe Glu Asp His Lys Gln Asp Leu Gln Lys
            260                 265                 270

Leu Lys Thr Met Trp Arg Glu Thr Ser Asn Lys Glu Ala Val Lys Ala
        275                 280                 285
```

```
Gly Lys Lys Ala Tyr Glu Asp Tyr Ile Gly His Glu Asp Ser Glu Thr
    290                 295                 300

Phe Tyr Lys Lys Ile Lys Lys Phe Leu Glu Lys Ala Gln Pro Val Asp
305                 310                 315                 320

Leu Ala Asn Lys Ala Leu Ala Glu Ile Glu Leu Glu Asn Tyr Leu Pro
                325                 330                 335

Lys Gln Arg Asn Arg Asn Asn Thr Val Ile Pro Tyr Gln Leu Asn Glu
            340                 345                 350

Asn Glu Leu Ile Ala Ile Leu Asp His Gln Glu Lys Tyr Tyr Pro Phe
        355                 360                 365

Leu Lys Glu Asn Arg Asp Lys Ile Leu Ser Leu Leu Thr Phe Arg Ile
    370                 375                 380

Pro Tyr Tyr Val Gly Pro Leu Gln Asp Ser Asn Asn Asn Arg Phe Ser
385                 390                 395                 400

Trp Met Thr Arg Lys Ala Ser Gly Ala Ile Arg Pro Trp Asn Phe Ser
                405                 410                 415

Glu Lys Val Asn Val Glu Gln Ser Ser Asn Asp Phe Ile Lys Arg Met
            420                 425                 430

Arg Ser Thr Asp Thr Tyr Leu Ile Gly Glu Pro Val Leu Pro Lys Lys
        435                 440                 445

Ser Leu Ile Tyr Gln Cys Tyr Glu Val Leu Ser Glu Leu Asn Asn Thr
    450                 455                 460

Arg Val Lys Asp Gly Ser Ser Asn Pro Lys Arg Leu Asp Val Thr Ile
465                 470                 475                 480

Lys Gln Arg Ile Tyr Asn Glu Ile Phe Lys Asn Gln Lys Ser Val Ser
```

```
                485                 490                 495

Val Lys Val Leu Gln Asn Trp Leu Ile Lys Glu Ser Tyr Phe Lys Ser
            500                 505                 510

Pro Glu Ile Ser Gly Leu Ala Asp Lys Lys Lys Tyr Leu Ser Ser Leu
        515                 520                 525

Ser Thr Tyr Ile Asp Phe Lys Lys Ile Phe Gly Gln Arg Phe Val Asp
    530                 535                 540

Asp Pro Val Asn Ser Pro Gln Leu Glu Glu Leu Ala Glu Trp Leu Thr
545                 550                 555                 560

Leu Phe Glu Asp Lys Lys Ile Leu Leu Ile Lys Leu Gln Asn Ser Lys
                565                 570                 575

Tyr Ser Tyr Asp Gln Ala Thr Ile Asn Lys Leu Ser Thr Met Arg Tyr
            580                 585                 590

Gln Gly Thr Gly Lys Leu Ser Lys Lys Leu Leu Val Asp Leu Lys Thr
        595                 600                 605

Thr Lys Lys Ser Ile Gly Lys Ser Gly Ala Glu Ser Leu Ser Ile Leu
    610                 615                 620

Asp Leu Met Trp Ser Thr Lys Asp Asn Phe Met Gln Ile Ile His Asp
625                 630                 635                 640

Ala Asp Tyr Thr Phe Glu Gln Gln Ile Lys Glu Phe Asn Tyr Asp Thr
                645                 650                 655

Glu Asp Glu Leu Thr Pro Leu Glu Lys Val Ala Asn Leu His Gly Ser
            660                 665                 670

Pro Ala Leu Lys Arg Gly Leu Asn Gln Ser Ile Lys Val Val Ala Asp
        675                 680                 685
```

```
Ile Val Lys Phe Met Gly His Asp Pro Glu Lys Ile Phe Ile Glu Phe
    690                 695                 700

Thr Arg Ser Asp Asp Phe Ser Lys Leu Thr Ile Ser Arg Tyr Arg Arg
705                 710                 715                 720

Ile Lys Lys Gln Tyr Leu Glu Ile Ala Lys Ala Ile Lys Lys Ile Pro
                725                 730                 735

Ala Glu Phe Lys Asp Ile Lys Glu Tyr Gln Thr Gln Leu Glu Glu Asn
            740                 745                 750

Lys Gly Lys Leu Ala Ser Glu Arg Leu Met Leu Tyr Phe Leu Gln Cys
        755                 760                 765

Gly His Ser Leu Tyr Ser Asn Lys Pro Ile Asp Leu Asn Met Ile Asn
    770                 775                 780

Ser Ser Lys Tyr His Val Asp His Ile Leu Pro Gln Ser Tyr Ile Lys
785                 790                 795                 800

Asp Asp Ser Leu Glu Asn Lys Ala Leu Val Leu Ala Ser Glu Asn Glu
                805                 810                 815

Asn Lys Ile Asp Asn Met Leu Ile Ser His Asp Ile Ile Ala Thr Asn
            820                 825                 830

Leu Pro Arg Trp Gln Ala Leu Lys Asp Gln Asn Leu Met Gly Ser Lys
        835                 840                 845

Lys Phe Ala Asp Leu Thr Arg Thr Thr Val Thr Glu Asn Gln Lys Lys
    850                 855                 860

Gly Phe Ile Gln Arg Gln Leu Val Gln Thr Ser Gln Ile Val Lys Asn
865                 870                 875                 880

Ile Thr Leu Ile Leu Asn Asp Leu Tyr Lys Asn Thr Ser Cys Ile Glu
```

```
               885                 890                 895

Thr Arg Ala Thr Leu Ser Ser Glu Phe Arg Lys Ala Phe Ser Asn Phe
            900                 905                 910

Asp Glu Thr Thr Tyr His Tyr Gln Phe Pro Glu Phe Val Lys Asn Arg
        915                 920                 925

Asp Val Asn Asp Phe His His Ala Gln Asp Ala Phe Leu Ala Cys Val
    930                 935                 940

Ile Gly Glu Tyr Gln Leu Lys Lys Tyr Pro Lys Asp Asn Leu Arg Leu
945                 950                 955                 960

Val Tyr Asp Gln Tyr Ser Lys Phe Leu Asp Ser Leu Lys Lys Asp Thr
               965                 970                 975

Arg Lys Lys Asn Gly Arg Met Pro Arg Tyr Thr Gln Asn Gly Phe Ile
            980                 985                 990

Ile Gly Ser Met Phe Asn Gly Lys  Thr Tyr Val Asp Asp  Asn Gly Glu
        995                 1000                1005

Ile Ile  Trp Asp Gln Lys Ile  Lys Glu Ser Ile Arg  Lys Thr Phe
    1010                1015                1020

Asn Tyr  His Gln Phe Asn Val  Val Arg Gln Thr Ile  Glu Gln His
    1025                1030                1035

Gly Lys  Leu Phe Asn Asp Thr  Ile Gln Pro His Ser  Asp Arg Tyr
    1040                1045                1050

Lys Leu  Ile Pro Leu Lys Thr  Asn Arg Asp Pro Ala  Ile Tyr Gly
    1055                1060                1065

Gly Tyr  Asn Asn Asp Asn Asn  Ala Tyr Ser Val Val  Leu Asp Val
    1070                1075                1080
```

```
Asp Gly  Lys Lys Lys Ile Asn  Gly Ile Pro Ile Arg  Ile Ala Asn
    1085                1090                1095

Gln Leu  Lys Ser Asp Glu Leu  Asp Leu Ser Ser Trp  Leu Glu Asn
    1100                1105                1110

Asn Ile  Lys His Lys Lys Pro  Met Thr Ile Leu Ile  Asp Lys Val
    1115                1120                1125

Pro Lys  Tyr Gln Arg Ile Ile  Asn Glu Glu Thr Gly  Asp Leu Leu
    1130                1135                1140

Ile Thr  Ser Ala Asn Glu Val  Ile Asn Asn Val Gln  Leu Phe Leu
    1145                1150                1155

Pro Ser  Met Tyr Thr Ala Leu  Ile Ser Leu Leu Asp  Ser Thr Lys
    1160                1165                1170

Thr Glu  Met Tyr Ser Lys Leu  Leu Ser Asn Tyr Glu  Ala Asn Ile
    1175                1180                1185

Leu Ile  Asp Ile Tyr Asp Tyr  Leu Leu Thr Lys Leu  Lys Asn Asn
    1190                1195                1200

Tyr Pro  Leu Tyr Arg Lys Glu  Trp Ala Lys Leu Ala  Glu His Arg
    1205                1210                1215

Asp Asp  Phe Ile Glu Ser Asp  Leu Val Thr Gln Ala  Ser Thr Leu
    1220                1225                1230

Gln Gln  Leu Ile Lys Phe Met  His Ala Asp Pro Ser  Asn Val Asn
    1235                1240                1245

Leu Lys  Phe Gly Asn Phe Lys  Gly Asn Arg Phe Gly  Arg Lys Asn
    1250                1255                1260

Gly Asn  Ile Lys Leu Ser Lys  Thr Asp Phe Ile Tyr  Glu Ser Pro
```

1265 1270 1275

Thr Gly Leu Phe Lys Ser Ile Lys His Ile Asp
1280 1285

<210> 519
<211> 1372
<212> PRT
<213> Legionella pneumophila

<400> 519

Met Glu Ser Ser Gln Ile Leu Ser Pro Ile Gly Ile Asp Leu Gly Gly
1 5 10 15

Lys Phe Thr Gly Val Cys Leu Ser His Leu Glu Ala Phe Ala Glu Leu
20 25 30

Pro Asn His Ala Asn Thr Lys Tyr Ser Val Ile Leu Ile Asp His Asn
35 40 45

Asn Phe Gln Leu Ser Gln Ala Gln Arg Arg Ala Thr Arg His Arg Val
50 55 60

Arg Asn Lys Lys Arg Asn Gln Phe Val Lys Arg Val Ala Leu Gln Leu
65 70 75 80

Phe Gln His Ile Leu Ser Arg Asp Leu Asn Ala Lys Glu Glu Thr Ala
85 90 95

Leu Cys His Tyr Leu Asn Asn Arg Gly Tyr Thr Tyr Val Asp Thr Asp
100 105 110

Leu Asp Glu Tyr Ile Lys Asp Glu Thr Thr Ile Asn Leu Leu Lys Glu
115 120 125

Leu Leu Pro Ser Glu Ser Glu His Asn Phe Ile Asp Trp Phe Leu Gln
130 135 140

```
Lys Met Gln Ser Ser Glu Phe Arg Lys Ile Leu Val Ser Lys Val Glu
145                 150                 155                 160

Glu Lys Lys Asp Asp Lys Glu Leu Lys Asn Ala Val Lys Asn Ile Lys
                165                 170                 175

Asn Phe Ile Thr Gly Phe Glu Lys Asn Ser Val Glu Gly His Arg His
            180                 185                 190

Arg Lys Val Tyr Phe Glu Asn Ile Lys Ser Asp Ile Thr Lys Asp Asn
        195                 200                 205

Gln Leu Asp Ser Ile Lys Lys Lys Ile Pro Ser Val Cys Leu Ser Asn
    210                 215                 220

Leu Leu Gly His Leu Ser Asn Leu Gln Trp Lys Asn Leu His Arg Tyr
225                 230                 235                 240

Leu Ala Lys Asn Pro Lys Gln Phe Asp Glu Gln Thr Phe Gly Asn Glu
                245                 250                 255

Phe Leu Arg Met Leu Lys Asn Phe Arg His Leu Lys Gly Ser Gln Glu
            260                 265                 270

Ser Leu Ala Val Arg Asn Leu Ile Gln Gln Leu Glu Gln Ser Gln Asp
        275                 280                 285

Tyr Ile Ser Ile Leu Glu Lys Thr Pro Pro Glu Ile Thr Ile Pro Pro
    290                 295                 300

Tyr Glu Ala Arg Thr Asn Thr Gly Met Glu Lys Asp Gln Ser Leu Leu
305                 310                 315                 320

Leu Asn Pro Glu Lys Leu Asn Asn Leu Tyr Pro Asn Trp Arg Asn Leu
                325                 330                 335

Ile Pro Gly Ile Ile Asp Ala His Pro Phe Leu Glu Lys Asp Leu Glu
            340                 345                 350
```

```
His Thr Lys Leu Arg Asp Arg Lys Arg Ile Ile Ser Pro Ser Lys Gln
        355                 360                 365

Asp Glu Lys Arg Asp Ser Tyr Ile Leu Gln Arg Tyr Leu Asp Leu Asn
    370                 375                 380

Lys Lys Ile Asp Lys Phe Lys Ile Lys Lys Gln Leu Ser Phe Leu Gly
385                 390                 395                 400

Gln Gly Lys Gln Leu Pro Ala Asn Leu Ile Glu Thr Gln Lys Glu Met
                405                 410                 415

Glu Thr His Phe Asn Ser Ser Leu Val Ser Val Leu Ile Gln Ile Ala
            420                 425                 430

Ser Ala Tyr Asn Lys Glu Arg Glu Asp Ala Ala Gln Gly Ile Trp Phe
        435                 440                 445

Asp Asn Ala Phe Ser Leu Cys Glu Leu Ser Asn Ile Asn Pro Pro Arg
    450                 455                 460

Lys Gln Lys Ile Leu Pro Leu Leu Val Gly Ala Ile Leu Ser Glu Asp
465                 470                 475                 480

Phe Ile Asn Asn Lys Asp Lys Trp Ala Lys Phe Lys Asn Phe Trp Asn
                485                 490                 495

Thr His Lys Ile Gly Arg Thr Ser Leu Lys Ser Lys Cys Lys Glu Ile
            500                 505                 510

Glu Glu Ala Arg Lys Asn Ser Gly Asn Ala Phe Lys Ile Asp Tyr Glu
        515                 520                 525

Glu Ala Leu Asn His Pro Glu His Ser Asn Asn Lys Ala Leu Ile Lys
    530                 535                 540
```

```
Ile Ile Gln Thr Ile Pro Asp Ile Ile Gln Ala Ile Gln Ser His Leu
545                 550                 555                 560

Gly His Asn Asp Ser Gln Ala Leu Ile Tyr His Asn Pro Phe Ser Leu
                565                 570                 575

Ser Gln Leu Tyr Thr Ile Leu Glu Thr Lys Arg Asp Gly Phe His Lys
            580                 585                 590

Asn Cys Val Ala Val Thr Cys Glu Asn Tyr Trp Arg Ser Gln Lys Thr
        595                 600                 605

Glu Ile Asp Pro Glu Ile Ser Tyr Ala Ser Arg Leu Pro Ala Asp Ser
    610                 615                 620

Val Arg Pro Phe Asp Gly Val Leu Ala Arg Met Met Gln Arg Leu Ala
625                 630                 635                 640

Tyr Glu Ile Ala Met Ala Lys Trp Glu Gln Ile Lys His Ile Pro Asp
                645                 650                 655

Asn Ser Ser Leu Leu Ile Pro Ile Tyr Leu Glu Gln Asn Arg Phe Glu
            660                 665                 670

Phe Glu Glu Ser Phe Lys Lys Ile Lys Gly Gly Ser Ser Asp Lys Thr
        675                 680                 685

Leu Glu Gln Ala Ile Glu Lys Gln Asn Ile Gln Trp Glu Glu Lys Phe
    690                 695                 700

Gln Arg Ile Ile Asn Ala Ser Met Asn Ile Cys Pro Tyr Lys Gly Ala
705                 710                 715                 720

Ser Ile Gly Gly Gln Gly Glu Ile Asp His Ile Tyr Pro Arg Ser Leu
                725                 730                 735

Ser Lys Lys His Phe Gly Val Ile Phe Asn Ser Glu Ala Asn Leu Ile
            740                 745                 750
```

```
Tyr Cys Ser Ser Gln Gly Asn Arg Glu Lys Lys Glu Glu His Tyr Leu
        755                 760                 765

Leu Glu His Leu Ser Pro Leu Tyr Leu Lys His Gln Phe Gly Thr Asp
    770                 775                 780

Asn Val Ser Asp Ile Lys Asn Phe Ile Ser Gln Asn Val Ala Asn Ile
785                 790                 795                 800

Lys Lys Tyr Ile Ser Phe His Leu Leu Thr Pro Glu Gln Gln Lys Ala
                805                 810                 815

Ala Arg His Ala Leu Phe Leu Asp Tyr Asp Asp Glu Ala Phe Lys Thr
            820                 825                 830

Ile Thr Lys Phe Leu Met Ser Gln Gln Lys Ala Arg Val Asn Gly Thr
        835                 840                 845

Gln Lys Phe Leu Gly Lys Gln Ile Met Glu Phe Leu Ser Thr Leu Ala
    850                 855                 860

Asp Ser Lys Gln Leu Gln Leu Glu Phe Ser Ile Lys Gln Ile Thr Ala
865                 870                 875                 880

Glu Glu Val His Asp His Arg Glu Leu Leu Ser Lys Gln Glu Pro Lys
                885                 890                 895

Leu Val Lys Ser Arg Gln Gln Ser Phe Pro Ser His Ala Ile Asp Ala
            900                 905                 910

Thr Leu Thr Met Ser Ile Gly Leu Lys Glu Phe Pro Gln Phe Ser Gln
        915                 920                 925

Glu Leu Asp Asn Ser Trp Phe Ile Asn His Leu Met Pro Asp Glu Val
    930                 935                 940
```

```
His Leu Asn Pro Val Arg Ser Lys Glu Lys Tyr Asn Lys Pro Asn Ile
945                 950                 955                 960


Ser Ser Thr Pro Leu Phe Lys Asp Ser Leu Tyr Ala Glu Arg Phe Ile
                965                 970                 975


Pro Val Trp Val Lys Gly Glu Thr Phe Ala Ile Gly Phe Ser Glu Lys
            980                 985                 990


Asp Leu Phe Glu Ile Lys Pro Ser  Asn Lys Glu Lys Leu  Phe Thr Leu
        995                 1000                1005


Leu Lys  Thr Tyr Ser Thr Lys  Asn Pro Gly Glu Ser  Leu Gln Glu
    1010                1015                1020


Leu Gln  Ala Lys Ser Lys Ala  Lys Trp Leu Tyr Phe  Pro Ile Asn
    1025                1030                1035


Lys Thr  Leu Ala Leu Glu Phe  Leu His His Tyr Phe  His Lys Glu
    1040                1045                1050


Ile Val  Thr Pro Asp Asp Thr  Thr Val Cys His Phe  Ile Asn Ser
    1055                1060                1065


Leu Arg  Tyr Tyr Thr Lys Lys  Glu Ser Ile Thr Val  Lys Ile Leu
    1070                1075                1080


Lys Glu  Pro Met Pro Val Leu  Ser Val Lys Phe Glu  Ser Ser Lys
    1085                1090                1095


Lys Asn  Val Leu Gly Ser Phe  Lys His Thr Ile Ala  Leu Pro Ala
    1100                1105                1110


Thr Lys  Asp Trp Glu Arg Leu  Phe Asn His Pro Asn  Phe Leu Ala
    1115                1120                1125


Leu Lys  Ala Asn Pro Ala Pro  Asn Pro Lys Glu Phe  Asn Glu Phe
    1130                1135                1140
```

```
Ile Arg  Lys Tyr Phe Leu Ser  Asp Asn Asn Pro Asn  Ser Asp Ile
    1145                1150                1155

Pro Asn  Asn Gly His Asn Ile  Lys Pro Gln Lys His  Lys Ala Val
    1160                1165                1170

Arg Lys  Val Phe Ser Leu Pro  Val Ile Pro Gly Asn  Ala Gly Thr
    1175                1180                1185

Met Met  Arg Ile Arg Arg Lys  Asp Asn Lys Gly Gln  Pro Leu Tyr
    1190                1195                1200

Gln Leu  Gln Thr Ile Asp Asp  Thr Pro Ser Met Gly  Ile Gln Ile
    1205                1210                1215

Asn Glu  Asp Arg Leu Val Lys  Gln Glu Val Leu Met  Asp Ala Tyr
    1220                1225                1230

Lys Thr  Arg Asn Leu Ser Thr  Ile Asp Gly Ile Asn  Asn Ser Glu
    1235                1240                1245

Gly Gln  Ala Tyr Ala Thr Phe  Asp Asn Trp Leu Thr  Leu Pro Val
    1250                1255                1260

Ser Thr  Phe Lys Pro Glu Ile  Ile Lys Leu Glu Met  Lys Pro His
    1265                1270                1275

Ser Lys  Thr Arg Arg Tyr Ile  Arg Ile Thr Gln Ser  Leu Ala Asp
    1280                1285                1290

Phe Ile  Lys Thr Ile Asp Glu  Ala Leu Met Ile Lys  Pro Ser Asp
    1295                1300                1305

Ser Ile  Asp Asp Pro Leu Asn  Met Pro Asn Glu Ile  Val Cys Lys
    1310                1315                1320
```

```
Asn Lys  Leu Phe Gly Asn Glu  Leu Lys Pro Arg Asp  Gly Lys Met
    1325                1330                1335


Lys Ile  Val Ser Thr Gly Lys  Ile Val Thr Tyr Glu  Phe Glu Ser
    1340                1345                1350


Asp Ser  Thr Pro Gln Trp Ile  Gln Thr Leu Tyr Val  Thr Gln Leu
    1355                1360                1365


Lys Lys  Gln Pro
    1370
```

<210> 520
<211> 907
<212> PRT
<213> Leptospira inadai

<400> 520

```
Met Ala Lys Ser Ile Glu Glu Ile Arg Ser Ile Gln Asn Glu Phe Val
1               5                   10                  15


Val Glu Tyr Ser Ile Leu Leu Lys Lys Ile Lys Lys Gly Glu Ile Asp
            20                  25                  30


Lys Lys Asn Asp Val Tyr Lys Val Tyr Gln Asn Thr Ile Lys Ser Ser
        35                  40                  45


Glu Arg Leu Glu Gln Val Leu Lys Glu Arg Leu Gly Phe Gln Asn Val
    50                  55                  60


Ser Lys Ser Tyr Phe Asn Asn Pro Tyr Ser Ile Ala Gln Leu Tyr Asn
65                  70                  75                  80


Leu Ile Ser Val Asp Arg Ser Gly Phe Ser Lys Val Cys Arg Ser Cys
                85                  90                  95


Gln Glu Glu Asn His Trp Arg Ser Thr Leu Ile Asp Thr Asp Arg Gly
            100                 105                 110
```

```
Pro Gln Ala Gln Ala Ser Lys Gln Val Ser Asp Thr Gly Arg Pro Phe
        115                 120                 125

Asp Gly Gln Leu Ala Met Leu Leu Asp Arg Ile Ala Phe Glu Ile Val
    130                 135                 140

Lys Leu Lys Arg Ile Glu Ile Glu Arg Leu Leu Ser Asn Lys Asn Ser
145                 150                 155                 160

Ser Lys Ile Glu Val Val Glu Ile Pro Leu Leu Ile Glu Glu Asn Ser
                165                 170                 175

Phe Asn Phe Arg Tyr Glu Leu Ala Glu Leu Lys Lys Leu Ser Lys Lys
            180                 185                 190

Lys Lys Asp Gln Leu Lys Lys Ser Val Glu Glu Phe Asp Thr Lys Leu
        195                 200                 205

Asn Ser Lys Gln Glu Arg Ile Lys Ala Ala Ser Arg Glu Leu Cys Pro
    210                 215                 220

Tyr Thr Gly Lys Lys Ile Ser Lys Gly Glu Ile Asp His Ile Leu Pro
225                 230                 235                 240

Arg Ser Trp Thr Gln Lys Gln Phe Gly Thr Ala Leu Asn Ala Glu Ala
                245                 250                 255

Asn Leu Ile Tyr Ala Ser Arg Glu Gly Asn Gln Ser Lys Gly Asn Arg
            260                 265                 270

Glu Tyr Gly Leu Asn Asp Leu Asp Glu Lys Tyr Leu Asn Ile Ile Phe
        275                 280                 285

Gly Thr Lys Glu Val Asp Ser Ile Gln Arg Asn Ile Ser Asp Thr Ile
    290                 295                 300

Asp Arg Leu Asp Ile Glu Arg Gly Thr Thr Arg Ile Val Phe Asp Arg
```

```
305                 310                 315                 320

Leu Ala Pro Asn Glu Arg Asp Cys Leu Arg His Ala Leu Phe Ile Lys
                325                 330                 335

Ser Leu Arg Pro Lys Val Phe Glu Leu Leu Ser Gly Gln Leu Lys Ala
            340                 345                 350

Arg Val Asn Gly Thr Gln Leu Tyr Leu Ala Lys Arg Ile Arg Ser Leu
        355                 360                 365

Leu Leu Lys Asn Gln Asp Phe Ile Thr Lys Ser Leu Ile Ile Lys Val
    370                 375                 380

Pro Ser Phe Ser Phe Tyr Glu Pro Arg Thr Val Asp Leu Pro Tyr Met
385                 390                 395                 400

Arg Lys Glu Leu Ala Glu Lys Phe Pro Asn Leu Gly Lys Gln Asn Pro
                405                 410                 415

Gln Pro Thr Gly Ser His Ile Ile Asp Ala Ala Met Val Met Ala Tyr
            420                 425                 430

Ala Val Glu Thr Asp Ser Gly Asn Leu Ser Phe Gly Ser Lys Asp Lys
        435                 440                 445

Ser Glu Gly Phe Asp Ser Glu Ser Leu Ser Arg Phe Leu Pro Ser Asn
    450                 455                 460

Ile Gln Phe Leu Ser Ile Lys Ser Lys Asp Lys Thr Asp Ser Lys Tyr
465                 470                 475                 480

Pro Tyr Lys Lys Pro Leu Phe Lys Asp Gly Val Phe Gly Glu Arg Phe
                485                 490                 495

Leu Pro Ile Leu Ile Ala Glu Lys Gly Leu Arg Val Gly Tyr Thr Leu
            500                 505                 510
```

```
Glu Asn Ser Leu Glu Val Asn Ser Glu Asn Pro Glu Glu Phe Phe Asn
        515                 520                 525

Val Leu Lys Pro Tyr Leu Leu Phe Lys Arg Lys Pro Ile Glu Ser Asn
    530                 535                 540

Tyr Gln Thr Leu Val Ala Phe Ala Gln Lys Asp Lys Arg Gly Tyr Ile
545                 550                 555                 560

Val Leu Pro Val Asn Lys Pro Lys Ala Leu Glu Ser Ile Ser Gln Arg
                565                 570                 575

Lys Ser Asp Pro His Thr Ser Ile Leu Lys Asn Ile Leu Tyr Thr Val
            580                 585                 590

Ser Arg Glu Ser Ile Pro Ser Leu Ile Phe Asp Lys Asn Thr Leu Ile
        595                 600                 605

Pro Glu Ile Lys Ser Asn Lys Val Asn Trp Gly Asp Lys Leu Glu Lys
    610                 615                 620

Lys Phe Arg Ile Lys Ile Glu Ile Lys Leu Tyr Gly Lys Lys Ile Ala
625                 630                 635                 640

Asp Gly Phe Ile Arg Tyr Pro Gly Lys Thr Glu Trp Glu Lys Leu Leu
                645                 650                 655

Leu Thr Glu Pro Leu Lys Gly Leu Val Lys Asn Lys Thr Leu Thr Pro
            660                 665                 670

Lys Trp Phe Asp Ser Leu Glu Asn Leu Ala Gly Leu Asp Asp His Phe
        675                 680                 685

Lys Asp Thr Ser Asn Pro Glu Ala Lys His Lys Arg Lys Ser Asn His
    690                 695                 700

Tyr Ala Leu Pro Val Pro Lys Gly Pro Ser Gly Gly Phe Arg Ile Arg
```

```
705                 710                 715                 720

Arg Asn Ser Phe Asp Gly Tyr Lys Val Tyr Gln Leu Tyr Ser Val Asp
                725                 730                 735

Gly Asn Ser Phe His Ala Phe Lys Ile Glu Asn Gly Trp Thr Gly Lys
            740                 745                 750

Thr Leu Leu Leu Asp Ile Tyr Gln Asn Ser Gly Asn Leu His Ser Leu
        755                 760                 765

Asp Tyr Asp Tyr Glu Asn Thr Asp Ile Ser Gln Thr Ala Leu Phe Ser
    770                 775                 780

Lys Phe Tyr Lys Ile Glu Phe Ser Lys Glu Glu Thr Gln Lys Ile Asn
785                 790                 795                 800

Ser Lys Gly Ile Lys Ser Leu Tyr Val Ala Pro Gly Ser Ser Ser Arg
                805                 810                 815

Gln Tyr Ile Arg Val Ile Phe Asp Lys Gln Thr Phe Ser Lys Phe Ile
            820                 825                 830

Lys Phe Gln Ser Lys Phe Trp Glu Phe Asp Leu Ile Thr Pro Leu Pro
        835                 840                 845

Lys Asp Lys Ala Lys Asp Leu Ile Glu Ser Ile Leu Lys Ile Phe Pro
    850                 855                 860

Glu Asp Leu Arg Pro Lys Lys Pro Arg Asn Asp Ile His Ile Gln Asn
865                 870                 875                 880

Ile Ser His Asp Ser Val Gln Val Glu Tyr Ile Ala Asp Gly Lys Thr
                885                 890                 895

Gln Gly Phe Gly Gln Tyr Phe Ile Asn Gln Asn
            900                 905
```

<210> 521
<211> 418
<212> PRT
<213> Leptospira inadai

<400> 521

```
Met Ile Leu Lys Ser Pro Ile Ala Ile Asp Leu Gly Ala Lys Asn Thr
1               5                  10                  15


Gly Ile Val Tyr Thr Thr Tyr Gln Pro Asn Ala Leu Pro Thr Glu Ile
            20                  25                  30


His Gly Ala Thr Ile Ile Ser Asp Asn Leu Lys Leu Ser Gln Val Asp
        35                  40                  45


Arg Arg Ala Lys Arg His Gln Arg Arg Asn Tyr Thr Arg Met Lys Leu
    50                  55                  60


Ala Arg Arg Leu Val Tyr Leu Ile Ile Arg Tyr His Tyr Arg Ile Pro
65                  70                  75                  80


Glu Gln Asp Leu Thr Pro Glu Val Lys Thr Ser Leu Gln Ser Leu Leu
                85                  90                  95


Thr Arg Arg Gly Tyr Thr Phe Gln Ser Ile Glu Thr Glu Gly Asn Glu
            100                 105                 110


Leu Gly Gln Ala Pro Trp Gly Glu Ile Glu Asp Tyr Phe Pro Asn Val
        115                 120                 125


Gln Asp Tyr Glu Lys Ser Leu Pro Ile Gln Thr Val Leu Tyr His Phe
    130                 135                 140


Phe Ser Ser Glu Asn Leu Glu Leu Asn Lys Leu Val Pro Ser Lys Glu
145                 150                 155                 160


Pro Glu Thr Lys Glu Asp Lys Asn Ile Leu Lys Tyr Ile Arg Glu Gln
                165                 170                 175
```

```
Lys Glu Ala Phe Glu Ser Glu Gln Asn Asn Gly Ala Arg His Arg Leu
            180                 185                 190

Lys Tyr Phe Glu Glu Ile Lys Glu Asp Phe Pro Arg Lys Ile Lys Leu
        195                 200                 205

Met Glu Cys Leu Gln Lys Asn Lys Ile Glu Glu Lys Lys Phe Leu Asn
    210                 215                 220

Leu Ile Gln Asn Ile Ser Asn Leu Gln Ile Lys Pro Leu Arg Ala Tyr
225                 230                 235                 240

Phe Asn Asp Lys Asp Met Lys Glu Lys Glu Ile Trp Glu Pro Arg Arg
                245                 250                 255

Leu His Thr Tyr Ile Ala Arg Trp Ile Arg Ser Trp His Ile Asp Pro
            260                 265                 270

Lys Asn Ser Ser Lys Arg Leu Ile Arg Gln Lys Leu Leu Ser Gln Leu
        275                 280                 285

Glu Asn Gly Lys Leu Lys Ile Ile Arg Asp Thr Ser Ile Tyr Ser Pro
    290                 295                 300

Ser Lys Asp Ile Ile Ser Phe Leu Glu Glu Ile Asp Pro Lys Asp Thr
305                 310                 315                 320

Ile Pro Pro Tyr Glu Asp Gln Asn Asn Arg His Pro Pro Arg Cys Gln
                325                 330                 335

Asn Leu Trp Leu Asp Gly Lys Ile Leu Asp Arg Tyr Phe Pro Gly Trp
            340                 345                 350

Glu Gln Ser Leu Trp Lys Leu Ile Arg Asn Glu Lys Asn Asn Pro Phe
        355                 360                 365
```

Glu Gln Leu Ile Thr Lys Asp Phe Arg Thr Asp Asp Thr Ile Ser Glu
370 375 380

Gly Lys Ser Leu Ser Glu Gln Ile Gln Ile Tyr Glu Arg Ser His Ser
385 390 395 400

Asn Ile Lys Leu Asp Val Arg Ala Val Ile Leu Gln Arg Phe Leu Asp
405 410 415

Arg Ser

<210> 522
<211> 125
<212> PRT
<213> Leptospira inadai

<400> 522

Met Ser Ala Tyr Asp Arg Ser Ala Asn Leu Asp Pro Trp Ser Leu Arg
1 5 10 15

Leu Gln Gly Lys Ala Lys Lys Glu Ile Lys Thr Thr Glu Ser Leu Ser
20 25 30

Lys Thr Asp Leu Gln Lys Ala Ser Asp Ala Tyr Glu Lys Ile Lys Glu
35 40 45

Ile Leu Ser Glu Ser Asp Thr Asp Gln Phe Ile Lys Leu Ala Asn Arg
50 55 60

Tyr Tyr Leu Glu Val Ala Asp Ile Lys Lys Gly Met Trp Leu Pro Thr
65 70 75 80

Ala Pro Glu Arg Lys His Lys Glu Ile Pro Lys Ser Ile Ala His Glu
85 90 95

Glu Asn Gln Asp Ile Ser Leu Phe His Lys Cys Asn Thr Lys Thr Gly
100 105 110

```
Ser Lys Lys Arg Ile Ser Gln Val Ser Leu Glu Met Phe
        115                 120                 125


<210>  523
<211>  1355
<212>  PRT
<213>  Leuconostoc gelidum

<400>  523

Met Thr Tyr Ser Ile Gly Leu Asp Ile Gly Thr Gly Ser Val Gly Trp
1               5                   10                  15


Ala Val Ile Gly Asp Asp Tyr Arg Leu Lys Arg Ala Lys Gly Lys Asn
            20                  25                  30


Leu Ile Gly Val Arg Leu Phe Asp Ser Ala Thr Thr Ala Ala Glu Arg
        35                  40                  45


Arg Gly Tyr Arg Thr Thr Arg Arg Arg Leu Ser Arg Arg His Trp Arg
    50                  55                  60


Leu Arg Leu Leu Asn Asp Ile Phe Ala Ser Asp Leu Ala Glu Gln Asp
65                  70                  75                  80


Glu Asn Phe Leu Pro Arg Leu Lys Tyr Ser Trp Val Asn Pro Asp Asp
                85                  90                  95


Glu Gln Asn Pro Gln Leu Asn Ser Asp Val Ala Asn Gly Ala Leu Phe
            100                 105                 110


Gly Ser Ser Glu Thr Asp Lys Ala Phe His Lys Asn Tyr Pro Thr Ile
        115                 120                 125


Tyr His Leu Arg His Glu Leu Met Thr Asp Thr Ala Lys His Asp Leu
    130                 135                 140


Arg Glu Val Tyr Leu Ala Ile His His Ile Val Lys Tyr Arg Gly Asn
145                 150                 155                 160
```

```
Phe Leu Asn Thr Ala Asp Lys Ile Asn Ala Glu Asn Ser Phe Asn Val
                165                 170                 175

Asp Leu Phe Ile Ala Ala Leu Asp Glu Tyr Asn Glu Phe Leu Glu Thr
            180                 185                 190

Pro Ile Thr Ser Ile Lys Asp Ala Gln Leu Phe Ser Asp Lys Leu Thr
        195                 200                 205

Asp Ile Asn Ala Arg Asn Lys Ser Val Arg Val Glu Asn Ala Met Ser
    210                 215                 220

Glu Thr Tyr Asp Asp Lys Ser Lys Ile Phe Lys Ala Ile Leu Thr Ala
225                 230                 235                 240

Leu Val Gly Asn Thr Ala Asn Phe Gln Thr Ile Phe Asp Leu Ser Asp
                245                 250                 255

Leu Glu Lys Asp Glu Ala Lys Asn Phe Lys Phe Lys Leu Asp Leu Glu
            260                 265                 270

Asp Val Glu Thr Lys Leu Asp Val Val Arg Ala Lys Leu Ser Asp Glu
        275                 280                 285

Gln Asn Ala Phe Leu Glu Ala Val Leu Ile Ala Tyr Asp Gly Ile Thr
    290                 295                 300

Leu Lys Met Ile Leu Gly Asp Tyr Lys Ser Ile Ser Gln Ser Met Ile
305                 310                 315                 320

Glu Ser Tyr Lys Ser His Gln Arg Asp Trp Lys Tyr Ile Lys Asn Asn
                325                 330                 335

Val Arg Leu Asn Glu Gln Lys Ile Glu Pro Asp Lys Asn Ser Val Lys
            340                 345                 350
```

```
Phe Phe Lys Leu Asp Pro Lys Lys Leu Ile Tyr Pro Ser Asn Leu Ala
        355                 360                 365

Tyr Leu Gln Val Ile Ser Ser Asn Glu Asp Glu His Arg Lys Gly Leu
    370                 375                 380

Asp Tyr Phe Lys Thr Ala Ile Gln Asp Ala Asp Ile Leu Gln Arg Ile
385                 390                 395                 400

Glu Asn Asp Thr Phe Leu Pro Arg Gln Arg Thr Lys Arg Asn Gly Val
                405                 410                 415

Leu Pro Tyr Gln Leu His Leu Ala Glu Leu Glu Gln Ile Ile Lys Lys
            420                 425                 430

Gln Ser Lys Tyr Tyr Pro Phe Leu Ala Asn Ile Tyr Thr Gln Asp Asn
        435                 440                 445

Lys Thr Glu Asn Lys Leu Ile Gly Leu Leu Lys Phe Arg Val Pro Tyr
    450                 455                 460

Tyr Val Gly Pro Leu Val Glu Ala Glu Lys Val Thr Gly Asp Gly Lys
465                 470                 475                 480

Asn His Trp Leu Ile Lys Lys Glu Leu Gln Glu Asn Thr Pro Ile Thr
                485                 490                 495

Pro Phe Asn Phe Asp Asp Val Val Asp Lys Asp Lys Ser Gly Glu Gln
            500                 505                 510

Phe Ile Lys Arg Ile Thr Gly Thr Asp Ser Tyr Leu Ile Gly Glu Pro
        515                 520                 525

Thr Leu Pro Glu Asn Ser Leu Leu Tyr Gln Lys Tyr Asn Val Leu Gln
    530                 535                 540

Glu Leu Asn Asn Val Arg Asn Glu Arg His Gln Arg Leu Pro Ile Lys
545                 550                 555                 560
```

```
Val Lys Gln Asp Ile Phe Glu His Val Phe Lys Ile Asp Lys Asn Val
                565                 570                 575

Asn Ala Lys Lys Val Met Ala Tyr Leu Lys Leu Asn Gly Tyr Gly Asp
            580                 585                 590

Phe Gln Ile Ala Gly Leu Ser Asp Thr Arg Thr Gly Lys Phe Asn Ser
        595                 600                 605

Asn Leu Ser Ser Tyr Asn Tyr Phe Val Asp Leu Leu Gly Arg Glu Lys
    610                 615                 620

Thr Glu Lys Ile Arg Glu Asp Arg Leu Glu Glu Ile Ile Glu Ile Gln
625                 630                 635                 640

Thr Val Phe Glu Asp Lys Ile Leu Val Ala Lys Arg Leu Ser Asn Leu
                645                 650                 655

Asp Phe Leu Thr Pro Gln Glu Lys Ser Lys Leu Ser Ala Lys His Tyr
            660                 665                 670

Thr Gly Trp Gly Arg Leu Ser Gln Lys Leu Leu Thr Thr Gln Phe Ile
        675                 680                 685

Lys Thr Ala Leu Ser Glu Ala Gly Asp Ile Ile Pro Gln Ser His Ser
    690                 695                 700

Ile Ile Asp Leu Leu Tyr Tyr Thr Asp Lys Asn Leu Met Glu Ile Leu
705                 710                 715                 720

Asn Asp Lys Thr Phe Asn Val Arg Asn Trp Leu Thr Glu Gln Asn Lys
                725                 730                 735

Gly Thr Glu Ser Gly Asn Ser Leu Tyr Asp Gln Ile Asp Ala Leu Ala
            740                 745                 750
```

```
Gly Pro Lys Asp Ile Lys Arg Gly Ile Thr Gln Val Phe Ser Ile Ile
        755                 760                 765

Asp Asp Ile Lys Lys Ala Met Gly Ser Asn Pro Glu Thr Val Tyr Leu
    770                 775                 780

Glu Phe Ala Arg Glu Thr Gln Thr Ser Arg Leu Thr Asn Ser Arg Leu
785                 790                 795                 800

Asn Arg Val Gln Glu Ile Tyr Asn Ser Pro Glu Leu Lys Thr Glu Phe
                805                 810                 815

Ala Tyr Leu Ala Lys Lys Leu Glu Ala Glu Thr Lys Glu Ser Ile His
            820                 825                 830

Asp Asp Arg Leu Tyr Leu Tyr Tyr Leu Gln Glu Gly Arg Asp Met Tyr
        835                 840                 845

Thr Gly Lys Glu Ile Pro Phe Asp Gln Ile Ser Ser Asn Tyr Asp Ile
    850                 855                 860

Asp His Ile Ile Pro Gln Ala Phe Thr Lys Asp Asp Ser Leu Asp Asn
865                 870                 875                 880

Arg Val Leu Val Asn Arg Ala Thr Asn Ala Arg Lys Ser Asn Ser Pro
                885                 890                 895

Thr Phe Thr Asn Asp Ile Ile Asp Asn Arg Lys Ser Trp Trp Gln Ser
            900                 905                 910

Leu Val Lys Arg Gly Leu Met Ser Lys Glu Lys Phe Glu Arg Leu Thr
        915                 920                 925

Asp Lys Arg Lys Thr Phe Ser Glu Asn Gln Thr Asn His Phe Ile Ala
    930                 935                 940

Arg Gln Leu Val Glu Thr Arg Gln Ile Ile Lys Asn Val Ala Asp Leu
945                 950                 955                 960
```

```
Ile Lys Asn Asn Tyr Asp Gly Thr Gln Ala Val Ala Ile Arg Ala Ser
               965                 970                 975

Leu Thr Gly Glu Met Arg Arg Tyr Leu Asp Trp Pro Lys Asn Arg Asp
            980                 985                 990

Met Asn Asp Tyr His His Ala His  Asp Ala Leu Met Met  Ala Thr Val
        995                 1000                1005

Gly Lys  Tyr Val Asp Arg Arg  Gly Phe Phe Asp Asn  Gly Ser Val
    1010                1015                1020

Ser Asp  Gly Ala Gly Asn Ala  Tyr Asn Leu Tyr Thr  Lys Asp Trp
    1025                1030                1035

Leu Val  Ala Ala Arg Val Gly  Thr Arg Asn Asp Ser  Gln Arg Val
    1040                1045                1050

Asn Pro  Tyr Gly Phe Ile Val  Gly Ser Met Asn Ser  Lys Ala Val
    1055                1060                1065

Arg Gln  Gln Val Asn Lys Glu  Thr Gly Glu Ile Val  Trp Gly Asn
    1070                1075                1080

Glu Asn  Leu Asp Tyr Leu Arg  His Val Leu Ser Tyr  Lys Lys Ile
    1085                1090                1095

Leu Val  Thr Arg Arg Leu Ser  Gly Ser Ser Gly Arg  Leu Tyr Ala
    1100                1105                1110

Glu Thr  Leu Phe Ser Pro Asn  Pro Lys Ala Lys Leu  Ile Ala Gln
    1115                1120                1125

Lys Ala  Asn Arg Ser Val Ala  Leu Tyr Gly Gly Phe  Thr Lys Ala
    1130                1135                1140
```

```
Glu Ser  Ala Tyr Thr Ala Leu  Val Glu Phe Asn Lys  Lys Gly Asp
    1145                1150                1155

Arg Ser  Tyr Lys Leu Ile Lys  Val Pro Met Ala Ile  Ala Asn Arg
    1160                1165                1170

Val Asn  Asp Lys Gln Ile Thr  Val Thr Ala Tyr Ile  Ala Ser Leu
    1175                1180                1185

Asn Leu  Arg Asp Phe Ser Arg  Val Val Leu Glu His  Leu Pro Leu
    1190                1195                1200

Gly Thr  Leu Ile Arg Glu Ser  Asp Gly Ser Glu Phe  Tyr Ala Ala
    1205                1210                1215

Ser Ser  Glu Tyr Lys His Asn  Ala Lys Glu Leu Trp  Ala Pro Lys
    1220                1225                1230

Glu Ile  Leu Arg Ser Ser Lys  Lys Leu Asp Lys Ala  Thr Ala Asp
    1235                1240                1245

Asn Leu  Ile Asp Ile Phe Asp  Phe Leu Thr Asn Asp  Lys Thr Ile
    1250                1255                1260

Ser Asn  Phe Lys Phe Tyr Glu  Lys Asp Leu Leu His  Leu Lys Asn
    1265                1270                1275

Val Arg  Asp Lys Phe Val Glu  Ala Ser Asp Glu Ile  Lys Ile Lys
    1280                1285                1290

Val Leu  Ser Asp Val Ile Tyr  Glu Leu His Asn Asp  Ala Gly Trp
    1295                1300                1305

Arg Asp  Pro Phe Lys His Ile  Gln Glu Lys Pro Ala  Trp Thr Met
    1310                1315                1320

Leu Gln  Val Lys Gly Gly Ile  Lys Leu Ser Glu Lys  Ala Ala Ile
    1325                1330                1335
```

Val Tyr Gln Ser Pro Thr Gly Leu Phe Glu Thr Ile Thr Ile Val
    1340   1345   1350

Gly Glu
    1355

<210> 524
<211> 883
<212> PRT
<213> Leuconostoc pseudomesenteroides

<400> 524

Met Ile Gly Val Arg Leu Phe Glu Gly Ala Asp Thr Ala Ala Glu Arg
1   5   10   15

Arg Gly Tyr Arg Thr Thr Arg Arg Arg Leu Ser Arg Arg Arg Trp Arg
            20   25   30

Leu Arg Leu Leu Asn Asp Ile Phe Ala Ser Glu Leu Ser Lys Ile Asp
        35   40   45

Glu Asn Phe Leu Pro Arg Leu Lys Tyr Ser Trp Val Asn Lys Asn Asp
    50   55   60

Thr Asp Asn Val His Phe Gly Val Gly Val Phe Asp Asn Ser Glu Gln
65   70   75   80

Glu Lys Ala Phe Tyr Gln Asp Tyr Pro Thr Ile Tyr His Leu Arg Gln
                85   90   95

Lys Leu Met Thr Asp Asn Arg Gln His Asp Leu Arg Glu Val Tyr Leu
            100   105   110

Ala Ile His His Ile Val Lys Tyr Arg Gly His Phe Leu Asn Ser Gly
        115   120   125

Glu Ile Ser Ala Asn Ser Ser Phe Asp Ala Gln Lys Phe Leu Glu Leu

```
    130                 135                 140

Leu Arg Glu Phe Asp Asn Thr Phe Tyr Pro Asp Ala Val Lys Phe Leu
145                 150                 155                 160

Asn Leu Asp Gln Leu Asp Leu Pro Asp Lys Ile Ser Ser Glu Ile Ser
                165                 170                 175

Asp Ser Lys Ile Ser Lys Ser Glu Arg Val Asp Arg Val Leu Gln His
            180                 185                 190

Val Gln Leu Ala Asn Ser Gly Ala Lys Lys Ile Leu Lys Ala Ile Leu
        195                 200                 205

Asn Ala Val Val Gly Asn Ser Val Asp Ser Val Ala Met Phe Ser Leu
    210                 215                 220

Ser Asp Leu Asp Lys Glu Glu Lys Lys Lys Ile Asn His Pro Val Thr
225                 230                 235                 240

Asp Ser Lys Pro Phe Lys Tyr Ser Asp Lys Glu Val Glu Ala Lys Leu
                245                 250                 255

Asp Glu Leu Ser Asn Leu Leu Gln Asp Glu Gln Lys Ile Glu Phe Leu
            260                 265                 270

Ser Leu Leu Lys Leu Ser Phe Asp Gly Leu Thr Leu Lys Met Leu Leu
        275                 280                 285

Gly Asn Ala Lys Ser Val Ser Glu Ala Met Val Glu Arg Tyr Lys Val
    290                 295                 300

His Lys Asp Asp Leu Lys Phe Ile Lys Glu Asn Ile Leu Asn Ser Phe
305                 310                 315                 320

Ser Lys Asp Lys Lys Lys Glu Phe Asp Lys Tyr Tyr Glu Ala His Leu
                325                 330                 335
```

```
Ala Glu Lys Asp Val Asp Asn Val Asp Lys Tyr Phe Lys Lys Ile Ile
            340                 345                 350

Asp Asp Ser Ile Ile Ser Lys Asp Lys Lys Ile Glu Leu Leu Gln Lys
        355                 360                 365

Ile Asp Asp His Asp Phe Leu Pro Ser Gln Arg Ser Lys Ile Asn Gly
    370                 375                 380

Ala Ile Pro His Gln Leu His Arg Asn Glu Leu Asp Lys Ile Ile Ser
385                 390                 395                 400

Gln Gln Ser Lys Tyr Tyr Pro Phe Leu Ala Asp Ser Tyr Thr Gln Asn
                405                 410                 415

Gly Lys Thr Glu Thr Lys Leu Ala Gly Leu Val Asn Phe Arg Val Pro
            420                 425                 430

Tyr Tyr Val Gly Pro Leu Val Ser Lys Glu Asn Ala Asp Arg Asn Asn
        435                 440                 445

Pro Asp Gly Gly Gln Asn His Trp Val Glu Phe Lys Glu Asn Thr Ser
    450                 455                 460

Leu Ser Asn Leu Thr Pro Trp Asn Phe Asn Glu Ile Val Asp Lys Asp
465                 470                 475                 480

Lys Ser Ala Ala Lys Phe Ile Glu Arg Leu Thr Gly Met Asp Thr Tyr
                485                 490                 495

Leu Ile Gly Glu Pro Thr Leu Pro Gln Asn Ser Leu Leu Tyr Gln Lys
            500                 505                 510

Tyr Asn Val Leu Gln Glu Leu Asn Asn Ile Arg Val Asp Asn His Lys
        515                 520                 525

Leu Asp Val Lys Ile Lys Gln Asp Val Phe Glu His Leu Phe Lys Thr
```

```
    530                 535                 540

Gln Asn Ser Val Ser Ala Lys Asp Val Lys Asn Tyr Leu Ile Ala Asn
545                 550                 555                 560

Gly Tyr Ala Ala Pro Ser Ile Gln Ile Thr Gly Leu Ser Asp Thr Asn
                565                 570                 575

Glu Lys Thr Phe Asn Ser Lys Leu Ser Ser Tyr Asn Tyr Leu Val Asp
            580                 585                 590

Lys Leu Gly Arg Thr Phe Val Glu Ser Val Lys Ser Asp Val Leu Glu
        595                 600                 605

Lys Ile Ile Glu Leu Gln Thr Val Phe Glu Asp Lys Thr Val Leu Leu
    610                 615                 620

Arg Gln Leu Ser Met Ile Ser Glu Leu Thr Leu Ala Gln Ala Asn Gln
625                 630                 635                 640

Leu Ala Glu Lys His Trp Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
                645                 650                 655

Leu Ser Ser Lys Val Val Asp Val Asn Lys Ile Thr Asn Ser Thr Phe
            660                 665                 670

Tyr Pro Ala Thr Ser Arg Gln Thr Ile Ile Asp Thr Leu Tyr His Thr
        675                 680                 685

Gln Leu Asn Leu Met Glu Ile Ile Asn Asn Ala Glu Asp Leu Tyr Gly
    690                 695                 700

Val Arg Gln Trp Ile Ser Glu Gln Asn Lys Ser Asp Ser Ser Asp Thr
705                 710                 715                 720

Asn Asp Val Tyr Asp Gln Ile Gln Glu Leu Ala Gly Asp Lys Lys Ile
                725                 730                 735
```

```
Lys Arg Gly Ile Thr Gln Ser Phe Arg Ile Leu Asp Asp Ile Val Lys
            740                 745                 750

Ala Met Gly Gly Glu Pro Glu Arg Val Tyr Leu Glu Phe Ala Arg Glu
        755                 760                 765

Asn Gln Gln Ser Gly Val Ser Phe Ser Arg Lys Asn Leu Leu Ser Lys
    770                 775                 780

Leu Tyr Glu Asn Asp Ser Leu Lys Gln Thr Phe Lys Glu Leu Lys Ser
785                 790                 795                 800

Gln Leu Glu Ser Glu Thr Lys Glu Asn Leu Gln Asn Asp Arg Leu Tyr
                805                 810                 815

Leu Tyr Tyr Leu Gln Gln Gly Arg Asp Met Tyr Ser Asn Asp Glu Leu
            820                 825                 830

Asn Ile Asp Gln Leu Ser Ser Tyr Asp Ile Asp His Ile Ile Pro Gln
        835                 840                 845

Ala Tyr Thr Lys Asp Asn Ser Phe Asp Asn Arg Val Leu Val Ser Ser
    850                 855                 860

Lys Ala Asn Arg Leu Lys Arg Met Leu Leu Trp Tyr Pro Val Lys Leu
865                 870                 875                 880

Ser Lys Lys
```

<210> 525
<211> 468
<212> PRT
<213> Leuconostoc pseudomesenteroides

<400> 525

```
Met Lys Asp Gln Gly Phe Ile Ser Lys Arg Lys Phe Glu Asn Leu Thr
1               5                   10                  15
```

```
Arg Arg Gly Asp Phe Ser Glu Gln Gln Lys Glu Arg Phe Ile Ala Arg
            20                  25                  30

Ala Leu Val Glu Thr Arg Gln Ile Ile Val Asn Val Ser Ser Leu Ile
        35                  40                  45

Asp Ser His Phe Asn His Thr Lys Ala Val Ala Val Lys Ser Asn Met
    50                  55                  60

Thr Thr Asp Met Arg His Tyr Thr Lys Val Pro Lys Asn Arg Asp Ile
65                  70                  75                  80

Asn Asp Tyr His His Ala His Asp Ala Leu Phe Val Ala Thr Val Gly
                85                  90                  95

Gln Tyr Ile Glu Asn Lys Gly Phe Met Lys Ala Gly Lys Leu Ser Asp
            100                 105                 110

Ser Val Gly Asn Glu Tyr Asn Arg Tyr Thr Lys Lys Trp Ile Glu Thr
        115                 120                 125

Ala Arg Lys Asn Thr Asn Tyr Gly Arg Val Asn Pro Phe Gly Phe Val
    130                 135                 140

Val Gly Ser Met Gln Thr Ala Thr Arg Gly Lys Leu Asp Tyr Glu Thr
145                 150                 155                 160

Gly Glu Leu Lys Val Val Lys Asn Asn Tyr Trp Ser Lys Asp Asp Leu
                165                 170                 175

Asp Tyr Leu Leu Lys Val Val Ser Tyr Lys Lys Ile Leu Val Thr Thr
            180                 185                 190

Lys Leu Gln Asp Asn Lys Gly Ala Met Tyr Asp Ala Asn Leu Ile Ser
        195                 200                 205
```

```
Ala Lys Gly Ser Gly Lys Lys Lys Ala Gln Leu Gln Ile Ser Lys Ser
    210                 215                 220

Lys Asn Ile Asp Leu Tyr Gly Gly Phe Asn Lys Leu Gln Asn Glu Tyr
225                 230                 235                 240

Ser Val Leu Ile Leu Asn His Asp Glu Tyr Arg Trp Leu Ser Ile Pro
                245                 250                 255

Met Tyr Ala Arg Asn Ser Ser Glu Gln Tyr Leu His Asp Lys Tyr Pro
            260                 265                 270

Asp Ala Lys Val Ile Leu Asn His Ile Leu Val Gly Gln Pro Ile Leu
        275                 280                 285

Leu Ser Asn Ser Ser Asp Pro Gln Lys Ser Lys Phe Ala Ser Leu Arg
    290                 295                 300

Ile Ala Thr Gly Gly Asp Tyr His Asn Asn Phe Glu Phe Val Pro Ser
305                 310                 315                 320

Val Asp Val Lys Lys Ile Leu Asp Asn Ile Tyr Leu Asn His Ser Val
                325                 330                 335

Thr Asp Asp Glu Tyr Lys Lys Val Phe Glu Ser Leu Leu Ala Thr Leu
            340                 345                 350

His Asp Lys Phe Val Phe Gly Ile His Gln Val Met Tyr Asn Lys Ile
        355                 360                 365

Phe Asp Asn Lys Tyr Leu Phe Asp Lys Met Pro Asp Glu Ala Lys Arg
    370                 375                 380

Asn Val Ile Asn Ser Leu Leu Lys Phe Met Asn Ile Ser Lys Asn Gln
385                 390                 395                 400

Leu Gly Ala Val Gly Lys Ile Gly Gly Lys Val Asn Gly Val Leu Tyr
                405                 410                 415
```

```
Gly Phe Lys Thr Glu Thr Glu Lys Gly Thr Ser Ala Gly Gln Leu Ile
            420                 425                 430


Ser Asn Gly Lys Met Gln Pro His Asp Ile Phe Ile Phe Gln Ser Pro
        435                 440                 445


Thr Gly Ile Phe Glu Arg Arg Val Thr Val Ala Glu Leu Ala Asn Val
    450                 455                 460


Ile Lys Asp Glu
465
```

<210> 526
<211> 1103
<212> PRT
<213> Listeria innocua

<400> 526

```
Leu Lys Leu Tyr Pro Gly Glu Lys Ser Thr Gly Met Phe Ala Gln Phe
1               5                   10                  15


Ile Ser Leu Ile Val Gly Ser Lys Gly Asn Phe Gln Lys Pro Phe Asp
            20                  25                  30


Leu Ile Glu Lys Ser Asp Ile Glu Cys Ala Lys Asp Ser Tyr Glu Glu
        35                  40                  45


Asp Leu Glu Ser Leu Leu Ala Leu Ile Gly Asp Glu Tyr Ala Glu Leu
    50                  55                  60


Phe Val Ala Ala Lys Asn Ala Tyr Ser Ala Val Val Leu Ser Ser Ile
65                  70                  75                  80


Ile Thr Val Ala Glu Thr Glu Thr Asn Ala Lys Leu Ser Ala Ser Met
                85                  90                  95


Ile Glu Arg Phe Asp Thr His Glu Glu Asp Leu Gly Glu Leu Lys Ala
```

```
            100                 105                 110

Phe Ile Lys Leu His Leu Pro Lys His Tyr Glu Glu Ile Phe Ser Asn
        115                 120                 125

Thr Glu Lys His Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Lys Gln
    130                 135                 140

Ala Asp Phe Tyr Lys Tyr Met Lys Thr Thr Leu Glu Asn Ile Glu Gly
145                 150                 155                 160

Ala Asp Tyr Phe Ile Ala Lys Ile Glu Lys Glu Asn Phe Leu Arg Lys
                165                 170                 175

Gln Arg Thr Phe Asp Asn Gly Ala Ile Pro His Gln Leu His Leu Glu
            180                 185                 190

Glu Leu Glu Ala Ile Leu His Gln Gln Ala Lys Tyr Tyr Pro Phe Leu
        195                 200                 205

Lys Glu Asn Tyr Asp Lys Ile Lys Ser Leu Val Thr Phe Arg Ile Pro
    210                 215                 220

Tyr Phe Val Gly Pro Leu Ala Asn Gly Gln Ser Glu Phe Ala Trp Leu
225                 230                 235                 240

Thr Arg Lys Ala Asp Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu Lys
                245                 250                 255

Val Asp Phe Gly Lys Ser Ala Val Asp Phe Ile Glu Lys Met Thr Asn
            260                 265                 270

Lys Asp Thr Tyr Leu Pro Lys Glu Asn Val Leu Pro Lys His Ser Leu
        275                 280                 285

Cys Tyr Gln Lys Tyr Leu Val Tyr Asn Glu Leu Thr Lys Val Arg Tyr
    290                 295                 300
```

```
Ile Asn Asp Gln Gly Lys Thr Ser Tyr Phe Ser Gly Gln Glu Lys Glu
305                 310                 315                 320

Gln Ile Phe Asn Asp Leu Phe Lys Gln Lys Arg Lys Val Lys Lys Lys
                325                 330                 335

Asp Leu Glu Leu Phe Leu Arg Asn Met Ser His Val Glu Ser Pro Thr
            340                 345                 350

Ile Glu Gly Leu Glu Asp Ser Phe Asn Ser Ser Tyr Ser Thr Tyr His
        355                 360                 365

Asp Leu Leu Lys Val Gly Ile Lys Gln Glu Ile Leu Asp Asn Pro Val
    370                 375                 380

Asn Thr Glu Met Leu Glu Asn Ile Val Lys Ile Leu Thr Val Phe Glu
385                 390                 395                 400

Asp Lys Arg Met Ile Lys Glu Gln Leu Gln Gln Phe Ser Asp Val Leu
                405                 410                 415

Asp Gly Val Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly Trp
            420                 425                 430

Gly Arg Leu Ser Ala Lys Leu Leu Met Gly Ile Arg Asp Lys Gln Ser
        435                 440                 445

His Leu Thr Ile Leu Asp Tyr Leu Met Asn Asp Asp Gly Leu Asn Arg
    450                 455                 460

Asn Leu Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile
465                 470                 475                 480

Ile Glu Lys Glu Gln Val Thr Thr Ala Asp Lys Asp Ile Gln Ser Ile
                485                 490                 495

Val Ala Asp Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
```

```
            500                 505                 510

Ser Leu Lys Ile Val Asp Glu Leu Val Ser Val Met Gly Tyr Pro Pro
        515                 520                 525

Gln Thr Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Lys
    530                 535                 540

Gly Lys Asn Asn Ser Arg Pro Arg Tyr Lys Ser Leu Glu Lys Ala Ile
545                 550                 555                 560

Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln
                565                 570                 575

Glu Leu Lys Asn Asn Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys
            580                 585                 590

Asp Met Tyr Thr Gly Gln Asp Leu Asp Ile His Asn Leu Ser Asn Tyr
        595                 600                 605

Asp Ile Asp His Ile Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile
    610                 615                 620

Asp Asn Leu Val Leu Thr Ser Ser Ala Gly Asn Arg Glu Lys Gly Asn
625                 630                 635                 640

Asp Val Pro Pro Leu Glu Ile Val Gln Lys Arg Lys Val Phe Trp Glu
                645                 650                 655

Lys Leu Tyr Gln Gly Asn Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu
            660                 665                 670

Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Arg Phe
        675                 680                 685

Ile His Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala
    690                 695                 700
```

```
Asn Ile Leu His Gln Arg Phe Asn Tyr Gly Lys Asp Asp His Gly Asn
705                 710                 715                 720


Thr Met Lys Gln Val Arg Ile Val Thr Leu Lys Ser Ala Leu Val Ser
                725                 730                 735


Gln Phe Arg Lys Gln Phe Gln Leu Tyr Lys Val Arg Gly Val Asn Asp
            740                 745                 750


Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Asn Thr
        755                 760                 765


Leu Leu Lys Val Tyr Pro Gln Leu Glu Pro Glu Phe Val Tyr Gly Asp
    770                 775                 780


Tyr His Gln Phe Asp Trp Phe Lys Ala Asn Lys Ala Thr Ala Lys Lys
785                 790                 795                 800


Gln Phe Tyr Thr Asn Ile Met Leu Phe Phe Ala Gln Lys Asp Arg Ile
                805                 810                 815


Ile Asp Glu Asn Gly Glu Ile Leu Trp Asp Lys Lys Tyr Leu Asp Thr
            820                 825                 830


Val Lys Lys Val Met Ser Tyr Arg Gln Met Asn Ile Val Lys Lys Thr
        835                 840                 845


Glu Ile Gln Lys Gly Glu Phe Ser Lys Ala Thr Ile Lys Pro Lys Gly
    850                 855                 860


Asn Ser Ser Lys Leu Ile Pro Arg Lys Thr Asn Trp Asp Pro Met Lys
865                 870                 875                 880


Tyr Gly Gly Leu Asp Ser Pro Asn Met Ala Tyr Ala Val Val Ile Glu
                885                 890                 895


Tyr Ala Lys Gly Lys Asn Lys Leu Val Phe Glu Lys Lys Ile Ile Arg
```

```
            900                 905                 910

Val Thr Ile Met Glu Arg Lys Ala Phe Glu Lys Asp Glu Lys Ala Phe
        915                 920                 925

Leu Glu Glu Gln Gly Tyr Arg Gln Pro Lys Val Leu Ala Lys Leu Pro
    930                 935                 940

Lys Tyr Thr Leu Tyr Glu Cys Glu Glu Gly Arg Arg Arg Met Leu Ala
945                 950                 955                 960

Ser Ala Asn Glu Ala Gln Lys Gly Asn Gln Gln Val Leu Pro Asn His
                965                 970                 975

Leu Val Thr Leu Leu His His Ala Ala Asn Cys Glu Val Ser Asp Gly
            980                 985                 990

Lys Ser Leu Asp Tyr Ile Glu Ser  Asn Arg Glu Met Phe  Ala Glu Leu
        995                 1000                1005

Leu Ala  His Val Ser Glu Phe  Ala Lys Arg Tyr Thr  Leu Ala Glu
    1010                1015                1020

Ala Asn  Leu Asn Lys Ile Asn  Gln Leu Phe Glu Gln  Asn Lys Glu
    1025                1030                1035

Gly Asp  Ile Lys Ala Ile Ala  Gln Ser Phe Val Asp  Leu Met Ala
    1040                1045                1050

Phe Asn  Ala Met Gly Ala Pro  Ala Ser Phe Lys Phe  Phe Glu Thr
    1055                1060                1065

Thr Ile  Glu Arg Lys Arg Tyr  Asn Asn Leu Lys Glu  Leu Leu Asn
    1070                1075                1080

Ser Thr  Ile Ile Tyr Gln Ser  Ile Thr Gly Leu Tyr  Glu Ser Arg
    1085                1090                1095
```

Lys Arg Leu Asp Asp
    1100

<210> 527
<211> 1337
<212> PRT
<213> Listeria innocua

<400> 527

Met Lys Asn Met Lys Lys Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr
1   5   10   15

Asn Ser Val Gly Trp Ala Val Leu Thr Asp Gln Tyr Asp Leu Val Lys
            20   25   30

Arg Lys Met Lys Ile Ala Gly Asp Ser Glu Lys Lys Gln Ile Lys Lys
        35   40   45

Asn Phe Trp Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Ala Asp
    50   55   60

Arg Arg Met Ala Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn
65   70   75   80

Arg Ile Ser Tyr Leu Gln Gly Ile Phe Ala Glu Glu Met Ser Lys Thr
                85   90   95

Asp Ala Asn Phe Phe Cys Arg Leu Ser Asp Ser Phe Tyr Val Asp Asn
            100   105   110

Glu Lys Arg Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu
        115   120   125

Val Glu Tyr His Lys Asn Tyr Pro Thr Ile Tyr His Leu Arg Glu Glu
    130   135   140

Leu Val Asn Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala
145   150   155   160

```
Leu Ala His Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala
               165                 170                 175

Leu Asp Thr Gln Asn Thr Ser Val Asp Gly Ile Tyr Lys Gln Phe Ile
            180                 185                 190

Gln Thr Tyr Asn Gln Val Phe Ala Ser Gly Ile Glu Asp Gly Ser Leu
        195                 200                 205

Lys Lys Leu Glu Asp Asn Lys Asp Val Ala Lys Ile Leu Val Glu Lys
    210                 215                 220

Val Thr Arg Lys Glu Lys Leu Glu Arg Ile Leu Lys Leu Tyr Pro Gly
225                 230                 235                 240

Glu Lys Ser Ala Gly Met Phe Ala Gln Phe Ile Ser Leu Ile Val Gly
               245                 250                 255

Ser Lys Gly Asn Phe Gln Lys Pro Phe Asp Leu Ile Glu Lys Ser Asp
            260                 265                 270

Ile Glu Cys Ala Lys Asp Ser Tyr Glu Glu Asp Leu Glu Ser Leu Leu
        275                 280                 285

Ala Leu Ile Gly Asp Glu Tyr Ala Glu Leu Phe Val Ala Ala Lys Asn
    290                 295                 300

Ala Tyr Ser Ala Val Val Leu Ser Ser Ile Ile Thr Val Ala Glu Thr
305                 310                 315                 320

Glu Thr Asn Ala Lys Leu Ser Ala Ser Met Ile Glu Arg Phe Asp Thr
               325                 330                 335

His Glu Glu Asp Leu Gly Glu Leu Lys Ala Phe Ile Lys Leu His Leu
            340                 345                 350
```

```
Pro Lys His Tyr Glu Glu Ile Phe Ser Asn Thr Glu Lys His Gly Tyr
        355                 360                 365

Ala Gly Tyr Ile Asp Gly Lys Thr Lys Gln Ala Asp Phe Tyr Lys Tyr
    370                 375                 380

Met Lys Met Thr Leu Glu Asn Ile Glu Gly Ala Asp Tyr Phe Ile Ala
385                 390                 395                 400

Lys Ile Glu Lys Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn
                405                 410                 415

Gly Ala Ile Pro His Gln Leu His Leu Glu Glu Leu Glu Ala Ile Leu
            420                 425                 430

His Gln Gln Ala Lys Tyr Tyr Pro Phe Leu Lys Glu Asn Tyr Asp Lys
        435                 440                 445

Ile Lys Ser Leu Val Thr Phe Arg Ile Pro Tyr Phe Val Gly Pro Leu
    450                 455                 460

Ala Asn Gly Gln Ser Glu Phe Ala Trp Leu Thr Arg Lys Ala Asp Gly
465                 470                 475                 480

Glu Ile Arg Pro Trp Asn Ile Glu Glu Lys Val Asp Phe Gly Lys Ser
                485                 490                 495

Ala Val Asp Phe Ile Glu Lys Met Thr Asn Lys Asp Thr Tyr Leu Pro
            500                 505                 510

Lys Glu Asn Val Leu Pro Lys His Ser Leu Cys Tyr Gln Lys Tyr Leu
        515                 520                 525

Val Tyr Asn Glu Leu Thr Lys Val Arg Tyr Ile Asn Asp Gln Gly Lys
    530                 535                 540

Thr Ser Tyr Phe Ser Gly Gln Glu Lys Glu Gln Ile Phe Asn Asp Leu
545                 550                 555                 560
```

```
Phe Lys Gln Lys Arg Lys Val Lys Lys Lys Asp Leu Glu Leu Phe Leu
               565                 570                 575

Arg Asn Met Ser His Val Glu Ser Pro Thr Ile Glu Gly Leu Glu Asp
            580                 585                 590

Ser Phe Asn Ser Ser Tyr Ser Thr Tyr His Asp Leu Leu Lys Val Gly
        595                 600                 605

Ile Lys Gln Glu Ile Leu Asp Asn Pro Val Asn Thr Glu Met Leu Glu
    610                 615                 620

Asn Ile Val Lys Ile Leu Thr Val Phe Glu Asp Lys Arg Met Ile Lys
625                 630                 635                 640

Glu Gln Leu Gln Gln Phe Ser Asp Val Leu Asp Gly Val Val Leu Lys
               645                 650                 655

Lys Leu Glu Arg Arg His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys
            660                 665                 670

Leu Leu Met Gly Ile Arg Asp Lys Gln Ser His Leu Thr Ile Leu Asp
        675                 680                 685

Tyr Leu Met Asn Asp Asp Gly Leu Asn Arg Asn Leu Met Gln Leu Ile
    690                 695                 700

Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile Ile Glu Lys Glu Gln Val
705                 710                 715                 720

Thr Thr Ala Asp Lys Asp Ile Gln Ser Ile Val Ala Asp Leu Ala Gly
               725                 730                 735

Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp
            740                 745                 750
```

```
Glu Leu Val Ser Val Met Gly Tyr Pro Pro Gln Thr Ile Val Val Glu
        755                 760                 765

Met Ala Arg Glu Asn Gln Thr Thr Gly Lys Gly Lys Asn Asn Ser Arg
    770                 775                 780

Pro Arg Tyr Lys Ser Leu Glu Lys Ala Ile Lys Glu Phe Gly Ser Gln
785                 790                 795                 800

Ile Leu Lys Glu His Pro Thr Asp Asn Gln Glu Leu Arg Asn Asn Arg
                805                 810                 815

Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Gln
            820                 825                 830

Asp Leu Asp Ile His Asn Leu Ser Asn Tyr Asp Ile Asp His Ile Val
        835                 840                 845

Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile Asp Asn Leu Val Leu Thr
    850                 855                 860

Ser Ser Ala Gly Asn Arg Glu Lys Gly Asp Asp Val Pro Pro Leu Glu
865                 870                 875                 880

Ile Val Arg Lys Arg Lys Val Phe Trp Glu Lys Leu Tyr Gln Gly Asn
                885                 890                 895

Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu Thr Lys Ala Glu Arg Gly
            900                 905                 910

Gly Leu Thr Glu Ala Asp Lys Ala Arg Phe Ile His Arg Gln Leu Val
        915                 920                 925

Glu Thr Arg Gln Ile Thr Lys Asn Val Ala Asn Ile Leu His Gln Arg
    930                 935                 940

Phe Asn Tyr Glu Lys Asp Asp His Gly Asn Thr Met Lys Gln Val Arg
945                 950                 955                 960
```

```
Ile Val Thr Leu Lys Ser Ala Leu Val Ser Gln Phe Arg Lys Gln Phe
               965                 970                 975

Gln Leu Tyr Lys Val Arg Asp Val Asn Asp Tyr His His Ala His Asp
           980                 985                 990

Ala Tyr Leu Asn Gly Val Val Ala  Asn Thr Leu Leu Lys  Val Tyr Pro
        995                 1000                1005

Gln Leu  Glu Pro Glu Phe Val  Tyr Gly Asp Tyr His  Gln Phe Asp
    1010                1015                1020

Trp Phe  Lys Ala Asn Lys Ala  Thr Ala Lys Lys Gln  Phe Tyr Thr
    1025                1030                1035

Asn Ile  Met Leu Phe Phe Ala  Gln Lys Asp Arg Ile  Ile Asp Glu
    1040                1045                1050

Asn Gly  Glu Ile Leu Trp Asp  Lys Lys Tyr Leu Asp  Thr Val Lys
    1055                1060                1065

Lys Val  Met Ser Tyr Arg Gln  Met Asn Ile Val Lys  Lys Thr Glu
    1070                1075                1080

Ile Gln  Lys Gly Glu Phe Ser  Lys Ala Thr Ile Lys  Pro Lys Gly
    1085                1090                1095

Asn Ser  Ser Lys Leu Ile Ser  Arg Lys Thr Asn Trp  Asp Pro Met
    1100                1105                1110

Lys Tyr  Gly Gly Leu Asp Ser  Pro Asn Met Ala Tyr  Ala Val Val
    1115                1120                1125

Ile Glu  Tyr Ala Lys Gly Lys  Asn Lys Leu Val Phe  Glu Lys Lys
    1130                1135                1140
```

```
Ile Ile  Arg Val Thr Ile Met  Glu Arg Lys Ala Phe  Glu Lys Asp
    1145                1150                1155

Glu Lys  Ala Phe Leu Glu Glu  Gln Gly Tyr Arg Gln  Pro Lys Val
    1160                1165                1170

Leu Ala  Lys Leu Pro Lys Tyr  Thr Leu Tyr Glu Cys  Glu Glu Gly
    1175                1180                1185

Arg Arg  Arg Met Leu Ala Ser  Ala Asn Glu Ala Gln  Lys Gly Asn
    1190                1195                1200

Gln Gln  Val Leu Pro Asn His  Leu Val Thr Leu Leu  His His Val
    1205                1210                1215

Ala Asn  Cys Glu Val Ser Asp  Gly Lys Ser Leu Asp  Tyr Ile Glu
    1220                1225                1230

Ser Asn  Arg Glu Met Phe Ala  Glu Leu Leu Ala His  Val Ser Glu
    1235                1240                1245

Phe Ala  Lys Arg Tyr Thr Leu  Ala Glu Ala Asn Leu  Asn Lys Ile
    1250                1255                1260

Asn Gln  Leu Phe Glu Gln Asn  Lys Glu Gly Asp Ile  Lys Ala Ile
    1265                1270                1275

Ala Gln  Ser Phe Val Asp Leu  Met Ala Phe Asn Ala  Met Gly Ala
    1280                1285                1290

Pro Ala  Ser Phe Lys Phe Phe  Glu Thr Thr Ile Glu  Arg Lys Arg
    1295                1300                1305

Tyr Asn  Asn Leu Lys Glu Leu  Leu Asn Ser Thr Ile  Ile Tyr Gln
    1310                1315                1320

Ser Ile  Thr Gly Leu Tyr Glu  Ser Arg Lys Arg Leu  Asp Asp
    1325                1330                1335
```

<210> 528
<211> 953
<212> PRT
<213> Listeria ivanovii

<400> 528

Met Lys Lys Met Leu Ala Asn Ile Asp Gly Ala Asp Tyr Phe Ile Asp
1   5   10   15

Gln Ile Glu Glu Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn
            20   25   30

Gly Thr Ile Pro His Gln Leu His Leu Glu Glu Leu Glu Ala Ile Leu
        35   40   45

His Gln Gln Ala Lys Tyr Tyr Pro Phe Leu Arg Lys Asp Tyr Glu Lys
    50   55   60

Ile Arg Ser Leu Val Thr Phe Arg Ile Pro Tyr Phe Ile Gly Pro Leu
65   70   75   80

Ala Asn Gly Gln Ser Asp Phe Ala Trp Leu Thr Arg Lys Ala Asp Gly
                85   90   95

Glu Ile Arg Pro Trp Asn Ile Glu Glu Lys Val Asp Phe Gly Lys Ser
            100   105   110

Ala Ile Asp Phe Ile Glu Lys Met Thr Asn Lys Asp Thr Tyr Leu Pro
        115   120   125

Lys Glu Asn Val Leu Pro Lys His Ser Leu Cys Tyr Gln Lys Tyr Met
    130   135   140

Val Tyr Asn Glu Leu Thr Lys Ile Arg Tyr Ile Asp Asp Gln Gly Lys
145   150   155   160

Thr His His Phe Ser Gly Gln Glu Lys Gln Gln Ile Phe Asn Gly Leu

```
                165                 170                 175

Phe Lys Gln Gln Arg Lys Val Lys Lys Lys Asp Leu Glu Arg Phe Leu
            180                 185                 190

Tyr Thr Ile Asn His Ile Glu Ser Pro Thr Ile Glu Gly Val Glu Asp
        195                 200                 205

Ala Phe Asn Ser Ser Phe Ala Thr Tyr His Asp Leu Gln Lys Gly Gly
    210                 215                 220

Val Thr Gln Glu Ile Leu Asp Asn Pro Leu Asn Ala Asp Met Leu Glu
225                 230                 235                 240

Glu Ile Val Lys Ile Leu Thr Val Phe Glu Asp Lys Arg Met Ile Lys
                245                 250                 255

Glu Gln Leu Gln Ser Phe Ser Asp Val Leu Asp Gly Thr Ile Leu Lys
            260                 265                 270

Lys Leu Glu Arg Arg His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys
        275                 280                 285

Leu Leu Thr Gly Ile Arg Asp Lys His Ser His Leu Thr Ile Leu Asp
    290                 295                 300

Tyr Leu Met Asn Asp Asp Gly Leu Asn Arg Asn Leu Met Gln Leu Ile
305                 310                 315                 320

Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile Ile Glu Lys Glu Gln Val
                325                 330                 335

Ser Thr Ala Asp Lys Gly Ile Gln Ser Ile Val Ala Glu Leu Ala Gly
            340                 345                 350

Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp
        355                 360                 365
```

```
Glu Leu Val Gly Ile Met Gly Tyr Pro Pro Gln Thr Ile Val Val Glu
    370                 375                 380

Met Ala Arg Glu Asn Gln Thr Thr Gly Lys Gly Lys Asn Asn Ser Lys
385                 390                 395                 400

Pro Arg Phe Ile Ser Leu Glu Lys Ala Ile Lys Glu Phe Gly Ser Gln
                405                 410                 415

Ile Leu Lys Glu His Pro Thr Asp Asn Gln Cys Leu Lys Asn Asp Arg
            420                 425                 430

Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Lys
        435                 440                 445

Glu Leu Asp Ile His Asn Leu Ser Asn Tyr Asp Ile Asp His Ile Ile
    450                 455                 460

Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile Asp Asn Arg Val Leu Val
465                 470                 475                 480

Ser Ser Thr Ala Asn Arg Glu Lys Gly Asp Asn Val Pro Leu Leu Glu
                485                 490                 495

Val Val Arg Lys Arg Lys Ala Phe Trp Glu Lys Leu Tyr Gln Ala Lys
            500                 505                 510

Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu Thr Lys Ala Glu Arg Gly
        515                 520                 525

Gly Leu Thr Glu Ala Asp Lys Ala Asn Phe Ile Gln Arg Gln Leu Val
    530                 535                 540

Glu Thr Arg Gln Ile Thr Lys Asn Val Ala Asn Ile Leu Tyr Gln Arg
545                 550                 555                 560

Phe Asn Cys Lys Gln Asp Glu Asn Gly Asn Glu Val Glu Gln Val Arg
```

```
               565                 570                 575

Ile Val Thr Leu Lys Ser Thr Leu Val Ser Gln Phe Arg Lys Gln Phe
            580                 585                 590

Gln Leu Tyr Lys Val Arg Glu Val Asn Asp Tyr His His Ala His Asp
        595                 600                 605

Ala Tyr Leu Asn Gly Val Val Ala Asn Thr Leu Leu Lys Val Tyr Pro
    610                 615                 620

Gln Leu Glu Pro Glu Phe Val Tyr Gly Asp Tyr His Gln Phe Asp Trp
625                 630                 635                 640

Phe Lys Ala Asn Lys Ala Thr Ala Lys Lys Gln Phe Tyr Thr Asn Ile
               645                 650                 655

Met Arg Phe Phe Ala Lys Glu Asn Gln Ile Ile Asp Lys Asn Gly Glu
            660                 665                 670

Ile Leu Trp Asp Asn Arg Tyr Leu Asp Thr Ile Lys Lys Val Leu Ser
        675                 680                 685

Tyr Arg Gln Met Asn Ile Val Lys Lys Thr Glu Ile Gln Lys Gly Glu
    690                 695                 700

Phe Ser Asn Ala Thr Val Asn Pro Lys Gly Asn Ser Ser Lys Leu Ile
705                 710                 715                 720

Ser Arg Lys Ala Asp Trp Asn Pro Ile Lys Tyr Gly Gly Phe Asp Gly
               725                 730                 735

Ser Asn Met Ala Tyr Ser Ile Val Ile Glu Tyr Glu Lys Arg Lys Lys
            740                 745                 750

Lys Thr Val Ile Lys Lys Glu Leu Ile Gln Ile Asn Ile Met Glu Arg
        755                 760                 765
```

```
Val Ala Phe Glu Lys Asp Gln Lys Ala Phe Leu Glu Glu Lys Gly Tyr
    770                 775                 780

Tyr Ser Pro Lys Val Leu Thr Lys Ile Pro Lys Tyr Thr Leu Tyr Glu
785                 790                 795                 800

Cys Glu Asn Gly Arg Arg Arg Met Leu Gly Ser Ala Asn Glu Ala Gln
                805                 810                 815

Lys Gly Asn Gln Met Val Leu Pro Asn His Leu Met Thr Leu Leu Tyr
            820                 825                 830

His Ala Lys Asn Cys Glu Ala Asn Asp Gly Glu Ser Leu Ala Tyr Ile
        835                 840                 845

Glu Met His Arg Glu Met Phe Ala Glu Leu Leu Ala Tyr Ile Ser Glu
    850                 855                 860

Phe Ala Lys Arg Tyr Thr Leu Ala Asn Asp Arg Leu Glu Lys Ile Asn
865                 870                 875                 880

Met Phe Phe Glu Gln Asn Lys Lys Gly Asp Ile Lys Val Ile Ala Lys
                885                 890                 895

Ser Phe Asp Lys Leu Lys Val Phe Asn Ala Phe Gly Ala Pro Arg Asp
            900                 905                 910

Phe Glu Phe Phe Glu Thr Thr Ile Lys Arg Lys Arg Tyr Tyr Asn Ile
        915                 920                 925

Lys Glu Leu Leu Asn Ala Thr Ile Ile Tyr Gln Ser Ile Thr Gly Leu
    930                 935                 940

Tyr Glu Ala Arg Lys Arg Leu Glu Asp
945                 950
```

<210> 529

<211> 232
<212> PRT
<213> Listeria ivanovii

<400> 529

```
Met Met Ser Lys Leu Ile Leu Gly Leu Asp Ile Gly Ile Ser Ser Val
1               5                  10                  15


Gly Trp Gly Val Leu Asp Glu Ser Thr Asn Glu Val Val Asp Ala Gly
            20                  25                  30


Val Arg Leu Phe Glu Glu Ala Thr Arg Asn Gly Asn Glu Asp Arg Arg
        35                  40                  45


Gly Phe Arg Ser Ala Arg Arg Leu Lys Arg Arg Arg Gln His Arg Leu
    50                  55                  60


Glu Arg Ala Lys Gly Leu Ile Glu Asn Asn Gly Phe Ser Cys Thr Asp
65                  70                  75                  80


Ile Asn Lys Phe Asn Pro Tyr Gln Ala Arg Tyr Asn Ala Ile Phe Gly
                85                  90                  95


Glu Val Thr Lys Asp Glu Leu Ala Ala Ala Leu Phe His Leu Val Lys
            100                 105                 110


Arg Arg Gly Thr Thr Ile Asp Ala Pro Glu Glu Glu Val Lys Asp Val
        115                 120                 125


Glu Asn Glu Leu Ser Thr Lys Met Gln Leu Glu Lys Asn Ala Lys Lys
    130                 135                 140


Leu Ala Thr Lys Tyr Asp Tyr Ile Cys Glu Ile Gln Leu Glu Lys Leu
145                 150                 155                 160


Lys Glu Asn Lys Val Val Arg Asp His Glu Asn Arg Phe Arg Thr Glu
                165                 170                 175
```

```
Asp Tyr Val Lys Glu Ala Arg Ala Ile Leu Glu Asn Gln Gln Glu Tyr
            180                 185                 190


Tyr Pro Glu Val Thr Asn Glu Phe Ile Glu Ser Tyr Met Ala Leu Ile
        195                 200                 205


Glu Thr Arg Arg Met Tyr Tyr Asp Gly Pro Gly Ser Glu Lys Ser Pro
    210                 215                 220


Thr Pro Tyr Gly Gln Tyr Phe Ile
225                 230


<210>  530
<211>  300
<212>  PRT
<213>  Listeria monocytogenes

<400>  530

Asp Asp Gly Leu Asn Arg Asn Leu Met Gln Leu Ile Asn Asp Ser Asn
1               5                   10                  15


Leu Ser Phe Lys Ser Ile Ile Glu Lys Glu Gln Val Ser Thr Thr Asp
            20                  25                  30


Lys Asp Leu Gln Ser Ile Val Ala Asp Leu Ala Gly Ser Pro Ala Ile
        35                  40                  45


Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Ser
    50                  55                  60


Ile Met Gly Tyr Pro Pro Gln Thr Ile Val Val Glu Met Ala Arg Glu
65                  70                  75                  80


Asn Gln Thr Thr Val Lys Gly Lys Asn Asn Ser Arg Pro Arg Tyr Lys
                85                  90                  95


Ser Leu Glu Lys Ala Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu
            100                 105                 110
```

```
His Pro Thr Asp Asn Gln Glu Leu Arg Asn Asn Arg Leu Tyr Leu Tyr
        115                 120                 125

Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Gln Glu Leu Asp Ile
    130                 135                 140

His Asn Leu Ser Asn Tyr Asp Ile Asp His Ile Val Pro Gln Ser Phe
145                 150                 155                 160

Ile Thr Asp Asn Ser Ile Asp Asn Leu Val Leu Thr Ser Ser Ala Gly
                165                 170                 175

Asn Arg Glu Lys Gly Asp Asp Val Pro Pro Leu Glu Ile Val Arg Lys
            180                 185                 190

Arg Lys Val Phe Trp Glu Lys Leu Phe Gln Gly Asn Leu Met Ser Lys
        195                 200                 205

Arg Lys Phe Asp Tyr Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu
    210                 215                 220

Ala Asp Lys Ala Thr Phe Ile His Arg Gln Leu Val Glu Thr Arg Gln
225                 230                 235                 240

Ile Thr Lys Asn Val Ala Asn Ile Leu His Gln Arg Phe Asn Asn Glu
                245                 250                 255

Thr Asp Asn His Gly Asn Asn Met Glu Gln Val Arg Ile Val Met Leu
            260                 265                 270

Lys Ser Ala Leu Val Ser Gln Phe Arg Lys Gln Phe Gln Leu Tyr Lys
        275                 280                 285

Val Arg Glu Val Asn Asp Tyr His His Ala His Asp
    290                 295                 300
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<210> 531

<211> 782
<212> PRT
<213> Listeria monocytogenes

<220>
<221> misc_feature
<222> (722)..(722)
<223> Xaa can be any naturally occurring amino acid

<400> 531

Ile Phe Asn Asp Leu Phe Lys Gln Lys Arg Lys Val Lys Lys Lys Asp
1 5 10 15

Leu Glu Leu Phe Leu Arg Asn Ile Asn Gln Ile Glu Ser Pro Thr Ile
20 25 30

Glu Gly Leu Glu Asp Ser Phe Asn Ala Ser Tyr Ala Thr Tyr His Asp
35 40 45

Leu Leu Lys Val Gly Met Lys Gln Glu Ile Leu Asp Asn Pro Leu Asn
50 55 60

Thr Glu Met Leu Glu Asp Ile Val Lys Ile Leu Thr Val Phe Glu Asp
65 70 75 80

Lys Arg Met Ile Lys Glu Gln Leu Gln Gln Phe Ser Asp Val Leu Asp
85 90 95

Gly Val Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly Trp Gly
100 105 110

Arg Leu Ser Ala Lys Leu Leu Val Gly Ile Arg Asp Lys Gln Ser His
115 120 125

Leu Thr Ile Leu Glu Tyr Leu Met Asn Asp Asp Gly Leu Asn Arg Asn
130 135 140

Leu Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile Ile
145 150 155 160

```
Glu Lys Glu Gln Val Ser Thr Thr Asp Lys Asp Leu Gln Ser Ile Val
                165                 170                 175

Ala Asp Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Ser
            180                 185                 190

Leu Lys Ile Val Asp Glu Leu Val Ser Ile Met Gly Tyr Pro Pro Gln
        195                 200                 205

Thr Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Val Lys Gly
    210                 215                 220

Lys Asn Asn Ser Arg Pro Arg Tyr Lys Ser Leu Glu Lys Ala Ile Lys
225                 230                 235                 240

Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln Glu
                245                 250                 255

Leu Lys Asn Asn Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys Asp
            260                 265                 270

Ile Tyr Thr Gly Gln Glu Leu Asp Ile His Asn Leu Ser Asn Tyr Asp
        275                 280                 285

Ile Asp His Ile Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile Asp
    290                 295                 300

Asn Leu Val Leu Thr Ser Ser Ala Gly Asn Arg Glu Lys Gly Asp Asp
305                 310                 315                 320

Val Pro Pro Leu Glu Ile Val Arg Lys Arg Lys Val Phe Trp Glu Lys
                325                 330                 335

Leu Tyr Gln Gly Asn Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu Thr
            340                 345                 350
```

```
Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Arg Phe Ile
        355                 360                 365

His Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala Asn
    370                 375                 380

Ile Leu His Gln Arg Phe Asn Asn Glu Thr Asp Asn His Gly Asn Thr
385                 390                 395                 400

Met Glu Gln Val Arg Ile Val Thr Leu Lys Ser Ala Leu Val Ser Gln
                405                 410                 415

Phe Arg Lys Gln Phe Gln Leu Tyr Lys Val Arg Glu Val Asn Asp Tyr
            420                 425                 430

His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Asn Thr Leu
        435                 440                 445

Leu Lys Val Tyr Pro Gln Leu Glu Pro Glu Phe Val Tyr Gly Glu Tyr
    450                 455                 460

His Gln Phe Asp Trp Phe Lys Ala Asn Lys Ala Thr Ala Lys Lys Gln
465                 470                 475                 480

Phe Tyr Thr Asn Ile Met Leu Phe Phe Ala Gln Lys Glu Arg Ile Ile
                485                 490                 495

Asp Glu Asn Gly Glu Ile Leu Trp Asp Lys Lys Tyr Leu Glu Thr Ile
            500                 505                 510

Lys Lys Val Leu Asp Tyr Arg Gln Met Asn Ile Val Lys Lys Thr Glu
        515                 520                 525

Ile Gln Lys Gly Glu Phe Ser Lys Ala Thr Ile Lys Pro Lys Gly Asn
    530                 535                 540

Ser Ser Lys Leu Ile Pro Arg Lys Glu Asn Trp Asp Pro Met Lys Tyr
545                 550                 555                 560
```

```
Gly Gly Leu Asp Ser Pro Asn Met Ala Tyr Ala Val Ile Ile Glu His
               565                 570                 575

Ala Lys Gly Lys Lys Lys Ile Val Ile Glu Lys Lys Leu Ile Gln Ile
            580                 585                 590

Asn Ile Met Glu Arg Lys Met Phe Glu Lys Asp Glu Glu Ala Phe Leu
        595                 600                 605

Glu Glu Lys Gly Tyr Arg His Pro Lys Val Leu Thr Lys Leu Pro Lys
    610                 615                 620

Tyr Thr Leu Tyr Glu Cys Glu Lys Gly Arg Arg Arg Met Leu Ala Ser
625                 630                 635                 640

Ala Asn Glu Ala Gln Lys Gly Asn Gln Leu Val Leu Ser Asn His Leu
               645                 650                 655

Val Ser Leu Leu Tyr His Ala Lys Asn Cys Glu Ala Ser Asp Gly Lys
            660                 665                 670

Ser Leu Lys Tyr Thr Glu Ala His Arg Glu Thr Phe Ser Glu Leu Leu
        675                 680                 685

Ala Gln Val Ser Glu Phe Ala Thr Arg Tyr Thr Leu Ala Asp Ala Asn
    690                 695                 700

Leu Ser Lys Ile Asn Asn Leu Phe Glu Gln Asn Lys Glu Gly Asp Ile
705                 710                 715                 720

Lys Xaa Ile Ala Gln Ser Phe Val Asp Leu Met Val Phe Asn Ala Met
               725                 730                 735

Gly Ala Pro Ala Ser Phe Lys Phe Phe Glu Ala Thr Ile Asp Arg Lys
            740                 745                 750
```

```
Arg Tyr Thr Asn Leu Lys Glu Leu Leu Ser Ser Thr Ile Ile Tyr Gln
        755                 760                 765


Ser Ile Thr Gly Leu Tyr Glu Ser Arg Lys Arg Leu Asp Asp
    770                 775                 780


<210>  532
<211>  1334
<212>  PRT
<213>  Listeria monocytogenes

<400>  532

Met Lys Lys Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Leu Thr Asp Gln Tyr Asp Leu Val Lys Arg Lys Met
            20                  25                  30


Lys Ile Ser Gly Asp Ser Glu Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Glu Lys Gly Glu Thr Ala Ala Lys Arg Arg Met
    50                  55                  60


Ser Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Ile Gln Met Asn Glu Val Asp Asp Asn
                85                  90                  95


Phe Phe Asn Arg Leu Lys Glu Ser Phe Tyr Ala Glu Ser Asp Lys Lys
            100                 105                 110


Tyr Asn Arg His Pro Phe Phe Gly Thr Val Glu Glu Glu Val Ala Tyr
        115                 120                 125


Tyr Lys Asp Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ile Asp
    130                 135                 140
```

```
Ser Gln Lys Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175

Lys Asn Thr Ser Ile Asp Glu Met Phe Lys Gln Phe Leu Gln Ile Tyr
            180                 185                 190

Asn Gln Val Phe Ala Asn Asp Ile Glu Glu Ala Ser Leu Lys Lys Thr
        195                 200                 205

Glu Lys Asn Gln Glu Val Ala Gln Ile Leu Ala Glu Lys Phe Thr Arg
    210                 215                 220

Lys Asp Lys Leu Asp Lys Ile Leu Ser Leu Tyr Pro Gly Glu Lys Thr
225                 230                 235                 240

Thr Gly Val Phe Ala Gln Phe Val Asn Ile Ile Val Gly Ser Thr Gly
                245                 250                 255

Lys Phe Lys Lys His Phe Asn Leu His Glu Lys Lys Asp Ile Asn Cys
            260                 265                 270

Ala Glu Asp Thr Tyr Asp Thr Asp Leu Glu Ser Leu Leu Ala Ile Ile
        275                 280                 285

Gly Asp Glu Phe Ala Glu Val Phe Val Ala Ala Lys Asn Ala Tyr Asn
    290                 295                 300

Ala Val Val Leu Ser Asn Ile Ile Thr Val Thr Asp Ser Thr Thr Arg
305                 310                 315                 320

Ala Lys Leu Ser Ala Ser Leu Ile Glu Arg Phe Glu Asn His Lys Glu
                325                 330                 335

Asp Leu Lys Lys Met Lys Arg Phe Val Arg Thr Tyr Leu Pro Glu Lys
```

```
            340                 345                 350

Tyr Asp Glu Ile Phe Asp Asp Thr Glu Lys His Gly Tyr Ala Gly Tyr
        355                 360                 365

Ile Ser Gly Lys Thr Lys Gln Ala Asp Phe Tyr Lys Tyr Met Lys Ala
    370                 375                 380

Thr Leu Glu Lys Ile Glu Gly Ala Asp Tyr Phe Ile Ala Lys Ile Glu
385                 390                 395                 400

Glu Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile
                405                 410                 415

Pro His Gln Leu His Leu Glu Glu Leu Glu Ala Ile Leu His Gln Gln
            420                 425                 430

Ala Lys Tyr Tyr Pro Phe Leu Arg Glu Asp Tyr Glu Lys Ile Lys Ser
        435                 440                 445

Leu Val Thr Phe Arg Ile Pro Tyr Phe Val Gly Pro Leu Ala Lys Gly
    450                 455                 460

Gln Ser Glu Phe Ala Trp Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg
465                 470                 475                 480

Pro Trp Asn Ile Glu Glu Lys Val Asp Phe Gly Lys Ser Ala Val Asp
                485                 490                 495

Phe Ile Glu Lys Met Thr Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn
            500                 505                 510

Val Leu Pro Lys His Ser Leu Cys Tyr Gln Lys Tyr Met Val Tyr Asn
        515                 520                 525

Glu Leu Thr Lys Val Arg Tyr Ile Asp Asp Gln Gly Lys Thr Asn Tyr
    530                 535                 540
```

```
Phe Ser Gly Gln Glu Lys Gln Gln Ile Phe Asn Asp Leu Phe Lys Gln
545                 550                 555                 560

Lys Arg Lys Val Lys Lys Lys Asp Leu Glu Leu Phe Leu Arg Asn Ile
                565                 570                 575

Asn Gln Ile Glu Ser Pro Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn
            580                 585                 590

Ala Ser Tyr Ala Thr Tyr His Asp Leu Leu Lys Val Gly Met Lys Gln
        595                 600                 605

Glu Ile Leu Asp Asn Pro Leu Asn Thr Glu Met Leu Glu Asp Ile Val
    610                 615                 620

Lys Ile Leu Thr Val Phe Glu Asp Lys Arg Met Ile Lys Glu Gln Leu
625                 630                 635                 640

Gln Gln Phe Ser Asp Val Leu Asp Gly Thr Val Leu Lys Lys Leu Glu
                645                 650                 655

Arg Arg His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu Val
            660                 665                 670

Gly Ile Arg Asp Lys Gln Ser His Leu Thr Ile Leu Asp Tyr Leu Met
        675                 680                 685

Asn Asp Asp Gly Leu Asn Arg Asn Leu Met Gln Leu Ile Asn Asp Ser
    690                 695                 700

Asn Leu Ser Phe Lys Ser Ile Ile Glu Lys Glu Gln Val Ser Thr Thr
705                 710                 715                 720

Asp Lys Asp Leu Gln Ser Ile Val Ala Glu Leu Ala Gly Ser Pro Ala
                725                 730                 735

Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val
```

```
            740                 745                 750

Ser Val Met Gly Tyr Pro Pro Gln Thr Ile Val Val Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Asn Lys Gly Lys Asn Asn Ser Lys Pro Arg Tyr
    770                 775                 780

Lys Ser Leu Glu Lys Ala Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys
785                 790                 795                 800

Glu His Pro Thr Asp Asn Gln Glu Leu Lys Asn Asn Arg Leu Tyr Leu
                805                 810                 815

Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Gln Glu Leu Asp
            820                 825                 830

Ile His Asn Leu Ser Asn Tyr Asp Ile Asp His Ile Val Pro Gln Ser
        835                 840                 845

Phe Ile Thr Asp Asn Ser Val Asp Asn Leu Val Leu Thr Ser Ser Ala
    850                 855                 860

Gly Asn Arg Glu Lys Gly Asp Asn Val Pro Pro Leu Glu Ile Val Gln
865                 870                 875                 880

Lys Arg Lys Ile Phe Trp Glu Lys Leu Tyr Gln Gly Asn Leu Met Ser
                885                 890                 895

Lys Arg Lys Phe Asp Tyr Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr
            900                 905                 910

Glu Ala Asp Lys Ala Arg Phe Ile His Arg Gln Leu Val Glu Thr Arg
        915                 920                 925

Gln Ile Thr Lys Asn Val Ala Asn Ile Leu His Gln Arg Phe Asn Tyr
    930                 935                 940
```

```
Lys Thr Asp Gly Asn Lys Asp Thr Met Glu Thr Val Arg Ile Val Thr
945                 950                 955                 960


Leu Lys Ser Ala Leu Val Ser Gln Phe Arg Lys Gln Phe Gln Phe Tyr
                965                 970                 975


Lys Val Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala Tyr Leu
            980                 985                 990


Asn Gly Val Val Ala Asn Thr Leu  Leu Lys Val Tyr Pro  Gln Leu Glu
        995                 1000                1005


Pro Glu  Phe Val Tyr Gly Glu  Tyr His Gln Phe Gly  Trp Phe Lys
    1010                1015                1020


Ala Asn  Lys Ala Thr Ala Lys  Lys Gln Phe Tyr Thr  Asn Ile Met
    1025                1030                1035


Leu Phe  Phe Ala Gln Lys Asp  Arg Ile Ile Asp Glu  Asn Gly Glu
    1040                1045                1050


Ile Leu  Trp Asp Lys Arg Tyr  Leu Glu Thr Val Lys  Lys Val Leu
    1055                1060                1065


Gly Tyr  Arg Gln Met Asn Ile  Val Lys Lys Thr Glu  Ile Gln Lys
    1070                1075                1080


Gly Glu  Phe Ser Asn Val Thr  Pro Asn Pro Lys Gly  Lys Ser Asn
    1085                1090                1095


Lys Leu  Ile Pro Arg Lys Lys  Asp Trp Asp Pro Ile  Lys Tyr Gly
    1100                1105                1110


Gly Phe  Asp Gly Ser Lys Met  Ala Tyr Ala Ile Ile  Ile Glu Tyr
    1115                1120                1125


Glu Lys  Gln Lys Arg Lys Val  Arg Ile Glu Lys Lys  Leu Ile Gln
```

```
    1130                1135                1140

Ile Asn  Ile Met Glu Arg Glu  Ala Phe Glu Lys Asp  Glu Lys Thr
    1145                1150                1155

Phe Leu  Glu Glu Lys Gly Tyr  His Gln Pro Lys Val  Leu Ile Lys
    1160                1165                1170

Val Pro  Lys Tyr Thr Leu Tyr  Glu Cys Lys Asn Gly  Arg Arg Arg
    1175                1180                1185

Met Leu  Gly Ser Ala Asn Glu  Ala His Lys Gly Asn  Gln Met Leu
    1190                1195                1200

Leu Pro  Asn His Leu Met Ala  Leu Leu Tyr His Ala  Glu Lys Tyr
    1205                1210                1215

Glu Ala  Ile Asp Gly Glu Ser  Leu Ala Tyr Ile Glu  Val His Arg
    1220                1225                1230

Ala Leu  Phe Asp Glu Leu Leu  Ala Tyr Ile Ser Glu  Phe Ala Arg
    1235                1240                1245

Lys Tyr  Thr Leu Ser Asn Asp  Arg Leu Asp Glu Ile  Asn Met Leu
    1250                1255                1260

Tyr Glu  Arg Asn Lys Asp Gly  Asp Val Lys Ser Ile  Ala Glu Ser
    1265                1270                1275

Phe Val  Ser Leu Lys Lys Phe  Asn Ala Phe Gly Val  His Gln Asp
    1280                1285                1290

Phe Ser  Phe Phe Gly Thr Lys  Ile Glu Arg Lys Arg  Asp Arg Lys
    1295                1300                1305

Leu Asn  Glu Leu Leu Asn Ser  Thr Ile Ile Tyr Gln  Ser Ile Thr
    1310                1315                1320
```

```
Gly Leu  Tyr Glu Ser Arg Lys  Arg Leu Asp Asn
    1325                1330


<210>  533
<211>  1334
<212>  PRT
<213>  Listeria monocytogenes

<400>  533

Met Lys Asn Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Leu Thr Asp Gln Tyr Asp Leu Val Lys Arg Lys Met
            20                  25                  30


Lys Val Ala Gly Asn Ser Asp Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Asp Asp Gly Gln Thr Ala Val Asp Arg Arg Met
    50                  55                  60


Asn Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Val Glu Met Ala Asn Ile Asp Ala Asn
                85                  90                  95


Phe Phe Cys Arg Leu Asn Asp Ser Phe Tyr Val Asp Ser Glu Lys Arg
            100                 105                 110


Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Ala Tyr
        115                 120                 125


His Lys Asn Tyr Arg Thr Ile Tyr His Leu Arg Glu Glu Leu Val Asn
    130                 135                 140


Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160
```

```
Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175

Lys Asn Thr Ser Val Asp Glu Val Tyr Lys Gln Phe Ile Gln Thr Tyr
            180                 185                 190

Asn Gln Val Phe Met Ser Asn Ile Glu Glu Gly Ala Leu Ala Lys Val
        195                 200                 205

Glu Glu Asn Thr Glu Val Ala Ser Ile Leu Ala Gly Lys Phe Thr Arg
    210                 215                 220

Arg Glu Lys Phe Glu Arg Ile Leu Arg Leu Tyr Pro Gly Glu Lys Ser
225                 230                 235                 240

Thr Gly Met Phe Ala Gln Phe Ile Ser Leu Ile Val Gly Asn Lys Gly
                245                 250                 255

Asn Phe Gln Lys Val Phe Asn Leu Val Glu Lys Thr Asp Ile Glu Cys
            260                 265                 270

Ala Lys Asp Ser Tyr Glu Glu Asp Leu Glu Ala Leu Leu Ala Ile Ile
        275                 280                 285

Gly Asp Glu Tyr Ala Glu Leu Phe Val Ala Ala Lys Asn Thr Tyr Asn
    290                 295                 300

Ala Val Val Leu Ser Ser Ile Ile Thr Val Thr Ala Thr Glu Thr Asn
305                 310                 315                 320

Ala Lys Leu Ser Ala Ser Met Ile Glu Arg Phe Asp Ala His Glu Lys
                325                 330                 335

Glu Leu Gly Glu Leu Lys Ala Phe Ile Lys Leu His Leu Pro Lys Gln
            340                 345                 350
```

```
Tyr Gln Glu Ile Phe Asn Asn Ala Glu Ile Asp Gly Tyr Ala Gly Tyr
        355                 360                 365

Ile Asp Gly Lys Thr Lys Gln Val Asp Phe Tyr Lys Tyr Leu Lys Thr
    370                 375                 380

Thr Leu Glu Asn Val Glu Gly Ala Asp Tyr Phe Ile Thr Lys Ile Glu
385                 390                 395                 400

Glu Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile
                405                 410                 415

Pro His Gln Leu His Leu Glu Glu Leu Glu Ala Ile Leu His Gln Gln
            420                 425                 430

Ala Lys Tyr Tyr Pro Phe Leu Arg Glu Gly Tyr Asp Lys Ile Lys Ser
        435                 440                 445

Leu Val Thr Phe Arg Ile Pro Tyr Phe Val Gly Pro Leu Ala Asn Gly
    450                 455                 460

Gln Ser Glu Phe Ala Trp Leu Thr Arg Lys Asp Asp Gly Glu Ile Arg
465                 470                 475                 480

Pro Trp Asn Ile Glu Glu Lys Val Asp Phe Gly Lys Ser Ala Val Asp
                485                 490                 495

Phe Ile Glu Lys Met Thr Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn
            500                 505                 510

Val Leu Pro Lys His Ser Leu Cys Tyr Gln Lys Tyr Met Val Tyr Asn
        515                 520                 525

Glu Leu Thr Lys Ile Arg Tyr Ile Asp Asp Gln Gly Lys Thr Asn Tyr
    530                 535                 540

Phe Ser Gly Arg Glu Lys Gln Gln Ile Phe Asn Asp Leu Phe Lys Gln
545                 550                 555                 560
```

```
Lys Arg Lys Val Lys Lys Lys Asp Leu Glu Leu Phe Leu Arg Asn Ile
               565                 570                 575

Asn His Ile Glu Ser Pro Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn
            580                 585                 590

Ala Ser Tyr Ala Thr Tyr His Asp Leu Leu Lys Val Gly Leu Lys Gln
        595                 600                 605

Glu Ile Leu Asp Asn Pro Leu Asn Thr Glu Ile Leu Glu Asp Ile Val
    610                 615                 620

Lys Ile Leu Thr Val Phe Glu Asp Lys Arg Met Ile Lys Glu Gln Leu
625                 630                 635                 640

Glu Gln Phe Ser Asp Val Leu Asp Gly Val Val Leu Lys Lys Leu Glu
               645                 650                 655

Arg Arg His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu Val
            660                 665                 670

Gly Ile Arg Asp Lys Gln Ser His Leu Thr Ile Leu Asp Tyr Leu Met
        675                 680                 685

Asn Asp Asp Gly Leu Asn Arg Asn Leu Met Gln Leu Ile Asn Asp Ser
    690                 695                 700

Asn Leu Ser Phe Lys Ser Ile Ile Glu Lys Glu Gln Val Ser Thr Thr
705                 710                 715                 720

Asp Lys Asp Leu Gln Ser Ile Val Ala Asp Leu Ala Gly Ser Pro Ala
               725                 730                 735

Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val
            740                 745                 750
```

```
Ser Ile Met Gly Tyr Pro Pro Gln Thr Ile Val Val Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Gly Lys Gly Lys Asn Asn Ser Lys Pro Arg Tyr
    770                 775                 780

Lys Ser Leu Glu Lys Ala Ile Lys Asp Phe Gly Ser Gln Ile Leu Lys
785                 790                 795                 800

Glu His Pro Thr Asp Asn Gln Glu Leu Lys Asn Asn Arg Leu Tyr Leu
                805                 810                 815

Tyr Tyr Leu Gln Asn Gly Lys Asp Ile Tyr Thr Gly Gln Glu Leu Asp
            820                 825                 830

Ile His Asn Leu Ser Asn Tyr Asp Ile Asp His Ile Val Pro Gln Ser
        835                 840                 845

Phe Ile Thr Asp Asn Ser Ile Asp Asn Leu Val Leu Thr Ser Ser Ala
    850                 855                 860

Gly Asn Arg Glu Lys Gly Gly Asp Val Pro Pro Leu Glu Ile Val Arg
865                 870                 875                 880

Lys Arg Lys Val Phe Trp Glu Lys Leu Tyr Gln Gly Asn Leu Met Ser
                885                 890                 895

Lys Arg Lys Phe Asp Tyr Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr
            900                 905                 910

Glu Ala Asp Lys Ala Arg Phe Ile His Arg Gln Leu Val Glu Thr Arg
        915                 920                 925

Gln Ile Thr Lys Asn Val Ala Asn Ile Leu His Gln Arg Phe Asn Lys
    930                 935                 940

Glu Thr Asp Asn His Gly Asn Thr Met Glu Gln Val Arg Ile Val Thr
945                 950                 955                 960
```

```
Leu Lys Ser Ala Leu Val Ser Gln Phe Arg Lys Gln Phe Gln Leu Tyr
               965                 970                 975

Lys Val Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala Tyr Leu
            980                 985                 990

Asn Gly Val Val Ala Asn Thr Leu  Leu Lys Val Tyr Pro  Gln Leu Glu
        995                 1000                1005

Pro Glu  Phe Val Tyr Gly Glu  Tyr His Gln Phe Asp  Trp Phe Lys
    1010                1015                1020

Ala Asn  Lys Ala Thr Ala Lys  Lys Gln Phe Tyr Thr  Asn Ile Met
    1025                1030                1035

Leu Phe  Phe Ala Gln Lys Glu  Arg Ile Ile Asp Glu  Asn Gly Glu
    1040                1045                1050

Ile Leu  Trp Asp Lys Lys Tyr  Leu Glu Thr Ile Lys  Lys Val Leu
    1055                1060                1065

Asp Tyr  Arg Gln Ile Asn Ile  Val Lys Lys Thr Glu  Ile Gln Lys
    1070                1075                1080

Gly Glu  Phe Ser Lys Ala Thr  Ile Lys Pro Lys Gly  Asn Ser Ser
    1085                1090                1095

Lys Leu  Ile Pro Arg Lys Glu  Asn Trp Asp Pro Met  Lys Tyr Gly
    1100                1105                1110

Gly Leu  Asp Ser Pro Asn Met  Ala Tyr Ala Val Ile  Ile Glu His
    1115                1120                1125

Ala Lys  Gly Lys Lys Lys Ile  Val Ile Glu Lys Lys  Leu Ile Gln
    1130                1135                1140
```

```
Ile Asn  Ile Met Glu Arg Lys  Met Phe Glu Lys Asp  Glu Glu Ala
    1145                 1150                 1155

Phe Leu  Glu Glu Lys Gly Tyr  His Gln Pro Lys Val  Leu Thr Lys
    1160                 1165                 1170

Leu Pro  Lys Tyr Thr Leu Tyr  Glu Cys Glu Lys Gly  Arg Arg Arg
    1175                 1180                 1185

Met Leu  Ser Ser Ala Asn Glu  Ala Gln Lys Gly Asn  Gln Leu Val
    1190                 1195                 1200

Leu Ser  Asn His Leu Val Ser  Leu Leu Tyr His Ala  Lys Asn Cys
    1205                 1210                 1215

Glu Ala  Ser Asp Gly Lys Ser  Leu Lys Tyr Ile Glu  Ala His Arg
    1220                 1225                 1230

Glu Thr  Phe Ser Glu Leu Leu  Ala Gln Val Ser Glu  Phe Ala Thr
    1235                 1240                 1245

Lys Tyr  Thr Leu Ala Asp Ala  Asn Leu Ser Lys Ile  Asn Asn Leu
    1250                 1255                 1260

Phe Glu  Gln Asn Lys Glu Gly  Asp Ile Lys Ala Ile  Ala Gln Ser
    1265                 1270                 1275

Phe Val  Asp Leu Met Ala Phe  Asn Ala Met Gly Ala  Pro Ala Ser
    1280                 1285                 1290

Phe Lys  Phe Phe Glu Ala Thr  Ile Asp Arg Lys Arg  Tyr Thr Asn
    1295                 1300                 1305

Leu Lys  Glu Leu Leu Ser Ser  Thr Ile Ile Tyr Gln  Ser Ile Thr
    1310                 1315                 1320

Gly Leu  Tyr Glu Ser Arg Lys  Arg Leu Asp Asp
    1325                 1330
```

<210> 534
<211> 1334
<212> PRT
<213> Listeria monocytogenes

<400> 534

Met Lys Asn Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Leu Thr Asp Gln Tyr Asp Leu Val Lys Arg Lys Met
20 25 30

Lys Val Ala Gly Asn Ser Asp Lys Lys Gln Ile Lys Lys Asn Phe Trp
35 40 45

Gly Val Arg Leu Phe Asp Asp Gly Gln Thr Ala Val Asp Arg Arg Met
50 55 60

Asn Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ala Val Glu Met Ala Asn Ile Asp Ala Asn
85 90 95

Phe Phe Cys Arg Leu Asn Asp Ser Phe Tyr Val Asp Ser Glu Lys Arg
100 105 110

Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Ala Tyr
115 120 125

His Lys Asn Tyr Arg Thr Ile Tyr His Leu Arg Glu Glu Leu Val Asn
130 135 140

Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145 150 155 160

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr

```
                165                 170                 175

Lys Asn Thr Ser Val Asp Glu Val Tyr Lys Gln Phe Ile Gln Thr Tyr
            180                 185                 190

Asn Gln Val Phe Met Ser Asn Ile Glu Glu Gly Ala Leu Ala Lys Val
        195                 200                 205

Glu Glu Asn Thr Glu Val Ala Ser Ile Leu Ala Gly Lys Phe Thr Arg
    210                 215                 220

Arg Glu Lys Phe Glu Arg Ile Leu Arg Leu Tyr Pro Gly Glu Lys Ser
225                 230                 235                 240

Thr Gly Met Phe Ala Gln Phe Ile Ser Leu Ile Val Gly Asn Lys Gly
                245                 250                 255

Asn Phe Gln Lys Val Phe Asn Leu Val Glu Lys Thr Asp Ile Glu Cys
            260                 265                 270

Ala Lys Asp Ser Tyr Glu Glu Asp Leu Glu Ala Leu Leu Ala Ile Ile
        275                 280                 285

Gly Asp Glu Tyr Ala Glu Leu Phe Val Ala Ala Lys Asn Thr Tyr Asn
    290                 295                 300

Ala Val Val Leu Ser Ser Ile Ile Thr Val Thr Ala Thr Glu Thr Asn
305                 310                 315                 320

Ala Lys Leu Ser Ala Ser Met Ile Glu Arg Phe Asp Ala His Glu Lys
                325                 330                 335

Glu Leu Gly Glu Leu Lys Ala Phe Ile Lys Leu His Leu Pro Lys Gln
            340                 345                 350

Tyr Gln Glu Ile Phe Asn Asn Ala Glu Ile Asp Gly Tyr Ala Gly Tyr
        355                 360                 365
```

```
Ile Asp Gly Lys Thr Lys Gln Val Asp Phe Tyr Lys Tyr Leu Lys Thr
    370                 375                 380

Thr Leu Glu Asn Val Glu Gly Ala Asp Tyr Phe Ile Thr Lys Ile Glu
385                 390                 395                 400

Glu Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile
                405                 410                 415

Pro His Gln Leu His Leu Glu Glu Leu Glu Ala Ile Leu His Gln Gln
            420                 425                 430

Ala Lys Tyr Tyr Pro Phe Leu Arg Glu Gly Tyr Asp Lys Ile Lys Ser
        435                 440                 445

Leu Val Thr Phe Arg Ile Pro Tyr Phe Val Gly Pro Leu Ala Asn Gly
    450                 455                 460

Gln Ser Glu Phe Ala Trp Leu Thr Arg Lys Asp Asp Gly Glu Ile Arg
465                 470                 475                 480

Pro Trp Asn Ile Glu Glu Lys Val Asp Phe Gly Lys Ser Ala Val Asp
                485                 490                 495

Phe Ile Glu Lys Met Thr Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn
            500                 505                 510

Val Leu Pro Lys His Ser Leu Cys Tyr Gln Lys Tyr Met Val Tyr Asn
        515                 520                 525

Glu Leu Thr Lys Ile Arg Tyr Ile Asp Asp Gln Gly Lys Thr Asn Tyr
    530                 535                 540

Phe Ser Gly Arg Glu Lys Gln Gln Ile Phe Asn Asp Leu Phe Lys Gln
545                 550                 555                 560

Lys Arg Lys Val Lys Lys Lys Asp Leu Glu Leu Phe Leu Arg Asn Ile
```

```
                565                 570                 575

Asn His Ile Glu Ser Pro Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn
            580                 585                 590

Ala Ser Tyr Ala Thr Tyr His Asp Leu Leu Lys Val Gly Leu Lys Gln
        595                 600                 605

Glu Ile Leu Asp Asn Pro Leu Asn Thr Glu Ile Leu Glu Asp Ile Val
    610                 615                 620

Lys Ile Leu Thr Val Phe Glu Asp Lys Arg Met Ile Lys Glu Gln Leu
625                 630                 635                 640

Glu Gln Phe Ser Asp Val Leu Asp Gly Val Val Leu Lys Lys Leu Glu
                645                 650                 655

Arg Arg His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu Val
            660                 665                 670

Gly Ile Arg Asp Lys Gln Ser His Leu Thr Ile Leu Asp Tyr Leu Met
        675                 680                 685

Asn Asp Asp Gly Leu Asn Arg Asn Leu Met Gln Leu Ile Asn Asp Ser
    690                 695                 700

Asn Leu Ser Phe Lys Ser Ile Ile Glu Lys Glu Gln Val Ser Thr Thr
705                 710                 715                 720

Asp Lys Asp Leu Gln Ser Ile Val Ala Asp Leu Ala Gly Ser Pro Ala
                725                 730                 735

Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val
            740                 745                 750

Ser Ile Met Gly Tyr Pro Pro Gln Thr Ile Val Val Glu Met Ala Arg
        755                 760                 765
```

```
Glu Asn Gln Thr Thr Gly Lys Gly Lys Asn Asn Ser Lys Pro Arg Tyr
    770                 775                 780

Lys Ser Leu Glu Lys Ala Ile Lys Asp Phe Gly Ser Gln Ile Leu Lys
785                 790                 795                 800

Glu His Pro Thr Asp Asn Gln Glu Leu Lys Asn Asn Arg Leu Tyr Leu
                805                 810                 815

Tyr Tyr Leu Gln Asn Gly Lys Asp Ile Tyr Thr Gly Gln Glu Leu Asp
            820                 825                 830

Ile His Asn Leu Ser Asn Tyr Asp Ile Asp His Ile Val Pro Gln Ser
        835                 840                 845

Phe Ile Thr Asp Asn Ser Ile Asp Asn Leu Val Leu Thr Ser Ser Ala
    850                 855                 860

Gly Asn Arg Glu Lys Gly Gly Asp Val Pro Pro Leu Glu Ile Val Arg
865                 870                 875                 880

Lys Arg Lys Val Phe Trp Glu Lys Leu Tyr Gln Gly Asn Leu Met Ser
                885                 890                 895

Lys Arg Lys Phe Asp Tyr Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr
            900                 905                 910

Glu Ala Asp Lys Ala Arg Phe Ile His Arg Gln Leu Val Glu Thr Arg
        915                 920                 925

Gln Ile Thr Lys Asn Val Ala Asn Ile Leu His Gln Arg Phe Asn Lys
    930                 935                 940

Glu Thr Asp Asn His Gly Asn Thr Met Glu Gln Val Arg Ile Val Thr
945                 950                 955                 960

Leu Lys Ser Ala Leu Val Ser Gln Phe Arg Lys Gln Phe Gln Leu Tyr
```

```
               965                 970                 975

Lys Val Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala Tyr Leu
            980                 985                 990

Asn Gly Val Val Ala Asn Thr Leu  Leu Lys Val Tyr Pro  Gln Leu Glu
        995                 1000                1005

Pro Glu  Phe Val Tyr Gly Glu  Tyr His Gln Phe Asp  Trp Phe Lys
    1010                1015                1020

Ala Asn  Lys Ala Thr Ala Lys  Lys Gln Phe Tyr Thr  Asn Ile Met
    1025                1030                1035

Leu Phe  Phe Ala Gln Lys Glu  Arg Ile Ile Asp Glu  Asn Gly Glu
    1040                1045                1050

Ile Leu  Trp Asp Lys Lys Tyr  Leu Glu Thr Ile Lys  Lys Val Leu
    1055                1060                1065

Asp Tyr  Arg Gln Ile Asn Ile  Val Lys Lys Thr Glu  Ile Gln Lys
    1070                1075                1080

Gly Glu  Phe Ser Lys Ala Thr  Ile Lys Pro Lys Gly  Asn Ser Ser
    1085                1090                1095

Lys Leu  Ile Pro Arg Lys Glu  Asn Trp Asp Pro Val  Lys Tyr Gly
    1100                1105                1110

Gly Leu  Asp Ser Pro Asn Met  Ala Tyr Ala Val Ile  Ile Glu His
    1115                1120                1125

Ala Lys  Gly Lys Lys Lys Ile  Val Ile Glu Lys Lys  Leu Ile Gln
    1130                1135                1140

Ile Asn  Ile Met Glu Arg Lys  Met Phe Glu Lys Asp  Glu Glu Ala
    1145                1150                1155
```

```
Phe Leu  Glu Glu Lys Gly Tyr  His Gln Pro Lys Val  Leu Thr Lys
    1160                1165                1170

Leu Pro  Lys Tyr Thr Leu Tyr  Glu Cys Glu Lys Gly  Arg Arg Arg
    1175                1180                1185

Met Leu  Ser Ser Ala Asn Glu  Ala Gln Lys Gly Asn  Gln Leu Val
    1190                1195                1200

Leu Ser  Asn His Leu Val Ser  Leu Leu Tyr His Ala  Lys Asn Cys
    1205                1210                1215

Glu Ala  Ser Asp Gly Lys Ser  Leu Lys Tyr Ile Glu  Ala His Arg
    1220                1225                1230

Glu Thr  Phe Ser Glu Leu Leu  Ala Gln Val Ser Glu  Phe Ala Thr
    1235                1240                1245

Lys Tyr  Thr Leu Ala Asp Ala  Asn Leu Ser Lys Ile  Asn Asn Leu
    1250                1255                1260

Phe Glu  Gln Asn Lys Glu Gly  Asp Ile Lys Ala Ile  Ala Gln Ser
    1265                1270                1275

Phe Val  Asp Leu Met Ala Phe  Asn Ala Met Gly Ala  Pro Ala Ser
    1280                1285                1290

Phe Lys  Phe Phe Glu Ala Thr  Ile Asp Arg Lys Arg  Tyr Thr Asn
    1295                1300                1305

Leu Lys  Glu Leu Leu Ser Ser  Thr Ile Ile Tyr Gln  Ser Ile Thr
    1310                1315                1320

Gly Leu  Tyr Glu Ser Arg Lys  Arg Leu Asp Asp
    1325                1330
```

<210> 535

<211> 1099
<212> PRT
<213> Listeria monocytogenes

<400> 535

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Met Lys Asn Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Leu Thr Asp Gln Tyr Asp Leu Val Lys Arg Lys Met
            20                  25                  30


Lys Val Ala Gly Asn Ser Asp Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Asp Asp Gly Gln Thr Ala Val Asp Arg Arg Met
    50                  55                  60


Asn Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Val Glu Met Ala Asn Ile Asp Ala Asn
                85                  90                  95


Phe Phe Cys Arg Leu Asn Asp Ser Phe Tyr Val Asp Ser Glu Lys Arg
            100                 105                 110


Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Ala Tyr
        115                 120                 125


His Lys Asn Tyr Arg Thr Ile Tyr His Leu Arg Glu Glu Leu Val Asn
    130                 135                 140


Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175
```

```
Lys Asn Thr Ser Val Asp Glu Val Tyr Lys Gln Phe Ile Gln Thr Tyr
            180                 185                 190

Asn Gln Val Phe Met Ser Asn Ile Glu Glu Gly Ala Leu Ala Lys Val
        195                 200                 205

Glu Glu Asn Thr Glu Val Ala Ser Ile Leu Ala Gly Lys Phe Thr Arg
    210                 215                 220

Arg Glu Lys Phe Glu Arg Ile Leu Arg Leu Tyr Pro Gly Glu Lys Ser
225                 230                 235                 240

Thr Gly Met Phe Ala Gln Phe Ile Ser Leu Ile Val Gly Asn Lys Gly
                245                 250                 255

Asn Phe Gln Lys Val Phe Asn Leu Val Glu Lys Thr Asp Ile Glu Cys
            260                 265                 270

Ala Lys Asp Ser Tyr Glu Glu Asp Leu Glu Ala Leu Leu Ala Ile Ile
        275                 280                 285

Gly Asp Glu Tyr Ala Glu Leu Phe Val Ala Ala Lys Asn Thr Tyr Asn
    290                 295                 300

Ala Val Val Leu Ser Ser Ile Ile Thr Val Thr Ala Thr Glu Thr Asn
305                 310                 315                 320

Ala Lys Leu Ser Ala Ser Met Ile Glu Arg Phe Asp Ala His Glu Lys
                325                 330                 335

Glu Leu Gly Glu Leu Lys Ala Phe Ile Lys Leu His Leu Pro Lys Gln
            340                 345                 350

Tyr Gln Glu Ile Phe Asn Asn Ala Glu Ile Asp Gly Tyr Ala Gly Tyr
        355                 360                 365

Ile Asp Gly Lys Thr Lys Gln Val Asp Phe Tyr Lys Tyr Leu Lys Thr
    370                 375                 380
```

```
Thr Leu Glu Asn Val Glu Gly Ala Asp Tyr Phe Ile Thr Lys Ile Glu
385                 390                 395                 400

Glu Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile
                405                 410                 415

Pro His Gln Leu His Leu Glu Glu Leu Glu Ala Ile Leu His Gln Gln
            420                 425                 430

Ala Lys Tyr Tyr Pro Phe Leu Arg Glu Gly Tyr Asp Lys Ile Lys Ser
        435                 440                 445

Leu Val Thr Phe Arg Ile Pro Tyr Phe Val Gly Pro Leu Ala Asn Gly
    450                 455                 460

Gln Ser Glu Phe Ala Trp Leu Thr Arg Lys Asp Asp Gly Glu Ile Arg
465                 470                 475                 480

Pro Trp Asn Ile Glu Glu Lys Val Asp Phe Gly Lys Ser Ala Val Asp
                485                 490                 495

Phe Ile Glu Lys Met Thr Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn
            500                 505                 510

Val Leu Pro Lys His Ser Leu Cys Tyr Gln Lys Tyr Met Val Tyr Asn
        515                 520                 525

Glu Leu Thr Lys Ile Arg Tyr Ile Asp Asp Gln Gly Lys Thr Asn Tyr
    530                 535                 540

Phe Ser Gly Arg Glu Lys Gln Gln Ile Phe Asn Asp Leu Phe Lys Gln
545                 550                 555                 560

Lys Arg Lys Val Lys Lys Lys Asp Leu Glu Leu Phe Leu Arg Asn Ile
                565                 570                 575
```

```
Asn His Ile Glu Ser Pro Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn
            580                 585                 590

Ala Ser Tyr Ala Thr Tyr His Asp Leu Leu Lys Val Gly Leu Lys Gln
        595                 600                 605

Glu Ile Leu Asp Asn Pro Leu Asn Thr Glu Ile Leu Glu Asp Ile Val
    610                 615                 620

Lys Ile Leu Thr Val Phe Glu Asp Lys Arg Met Ile Lys Glu Gln Leu
625                 630                 635                 640

Glu Gln Phe Ser Asp Val Leu Asp Gly Val Val Leu Lys Lys Leu Glu
                645                 650                 655

Arg Arg His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu Val
            660                 665                 670

Gly Ile Arg Asp Lys Gln Ser His Leu Thr Ile Leu Asp Tyr Leu Met
        675                 680                 685

Asn Asp Asp Gly Leu Asn Arg Asn Leu Met Gln Leu Ile Asn Asp Ser
    690                 695                 700

Asn Leu Ser Phe Lys Ser Ile Ile Glu Lys Glu Gln Val Ser Thr Thr
705                 710                 715                 720

Asp Lys Asp Leu Gln Ser Ile Val Ala Asp Leu Ala Gly Ser Pro Ala
                725                 730                 735

Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val
            740                 745                 750

Ser Ile Met Gly Tyr Pro Pro Gln Thr Ile Val Val Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Gly Lys Gly Lys Asn Asn Ser Lys Pro Arg Tyr
    770                 775                 780
```

```
Lys Ser Leu Glu Lys Ala Ile Lys Asp Phe Gly Ser Gln Ile Leu Lys
785                 790                 795                 800

Glu His Pro Thr Asp Asn Gln Glu Leu Lys Asn Asn Arg Leu Tyr Leu
                805                 810                 815

Tyr Tyr Leu Gln Asn Gly Lys Asp Ile Tyr Thr Gly Gln Glu Leu Asp
            820                 825                 830

Ile His Asn Leu Ser Asn Tyr Asp Ile Asp His Ile Val Pro Gln Ser
        835                 840                 845

Phe Ile Thr Asp Asn Ser Ile Asp Asn Leu Val Leu Thr Ser Ser Ala
    850                 855                 860

Gly Asn Arg Glu Lys Gly Gly Asp Val Pro Pro Leu Glu Ile Val Arg
865                 870                 875                 880

Lys Arg Lys Val Phe Trp Glu Lys Leu Tyr Gln Gly Asn Leu Met Ser
                885                 890                 895

Lys Arg Lys Phe Asp Tyr Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr
            900                 905                 910

Glu Ala Asp Lys Ala Arg Phe Ile His Arg Gln Leu Val Glu Thr Arg
        915                 920                 925

Gln Ile Thr Lys Asn Val Ala Asn Ile Leu His Gln Arg Phe Asn Lys
    930                 935                 940

Glu Thr Asp Asn His Gly Asn Thr Met Glu Gln Val Arg Ile Val Thr
945                 950                 955                 960

Leu Lys Ser Ala Leu Val Ser Gln Phe Arg Lys Gln Phe Gln Leu Tyr
                965                 970                 975
```

Lys Val Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala Tyr Leu
980 985 990

Asn Gly Val Val Ala Asn Thr Leu Leu Lys Val Tyr Pro Gln Leu Glu
995 1000 1005

Pro Glu Phe Val Tyr Gly Glu Tyr His Gln Phe Asp Trp Phe Lys
1010 1015 1020

Ala Asn Lys Ala Thr Ala Lys Lys Gln Phe Tyr Thr Asn Ile Met
1025 1030 1035

Leu Phe Phe Ala Gln Lys Glu Arg Ile Ile Asp Glu Asn Gly Glu
1040 1045 1050

Ile Leu Trp Asp Lys Lys Tyr Leu Glu Thr Ile Lys Lys Val Leu
1055 1060 1065

Asp Tyr Arg Gln Ile Asn Ile Val Lys Lys Thr Glu Ile Gln Lys
1070 1075 1080

Gly Glu Phe Ser Lys Ala Thr Ile Lys Pro Lys Gly Ile Pro Ala
1085 1090 1095

Asn

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<211> 1334
<212> PRT
<213> Listeria monocytogenes

<400> 536

Met Lys Asn Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Leu Thr Asp Gln Tyr Asp Leu Val Lys Arg Lys Met
20 25 30

```
Lys Val Ala Gly Asn Ser Asp Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Asp Glu Gly Glu Thr Ala Ala Asp Arg Arg Met
    50                  55                  60

Asn Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Leu Glu Met Ala Asn Ile Asp Ala Asn
                85                  90                  95

Phe Phe Cys Arg Leu Asn Asp Ser Phe Tyr Val Asp Ser Glu Lys Arg
            100                 105                 110

Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Ala Tyr
        115                 120                 125

His Lys Asn Tyr Arg Thr Ile Tyr His Leu Arg Glu Glu Leu Val Asn
    130                 135                 140

Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175

Lys Asn Thr Ser Val Asp Gly Val Tyr Lys Gln Phe Ile Gln Thr Tyr
            180                 185                 190

Asn Gln Val Phe Ile Ser Asn Ile Glu Glu Gly Thr Leu Ala Lys Met
        195                 200                 205

Glu Glu Asn Thr Thr Val Ala Asp Ile Leu Ala Gly Lys Phe Thr Arg
    210                 215                 220

Lys Glu Lys Leu Glu Arg Ile Leu Gln Leu Tyr Pro Gly Glu Lys Ser
```

```
225                 230                 235                 240

Thr Gly Met Phe Ala Gln Phe Ile Ser Leu Ile Val Gly Ser Lys Gly
                245                 250                 255

Asn Phe Gln Lys Val Phe Asp Leu Val Glu Lys Thr Asp Ile Glu Cys
            260                 265                 270

Ala Lys Asp Ser Tyr Glu Glu Asp Leu Glu Ala Leu Leu Ala Ile Ile
        275                 280                 285

Gly Asp Glu Tyr Ala Glu Leu Phe Val Ala Ala Lys Asn Thr Tyr Asn
    290                 295                 300

Ala Val Val Leu Ser Ser Ile Ile Thr Val Thr Asp Thr Glu Thr Asn
305                 310                 315                 320

Ala Lys Leu Ser Ala Ser Met Ile Glu Arg Phe Asp Ala His Glu Lys
                325                 330                 335

Asp Leu Ser Glu Leu Lys Ala Phe Ile Lys Leu His Leu Pro Lys Gln
            340                 345                 350

Tyr Glu Glu Ile Phe Ser Asn Val Ala Ile Asp Gly Tyr Ala Gly Tyr
        355                 360                 365

Ile Asp Gly Lys Thr Lys Gln Val Asp Phe Tyr Lys Tyr Leu Lys Thr
    370                 375                 380

Leu Leu Glu Asn Ile Glu Gly Ala Asp Tyr Phe Ile Ala Lys Ile Glu
385                 390                 395                 400

Glu Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ala Ile
                405                 410                 415

Pro His Gln Leu His Leu Glu Glu Leu Glu Ala Ile Leu His Gln Gln
            420                 425                 430
```

```
Ala Lys Tyr Tyr Pro Phe Leu Lys Glu Ala Tyr Asp Lys Ile Lys Ser
        435                 440                 445

Leu Val Thr Phe Arg Ile Pro Tyr Phe Val Gly Pro Leu Ala Asn Gly
    450                 455                 460

Gln Ser Asp Phe Ala Trp Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg
465                 470                 475                 480

Pro Trp Asn Ile Glu Glu Lys Val Asp Phe Gly Lys Ser Ala Val Asp
                485                 490                 495

Phe Ile Glu Lys Met Thr Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn
            500                 505                 510

Val Leu Pro Lys His Ser Leu Tyr Tyr Gln Lys Tyr Met Val Tyr Asn
        515                 520                 525

Glu Leu Thr Lys Val Arg Tyr Ile Asp Asp Gln Gly Lys Thr Asn Tyr
    530                 535                 540

Phe Ser Gly Gln Glu Lys Gln Gln Ile Phe Asn Asp Tyr Phe Lys Gln
545                 550                 555                 560

Lys Arg Lys Val Ser Lys Lys Asp Leu Glu Gln Phe Leu Arg Asn Met
                565                 570                 575

Ser His Ile Glu Ser Pro Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn
            580                 585                 590

Ser Ser Tyr Ala Thr Tyr His Asp Leu Leu Lys Val Gly Ile Lys Gln
        595                 600                 605

Glu Val Leu Glu Asn Pro Leu Asn Thr Glu Met Leu Glu Asp Ile Val
    610                 615                 620

Lys Ile Leu Thr Val Phe Glu Asp Lys Arg Met Ile Lys Glu Gln Leu
```

625 630 635 640

Gln Gln Phe Ser Asp Val Leu Asp Gly Ala Val Leu Lys Lys Leu Glu
645 650 655

Arg Arg His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu Val
660 665 670

Gly Ile Arg Asp Lys Gln Ser His Leu Thr Ile Leu Asp Tyr Leu Met
675 680 685

Asn Asp Asp Gly Leu Asn Arg Asn Leu Met Gln Leu Ile Asn Asp Ser
690 695 700

Asn Leu Ser Phe Lys Ser Ile Ile Glu Lys Glu Gln Val Ser Thr Thr
705 710 715 720

Asp Lys Asp Leu Gln Ser Ile Val Ala Asp Leu Ala Gly Ser Pro Ala
725 730 735

Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val
740 745 750

Ser Ile Met Gly Tyr Pro Pro Gln Thr Ile Val Val Glu Met Ala Arg
755 760 765

Glu Asn Gln Thr Thr Val Lys Gly Lys Asn Asn Ser Arg Pro Arg Tyr
770 775 780

Lys Ser Leu Glu Lys Ala Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys
785 790 795 800

Glu His Pro Thr Asp Asn Gln Glu Leu Arg Asn Asn Arg Leu Tyr Leu
805 810 815

Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Gln Glu Leu Asp
820 825 830

```
Ile His Asn Leu Ser Asn Tyr Asp Ile Asp His Ile Val Pro Gln Ser
        835                 840                 845

Phe Ile Thr Asp Asn Ser Ile Asp Asn Leu Val Leu Thr Ser Ser Ala
    850                 855                 860

Gly Asn Arg Glu Lys Gly Asp Asp Val Pro Pro Leu Glu Ile Val Arg
865                 870                 875                 880

Lys Arg Lys Val Phe Trp Glu Lys Leu Phe Gln Gly Asn Leu Met Ser
                885                 890                 895

Lys Arg Lys Phe Asp Tyr Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr
            900                 905                 910

Glu Ala Asp Lys Ala Thr Phe Ile His Arg Gln Leu Val Glu Thr Arg
        915                 920                 925

Gln Ile Thr Lys Asn Val Ala Asn Ile Leu His Gln Arg Phe Asn Asn
    930                 935                 940

Glu Thr Asp Asn His Gly Asn Asn Met Glu Gln Val Arg Ile Val Met
945                 950                 955                 960

Leu Lys Ser Ala Leu Val Ser Gln Phe Arg Lys Gln Phe Gln Leu Tyr
                965                 970                 975

Lys Val Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala Tyr Leu
            980                 985                 990

Asn Gly Val Val Ala Asn Thr Leu  Leu Lys Val Tyr Pro  Gln Leu Glu
        995                 1000                1005

Pro Glu  Phe Val Tyr Gly Glu  Tyr His Gln Phe Asp  Trp Phe Lys
    1010                1015                1020

Ala Asn  Lys Ala Thr Ala Lys  Lys Gln Phe Tyr Thr  Asn Ile Met
```

```
    1025                1030                1035

Leu Phe  Phe Ala Gln Lys Glu  Arg Ile Ile Asp Glu  Asn Gly Glu
    1040                1045                1050

Ile Leu  Trp Asp Lys Lys Tyr  Leu Glu Thr Ile Lys  Lys Val Leu
    1055                1060                1065

Asp Tyr  Arg Gln Met Asn Ile  Val Lys Lys Thr Glu  Ile Gln Lys
    1070                1075                1080

Gly Glu  Phe Ser Lys Ala Thr  Ile Lys Pro Lys Gly  Asn Ser Ser
    1085                1090                1095

Lys Leu  Ile Pro Arg Lys Glu  Asn Trp Asp Pro Met  Lys Tyr Gly
    1100                1105                1110

Gly Leu  Asp Ser Pro Asn Met  Ala Tyr Ala Val Ile  Ile Glu His
    1115                1120                1125

Ala Lys  Gly Lys Lys Lys Val  Val Phe Glu Lys Lys  Ile Ile Arg
    1130                1135                1140

Ile Thr  Ile Met Glu Arg Lys  Ala Phe Glu Lys Asp  Glu Lys Ser
    1145                1150                1155

Phe Leu  Glu Lys Gln Gly Tyr  Arg Gln Pro Lys Val  Leu Thr Lys
    1160                1165                1170

Leu Pro  Lys Tyr Thr Leu Tyr  Glu Cys Glu Asn Gly  Arg Arg Arg
    1175                1180                1185

Met Leu  Ala Ser Ala Asn Glu  Ala Gln Lys Gly Asn  Gln Gln Val
    1190                1195                1200

Leu Lys  Gly Gln Leu Ile Thr  Leu Leu His His Ala  Lys Asn Cys
    1205                1210                1215
```

```
Glu Ala  Ser Asp Gly Lys Ser  Leu Asp Tyr Ile Glu  Ser Asn Arg
    1220                 1225                 1230


Glu Met  Phe Gly Glu Leu Leu  Ala His Val Ser Glu  Phe Ala Lys
    1235                 1240                 1245


Arg Tyr  Thr Leu Ala Asp Ala  Asn Leu Ser Lys Ile  Asn Gln Leu
    1250                 1255                 1260


Phe Glu  Gln Asn Lys Asp Asn  Asp Ile Lys Val Ile  Ala Gln Ser
    1265                 1270                 1275


Phe Val  Asn Leu Met Ala Phe  Asn Ala Met Gly Ala  Pro Ala Ser
    1280                 1285                 1290


Phe Lys  Phe Phe Glu Ala Thr  Ile Glu Arg Lys Arg  Tyr Thr Asn
    1295                 1300                 1305


Leu Lys  Glu Leu Leu Ser Ala  Thr Ile Ile Tyr Gln  Ser Ile Thr
    1310                 1315                 1320


Gly Leu  Tyr Glu Ala Arg Lys  Arg Leu Asp Gly
    1325                 1330


<210>  537
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<212>  PRT
<213>  Listeria monocytogenes

<400>  537

Met Lys Asn Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Leu Thr Asn Gln Tyr Asp Leu Val Lys Arg Lys Met
            20                  25                  30


Lys Val Ala Gly Asn Ser Asp Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45
```

```
Gly Val Arg Leu Phe Asp Asp Gly Gln Thr Ala Val Asp Arg Arg Met
    50                  55                  60

Asn Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Val Glu Met Ala Asn Ile Asp Ala Asn
                85                  90                  95

Phe Phe Cys Arg Leu Asn Asp Ser Phe Tyr Val Asp Ser Glu Lys Arg
            100                 105                 110

Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Ala Tyr
        115                 120                 125

His Lys Asn Tyr Arg Thr Ile Tyr His Leu Arg Glu Glu Leu Val Asn
    130                 135                 140

Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175

Lys Asn Thr Ser Val Asp Gly Val Tyr Glu Gln Phe Ile Gln Thr Tyr
            180                 185                 190

Asn Gln Val Phe Met Ser Asn Ile Glu Glu Gly Thr Leu Ala Lys Val
        195                 200                 205

Glu Glu Asn Ile Glu Val Ala Asn Ile Leu Ala Gly Lys Phe Thr Arg
    210                 215                 220

Arg Glu Lys Phe Glu Arg Ile Leu Gln Leu Tyr Pro Gly Glu Lys Ser
225                 230                 235                 240
```

```
Thr Gly Met Phe Ala Gln Phe Ile Ser Leu Ile Val Gly Ser Lys Gly
                245                 250                 255

Asn Phe Gln Lys Val Phe Asp Leu Ile Glu Lys Thr Asp Ile Glu Cys
            260                 265                 270

Ala Lys Asp Ser Tyr Glu Glu Asp Leu Glu Ala Leu Leu Ala Ile Ile
        275                 280                 285

Gly Asp Glu Tyr Ala Glu Leu Phe Val Ala Ala Lys Asn Thr Tyr Asn
    290                 295                 300

Ala Val Val Leu Ser Ser Ile Ile Thr Val Thr Ala Thr Glu Thr Asn
305                 310                 315                 320

Ala Lys Leu Ser Ala Ser Met Ile Glu Arg Phe Asp Ala His Glu Lys
                325                 330                 335

Asp Leu Gly Glu Leu Lys Ala Phe Ile Lys Leu His Leu Pro Lys Gln
            340                 345                 350

Tyr Gln Glu Ile Phe Asn Asn Ala Ala Ile Asp Gly Tyr Ala Gly Tyr
        355                 360                 365

Ile Asp Gly Lys Thr Lys Gln Val Asp Phe Tyr Lys Tyr Leu Lys Thr
    370                 375                 380

Ile Leu Glu Asn Ile Glu Gly Ala Asp Tyr Phe Ile Ala Lys Ile Glu
385                 390                 395                 400

Glu Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ala Ile
                405                 410                 415

Pro His Gln Leu His Leu Glu Glu Leu Glu Ala Ile Ile His Gln Gln
            420                 425                 430

Ala Lys Tyr Tyr Pro Phe Leu Arg Glu Asp Tyr Glu Lys Ile Lys Ser
        435                 440                 445
```

```
Leu Val Thr Phe Arg Ile Pro Tyr Phe Val Gly Pro Leu Ala Lys Gly
    450                 455                 460

Gln Ser Glu Phe Ala Trp Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg
465                 470                 475                 480

Pro Trp Asn Ile Glu Glu Lys Val Asp Phe Gly Lys Ser Ala Val Asp
                485                 490                 495

Phe Ile Glu Lys Met Thr Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn
            500                 505                 510

Val Leu Pro Lys His Ser Leu Cys Tyr Gln Lys Tyr Met Val Tyr Asn
        515                 520                 525

Glu Leu Thr Lys Val Arg Tyr Ile Asp Asp Gln Gly Lys Thr Asn Tyr
    530                 535                 540

Phe Ser Gly Gln Glu Lys Gln Gln Ile Phe Asn Asp Leu Phe Lys Gln
545                 550                 555                 560

Lys Arg Lys Val Lys Lys Lys Asp Leu Glu Leu Phe Leu Arg Asn Ile
                565                 570                 575

Asn His Ile Glu Ser Pro Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn
            580                 585                 590

Ala Ser Tyr Ala Thr Tyr His Asp Leu Leu Lys Val Gly Met Lys Gln
        595                 600                 605

Glu Ile Leu Asp Asn Pro Leu Asn Thr Glu Met Leu Glu Asp Ile Val
    610                 615                 620

Lys Ile Leu Thr Val Phe Glu Asp Lys Pro Met Ile Lys Glu Gln Leu
625                 630                 635                 640
```

```
Gln Gln Phe Ser Asp Val Leu Asp Gly Gly Val Leu Lys Lys Leu Glu
                645                 650                 655

Arg Arg His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu Val
            660                 665                 670

Gly Ile Arg Glu Lys Gln Ser His Leu Thr Ile Leu Asp Tyr Leu Met
        675                 680                 685

Asn Asp Asp Gly Leu Asn Arg Asn Leu Met Gln Leu Ile Asn Asp Ser
    690                 695                 700

Asn Leu Ser Phe Lys Ser Ile Ile Glu Lys Glu Gln Val Ser Thr Thr
705                 710                 715                 720

Asp Lys Asp Leu Gln Ser Ile Val Ala Asp Leu Ala Gly Ser Pro Ala
                725                 730                 735

Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val
            740                 745                 750

Ser Ile Met Gly Tyr Pro Pro Gln Thr Ile Val Val Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Gly Lys Gly Lys Asn Asn Ser Lys Pro Arg Tyr
    770                 775                 780

Lys Ser Leu Glu Lys Ala Ile Lys Glu Phe Gly Ser Lys Ile Leu Lys
785                 790                 795                 800

Glu His Pro Thr Asp Asn Gln Glu Leu Lys Asn Asn Arg Leu Tyr Leu
                805                 810                 815

Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Gln Glu Leu Asp
            820                 825                 830

Ile His Asn Leu Ser Asn Tyr Asp Ile Asp His Ile Val Pro Gln Ser
        835                 840                 845
```

```
Phe Ile Thr Asp Asn Ser Ile Asp Asn Leu Val Leu Thr Ser Ser Ala
    850                 855                 860

Gly Asn Arg Glu Lys Gly Gly Asp Val Pro Pro Leu Glu Ile Val Arg
865                 870                 875                 880

Lys Arg Lys Val Phe Trp Glu Lys Leu Tyr Gln Gly Asn Leu Met Ser
                885                 890                 895

Lys Arg Lys Phe Asp Tyr Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr
            900                 905                 910

Asp Ala Asp Lys Ala Arg Phe Ile His Arg Gln Leu Val Glu Thr Arg
        915                 920                 925

Gln Ile Thr Lys Asn Val Ala Asn Ile Leu His Gln Arg Phe Asn Asn
    930                 935                 940

Glu Thr Asp Asn His Gly Asn Thr Met Glu Gln Val Arg Ile Val Thr
945                 950                 955                 960

Leu Lys Ser Ala Leu Val Ser Gln Phe Arg Lys Gln Phe Gln Leu Tyr
                965                 970                 975

Lys Val Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala Tyr Leu
            980                 985                 990

Asn Gly Val Val Ala Asn Thr Leu  Leu Lys Val Tyr Pro  Gln Leu Glu
        995                 1000                1005

Pro Glu  Phe Val Tyr Gly Glu  Tyr His Gln Phe Asp  Trp Phe Lys
    1010                1015                1020

Ala Asn  Lys Ala Thr Ala Lys  Lys Gln Phe Tyr Thr  Asn Ile Met
    1025                1030                1035
```

```
Leu Phe  Phe Gly Gln Lys Glu  Arg Ile Ile Asp Glu  Asn Gly Glu
    1040                1045                1050

Ile Leu  Trp Asp Lys Lys Tyr  Leu Glu Thr Ile Lys  Lys Val Leu
    1055                1060                1065

Asp Tyr  Arg Gln Met Asn Ile  Val Lys Lys Thr Glu  Ile Gln Lys
    1070                1075                1080

Gly Glu  Phe Ser Lys Ala Thr  Ile Lys Pro Lys Gly  Asn Ser Ser
    1085                1090                1095

Lys Leu  Ile Pro Arg Lys Glu  Asn Trp Asp Pro Met  Lys Tyr Gly
    1100                1105                1110

Gly Leu  Asp Ser Pro Asn Met  Ala Tyr Ala Val Ile  Ile Glu His
    1115                1120                1125

Ala Lys  Gly Lys Lys Lys Leu  Ile Phe Glu Lys Lys  Ile Ile Arg
    1130                1135                1140

Ile Thr  Ile Met Glu Arg Lys  Met Phe Glu Lys Asp  Glu Glu Ala
    1145                1150                1155

Phe Leu  Glu Glu Lys Gly Tyr  Arg His Pro Lys Val  Leu Thr Lys
    1160                1165                1170

Leu Pro  Lys Tyr Thr Leu Tyr  Glu Cys Glu Lys Gly  Arg Arg Arg
    1175                1180                1185

Met Leu  Ala Ser Ala Asn Glu  Ala Gln Lys Gly Asn  Gln Leu Val
    1190                1195                1200

Leu Ser  Asn His Leu Val Ser  Leu Leu Tyr His Ala  Lys Asn Cys
    1205                1210                1215

Glu Ala  Ser Asp Gly Lys Ser  Leu Lys Tyr Ile Glu  Ala His Arg
    1220                1225                1230
```

```
Glu Thr  Phe Ser Glu Leu Leu  Ala Gln Val Ser Glu  Phe Ala Thr
    1235                1240                1245


Arg Tyr  Thr Leu Ala Asp Ala  Asn Leu Ser Lys Ile  Asn Asn Leu
    1250                1255                1260


Phe Glu  Gln Asn Lys Glu Gly  Asp Ile Gln Ala Ile  Ala Gln Ser
    1265                1270                1275


Phe Val  Asp Leu Met Ala Phe  Asn Ala Met Gly Ala  Pro Ala Ser
    1280                1285                1290


Phe Lys  Phe Phe Glu Ala Thr  Ile Asp Arg Lys Arg  Tyr Thr Asn
    1295                1300                1305


Leu Lys  Glu Leu Leu Ser Ser  Thr Ile Ile Tyr Gln  Ser Ile Thr
    1310                1315                1320


Gly Leu  Tyr Glu Ser Arg Lys  Arg Leu Asp Asp
    1325                1330


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<400>  538

Leu Ala Asn Gly Gln Ser Glu Phe Ser Trp Leu Thr Arg Lys Ala Asp
1               5                   10                  15


Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu Lys Val Asp Phe Gly Lys
            20                  25                  30


Ser Ala Ile Asp Phe Ile Glu Lys Met Thr Asn Lys Asp Thr Tyr Leu
        35                  40                  45


Pro Lys Glu Asn Val Leu Pro Lys His Ser Met Cys Tyr Gln Lys Tyr
```

```
    50                  55                  60

Met Val Tyr Asn Glu Leu Thr Lys Ile Arg Tyr Thr Asp Asp Gln Gly
65                  70                  75                  80

Lys Thr His Tyr Phe Ser Gly Gln Glu Lys Gln Gln Ile Phe Asn Asp
                85                  90                  95

Leu Phe Lys Gln Lys Arg Lys Val Lys Lys Lys Asp Leu Glu Leu Phe
            100                 105                 110

Leu Tyr Asn Met Asn His Val Glu Ser Pro Thr Val Glu Gly Val Glu
        115                 120                 125

Asp Ala Phe Asn Ser Ser Phe Thr Thr Tyr His Asp Leu Gln Lys Val
    130                 135                 140

Gly Val Pro Gln Glu Ile Leu Asp Asp Pro Leu Asn Thr Glu Met Leu
145                 150                 155                 160

Glu Glu Ile Ile Lys Ile Leu Thr Val Phe Glu Asp Lys Arg Met Ile
                165                 170                 175

Asn Glu Arg Leu Gln Glu Phe Ser Asn Val Leu Asp Glu Ala Val Leu
            180                 185                 190

Lys Lys Leu Glu Arg Arg His Tyr Thr Gly Trp Gly Arg Leu Ser Ala
        195                 200                 205

Lys Leu Leu Ile Gly Ile Arg Asp Lys Glu Ser His Leu Thr Ile Leu
    210                 215                 220

Asp Tyr Leu Met Asn Asp Asp Lys His Asn Arg Asn Leu Met Gln Leu
225                 230                 235                 240

Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile Ile Glu Lys Glu Gln
                245                 250                 255
```

```
Val Ser Thr Ala Asp Lys Asp Ile Gln Ser Ile Val Ala Asp Leu Ala
            260                 265                 270

Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val
        275                 280                 285

Asp Glu Leu Val Gly Ile Met Gly Tyr Pro Pro Gln Thr Ile Val Val
    290                 295                 300

Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Lys Gly Lys Asn Asn Ser
305                 310                 315                 320

Lys Pro Arg Phe Thr Ser Leu Glu Lys Ala Ile Lys Glu Leu Gly Ser
                325                 330                 335

Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln Gly Leu Lys Asn Asp
            340                 345                 350

Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly
        355                 360                 365

Gln Glu Leu Asp Ile His Asn Leu Ser Asn Tyr Asp Ile Asp His Val
    370                 375                 380

Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile Asp Asn Arg Val Leu
385                 390                 395                 400

Ala Ser Ser Ala Ala Asn Arg Glu Lys Gly Asp Asn Val Pro Ser Leu
                405                 410                 415

Glu Val Val Arg Lys Arg Lys Val Tyr Trp Glu Lys Leu Tyr Gln Ala
            420                 425                 430

Lys Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu Thr Lys Ala Glu Arg
        435                 440                 445

Gly Gly Leu Thr Glu Ala Asp Lys Ala Arg Phe Ile His Arg Gln Leu
```

```
    450                 455                 460

Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala Asn Ile Leu His Gln
465                 470                 475                 480

Arg Phe Asn Cys Lys Lys Asp Glu Ser Gly Asn Val Ile Glu Gln Val
                485                 490                 495

Arg Ile Val Thr Leu Lys Ala Ala Leu Val Ser Gln Phe Arg Lys Gln
            500                 505                 510

Phe Gln Leu Tyr Lys Val Arg Glu Val Asn Asp Tyr His His Ala His
        515                 520                 525

Asp Ala Tyr Leu Asn Cys Val Val Ala Asn Thr Leu Leu Lys Val Tyr
    530                 535                 540

Pro Gln Leu Glu Pro Glu Phe Val Tyr Gly Asp Tyr His Gln Phe Asp
545                 550                 555                 560

Trp Phe Lys Ala Asn Lys Ala Thr Ala Lys Lys Gln Phe Tyr Thr Asn
                565                 570                 575

Ile Met Leu Phe Phe Ala Lys Lys Asp Arg Ile Ile Asp Glu Asn Gly
            580                 585                 590

Glu Ile Leu Trp Asp Lys Lys Tyr Leu Asp Thr Ile Lys Lys Val Leu
        595                 600                 605

Asn Tyr Arg Gln Met Asn Ile Val Lys Lys Thr Glu Ile Gln Lys Gly
    610                 615                 620

Glu Phe Ser Asn Ala Thr Ala Asn Pro Lys Gly Asn Ser Ser Lys Leu
625                 630                 635                 640

Ile Pro Arg Lys Ala Asp Trp Asp Pro Ile Lys Tyr Gly Gly Phe Asp
                645                 650                 655
```

```
Gly Ser Asn Met Ala Tyr Ala Ile Val Ile Glu His Glu Lys Arg Lys
            660                 665                 670

Lys Lys Thr Val Ile Lys Lys Glu Leu Ile Gln Ile Asn Ile Met Glu
        675                 680                 685

Arg Thr Ala Phe Glu Lys Asp Gln Lys Glu Phe Leu Glu Gly Lys Gly
    690                 695                 700

Tyr Arg Asn Pro Lys Val Ile Thr Lys Ile Pro Lys Tyr Thr Leu Tyr
705                 710                 715                 720

Glu Cys Glu Asn Gly Arg Arg Arg Met Leu Gly Ser Ala Asn Glu Ala
                725                 730                 735

Gln Lys Gly Asn Gln Met Val Leu Pro Asn His Leu Met Thr Leu Leu
            740                 745                 750

Tyr His Ala Lys Asn Cys Glu Ala Ser Asp Gly Lys Ser Leu Ala Tyr
        755                 760                 765

Ile Glu Ser His Arg Glu Met Phe Ala Glu Leu Leu Asp Ser Ile Ser
    770                 775                 780

Glu Phe Ala Ser Arg Tyr Thr Leu Ala Asp Ala Asn Leu Glu Lys Ile
785                 790                 795                 800

Asn Thr Ile Phe Glu Gln Asn Lys Ser Gly Asp Val Lys Val Ile Ala
                805                 810                 815

Gln Ser Phe Val Asn Leu Leu Glu Phe Asn Ala Met Gly Ala Pro Ala
            820                 825                 830

Ser Phe Lys Tyr Phe Glu Thr Asn Ile Glu Arg Lys Arg Tyr Asn Asn
        835                 840                 845

Leu Lys Glu Leu Leu Asn Ala Thr Ile Ile Tyr Gln Ser Ile Thr Gly
```

```
    850                 855                 860


Leu Tyr Glu Ala Arg Lys Arg Leu Asp Asp
865                 870


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<213>  Listeriaceae bacterium

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Met Lys Lys Leu Val Leu Gly Leu Asp Ile Gly Val Ala Ser Val Gly
1               5                   10                  15


Trp Gly Ile Ile Asp Ala Glu Asn Gly Asp Val Val Asp Thr Gly Val
            20                  25                  30


Arg Leu Phe Ser Ser Arg Asp Ala Ser Glu Asn Glu Ser Arg Arg Thr
        35                  40                  45


Ser Arg Gln Ser Arg Arg Leu Ser Arg Arg Lys Lys His Arg Arg Glu
    50                  55                  60


Arg Ile Lys Gln Leu Leu Leu Ala His Asp Met Asp Ile Cys Asp Ile
65                  70                  75                  80


Val Asn Glu Asn Pro Tyr Glu Leu Arg Val Lys Gly Leu Asn Glu Lys
                85                  90                  95


Leu Glu Val Ser Glu Ile Tyr Val Ala Leu Thr His Leu Ala Lys Arg
            100                 105                 110


Arg Gly Val Ser Tyr Leu Asp Asp Val Val Glu Glu Gly Gly Thr Ile
        115                 120                 125


Lys Ser Glu His Leu Asn Lys Asn Met Glu Glu Ile Lys Ser Gly Lys
    130                 135                 140
```

```
Met Pro Cys Glu Ile Gln Leu Glu Arg Phe Glu Lys Tyr Gly Gln Val
145                 150                 155                 160

Arg Gly Met Ile Glu Ile Asn Gln Asp Thr Glu Glu Ser Ser Phe Leu
                165                 170                 175

Val Asn Ile Phe Arg Thr Ser Asp Tyr Ile Lys Glu Ala Lys Thr Ile
            180                 185                 190

Leu Ala Thr Gln Gln Lys Phe His Lys Gln Ile Thr Asn Glu Phe Ile
        195                 200                 205

Asp Glu Tyr Ile His Ile Met Ala Ser Lys Arg Asp Tyr Phe Ile Gly
    210                 215                 220

Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Val Tyr Arg Thr Asn
225                 230                 235                 240

Gly Asp Thr Trp Asp Asn Leu Phe Glu Ile Leu Ile Gly Lys Cys Ser
                245                 250                 255

Val Phe Pro Glu Glu Thr Arg Ala Ala Arg Ser Ser Tyr Val Ala Gln
            260                 265                 270

Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Lys Ile Ser Asn Leu
        275                 280                 285

Glu Ser Gly Lys Leu Ser Ala Ser Gln Lys His Asp Ile Val Glu Lys
    290                 295                 300

Val Lys Asn Ser Lys Lys Phe Gly Thr Lys Asp Leu Leu Lys Tyr Ile
305                 310                 315                 320

Ala Ser Val Cys Glu Cys Lys Ile Glu Asp Ile Gly Gly Cys Arg Val
                325                 330                 335

Asp Lys Asn Arg Lys Pro Ile Met His Thr Phe Glu Asn Tyr Arg Lys
            340                 345                 350
```

```
Val His Asn Ala Leu Asn Glu Ala Gly Val Asp Leu Arg Leu Ser Glu
        355                 360                 365

Thr Asp Tyr Asp Glu Leu Met Lys Ile Met Thr Leu Asn Ser Glu Thr
    370                 375                 380

Leu Glu Ile Lys Lys Gln Cys Lys Glu Lys Leu Pro Gln Leu Thr Glu
385                 390                 395                 400

Asp Tyr Leu Asn Val Cys Leu Val Leu Asn Lys Lys Gly Ala Phe Ser
                405                 410                 415

Gly Trp His Ala Leu Ser Leu Lys Ala Met Lys Leu Met Met Pro Glu
            420                 425                 430

Leu Tyr Gly Thr Ser Lys Asn Gln Met Gln Ile Ile His Thr Met Gln
        435                 440                 445

Leu Gly Lys Ala Tyr Leu Lys Pro Leu Asn Gln Gln Lys Tyr Leu Asn
    450                 455                 460

Ser Glu Ala Ile Leu Glu Glu Ile Tyr Asn Pro Ile Ala Ala Arg Ser
465                 470                 475                 480

Ile Arg Gln Thr Ile Lys Val Thr Asn Ala Ile Leu Lys Lys Tyr Gly
                485                 490                 495

His Leu Asp Ser Val Ile Ile Glu Met Pro Arg Asp Tyr Gln Thr Ser
            500                 505                 510

Glu Asp Glu Arg Lys Met Ile Glu Lys Met Gln Lys Glu Asn Glu Lys
        515                 520                 525

Glu Lys Lys Ala Ala Leu Lys Arg Ala Arg Glu Glu Tyr Pro Phe Pro
    530                 535                 540
```

```
Asp Glu Ala Phe Arg Asn His Lys Glu Leu Ala Thr Lys Leu Arg Leu
545                 550                 555                 560

Trp Tyr Gln Gln Asp Gln Phe Cys Val Tyr Ser Gly Arg Lys Ile Ser
                565                 570                 575

Val Val Asp Leu Val Arg Asn Pro Asn Gln Phe Glu Ile Asp His Ile
            580                 585                 590

Ile Pro Gln Ser Val Ser Leu Asp Asp Ser Leu Asn Asn Lys Val Leu
        595                 600                 605

Cys Phe Ser Glu Glu Asn Gln Lys Lys Gly Gln Gln Thr Pro Phe Tyr
    610                 615                 620

Tyr His Lys Gly Lys Ser Gly Asn Trp Thr Tyr Glu Gln Tyr Lys Leu
625                 630                 635                 640

Phe Val Glu Lys Leu Phe Asp Lys Lys Lys Ile Ser Asn Lys Lys Arg
                645                 650                 655

Glu Leu Leu Leu Phe Glu Glu Asp Ile Asn Lys Trp Asp Val Arg Arg
            660                 665                 670

Gly Phe Ile Ala Arg Asn Leu Val Asp Thr Arg Tyr Ala Ser Arg Val
        675                 680                 685

Ile Leu Asn Ser Tyr Gln Gln Tyr Phe Gly Asn His Glu Met Gly Thr
    690                 695                 700

Lys Val Lys Val Val Arg Gly Lys Phe Thr Ser Gln Leu Arg Lys Lys
705                 710                 715                 720

Trp Arg Ile Phe Lys Asp Arg Asn Glu Ser His Ser His His Ala Ile
                725                 730                 735

Asp Ala Leu Ile Val Ala Ala Thr Ala Asn Leu Arg Leu Trp Lys Lys
            740                 745                 750
```

```
Asn Thr Leu Gly Val Ser Asp Glu Gly Lys Val Tyr Asp Lys Glu Thr
        755                 760                 765

Gly Glu Ile Leu Pro Phe Glu Lys Leu Thr Glu Ser Glu Tyr Asn Glu
    770                 775                 780

Met Met Asn Lys Glu Pro Tyr Leu Asn Phe Lys Thr Lys Leu Gln Asn
785                 790                 795                 800

Ile Glu Thr Lys Val Lys Tyr Ser Tyr Arg Val Ser Lys Lys Val Asn
                805                 810                 815

Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ser Thr Arg Glu Arg Asp Gly
            820                 825                 830

Ile Asp Tyr Ile Val Gly Lys Ile Lys Asn Ile Tyr Asp Val Lys Thr
        835                 840                 845

Tyr Lys Asp Gln Phe Leu Lys Arg Tyr Lys Lys Asn Lys Glu Gln Phe
    850                 855                 860

Leu Met Tyr Gln His Asp Pro Gln Thr Phe Ala Ile Leu Glu Asn Ile
865                 870                 875                 880

Met Ala Thr Tyr Gln Asp Ala Glu Asn Pro Phe Leu Ala Tyr Lys Lys
                885                 890                 895

Glu Tyr Gly Val Ile Arg Lys Tyr Ser Lys Lys Gly Gly Gly Ser Pro
            900                 905                 910

Val Thr Ser Leu Lys Phe Ile Asp Lys Val Leu Gly Gln Lys Ile Asp
        915                 920                 925

Leu Thr Ala Lys Asn Gln Ala Ala Leu Pro Lys Asn Lys Lys Val Val
    930                 935                 940
```

```
Leu Gln Ser Ile Thr Pro Tyr Arg Ala Asp Val Tyr Tyr Asp Glu Ile
945                 950                 955                 960


Asp Lys Arg Tyr His Leu Ile Gly Val Lys Tyr Ser Leu Phe Ser Phe
                965                 970                 975


Ser Lys Gln Gly Tyr Val Ile Asn Pro Ile Ala Tyr Gln Lys Leu Leu
            980                 985                 990


Glu Lys Glu Gln Ile His Ser Glu  Met Lys Phe Cys Phe  Ser Leu Tyr
        995                 1000                1005


Arg Glu  Asp Ile Ile Glu Phe  Gly Glu Asp Pro Asp  Ser Leu Thr
    1010                1015                1020


Arg Tyr  Arg Phe Trp Ser Lys  Asn Glu Ser Gly Lys  Asn Lys Ile
    1025                1030                1035


Glu Val  Lys Pro Ile Glu Lys  Pro Asn Phe Glu Lys  Gln Thr Val
    1040                1045                1050


Leu Thr  Ile Thr Lys Lys Ile  Lys Ile Leu Asn Lys  Tyr Gln Thr
    1055                1060                1065


Asp Val  Leu Gly Asn Ser Phe  Lys Ala Gln Glu Glu  Lys Asp Pro
    1070                1075                1080


Arg Asn  Ile Glu
    1085
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<400> 540

```
Met Lys Lys Ile Leu Gly Leu Asp Leu Gly Thr Thr Ser Ile Gly Trp
1               5                   10                  15
```

```
Ala Phe Ile Lys Glu Pro Glu Lys Asp Val Val Gly Ser Glu Ile Val
            20                  25                  30

Asp Met Gly Val Arg Ile Val Ala Leu Ser Ser Asp Glu Glu Asn Asp
        35                  40                  45

Phe Ala Lys Gly Asn Thr Ile Ser Ile Asn Ala Asp Arg Thr Leu Lys
    50                  55                  60

Arg Gly Ala Arg Arg Asn Leu Gln Arg Phe Lys Leu Arg Arg Asp Ala
65                  70                  75                  80

Leu Leu Glu Ile Phe Lys Glu Met Lys Leu Ile Pro Ser Asn Phe Lys
                85                  90                  95

Tyr Ala Glu Asp Gly Pro Ser Ser Thr Phe Ser Thr Leu Lys Leu Arg
            100                 105                 110

Asp Lys Ala Ala Lys Glu Lys Ile Glu Leu Asp Asp Leu Val Lys Val
        115                 120                 125

Leu Leu Gln Ile Asn Lys Lys Arg Gly Tyr Arg Ser Ser Arg Lys Ala
    130                 135                 140

Lys Ser Glu Glu Asp Asp Gly Ser Ala Ile Asp Ser Met Gly Ile Ala
145                 150                 155                 160

Lys Glu Leu Tyr Glu Asn Asp Leu Thr Pro Gly Gln Trp Val Phe Glu
                165                 170                 175

Ala Leu Gln Lys Gly Arg Lys Asn Val Pro Asp Phe Tyr Arg Ser Asp
            180                 185                 190

Leu Gln Glu Glu Phe Lys Lys Ile Val Asn Tyr Gln Ser Glu Phe Tyr
        195                 200                 205

Pro Asp Val Leu Asn Ser Ser Phe Val Glu Asp Trp Met Gly Lys Ala
```

```
    210                 215                 220

Ser Thr Pro Thr Lys Gln Tyr Phe Asn Lys Lys Gly Val His Leu Ala
225                 230                 235                 240

Glu Asn Lys Gly Lys Arg Glu Glu Arg Arg Leu Gln Glu Tyr Asn Trp
                245                 250                 255

Arg Ala Val Ala Val Asn Ser Lys Ile Asp Leu Ser Glu Ile Ala Leu
            260                 265                 270

Ile Leu Ser Gln Ile Asn Ser Gln Ile Ser Asn Ser Ser Gly Tyr Leu
        275                 280                 285

Gly Ala Ile Ser Asp Arg Ser Lys Glu Leu Tyr Phe Lys Asn Gln Thr
    290                 295                 300

Val Gly Gln Tyr Leu Tyr Gln Gln Ile Lys Ile Asn Pro His Thr Arg
305                 310                 315                 320

Leu Lys Gly Gln Val Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe Glu
                325                 330                 335

Lys Ile Trp Ser Val Gln Ser Gly Phe His Pro Gln Leu Asn Asp Ala
            340                 345                 350

Leu Lys Lys Glu Ile Arg Asp Ile Thr Ile Phe Phe Gln Arg Arg Leu
        355                 360                 365

Lys Ser Gln Lys His Leu Ile Ser Asn Cys Glu Phe Glu Asp Tyr His
    370                 375                 380

Lys Val Val Pro Lys Ser His Pro Ile Phe Gln Glu Phe Arg Ile Trp
385                 390                 395                 400

Gln Asn Leu Asn Asn Leu Thr Leu Ile Lys Lys Asp Asn Leu Asn Glu
                405                 410                 415
```

```
Lys Ser Glu Leu Ala Leu Glu Asp Lys Ile Ala Leu Ala Asn Glu Leu
            420                 425                 430

Ala Phe Lys Arg Glu Gln Ser Val Lys Asp Ala Leu Asn Ile Leu Gly
        435                 440                 445

Leu Lys Ser Ser Glu Trp Glu Phe Asn Phe Thr Lys Ile Glu Gly Asn
    450                 455                 460

Arg Thr Asn His Ala Phe Phe Glu Ala Phe Ala Lys Ile Ile Glu Ile
465                 470                 475                 480

Glu Asp Gly Glu Pro Leu Asp Leu Gly Asn Leu Lys Ala Asp Asp Ile
                485                 490                 495

Leu Asp Gln Phe Ser Glu Ala Phe Leu Arg Ile Gly Ile Asp Pro Gly
            500                 505                 510

Leu Leu Gln Val Asn Asn Asp Ile Glu Gly Pro Asn Tyr Glu Lys Gln
        515                 520                 525

Pro Tyr Ile Gln Phe Trp His Leu Leu Tyr Ser Ser Glu Asp Asp Gln
    530                 535                 540

Lys Leu Lys Gln Asn Leu Ile Lys Lys Phe Gly Phe Lys Pro Asp His
545                 550                 555                 560

Ala Lys Ile Leu Ala Ser Ile Ser Leu Gln Asp Asp His Ala Ser Leu
                565                 570                 575

Ser Ser Arg Ala Ile Lys Lys Ile Leu Pro His Leu Gln Ser Gly Leu
            580                 585                 590

Ile Tyr Asp Lys Ala Cys Thr Tyr Ala Gly Tyr Asn His Ser Ser Ser
        595                 600                 605

Phe Thr Lys Glu Glu Asn Glu Lys Arg Glu Leu Ser Ser Glu Leu Asp
```

```
    610                 615                 620

Leu Leu Lys Lys Asn Ser Leu Arg Asn Pro Val Val Glu Lys Ile Leu
625                 630                 635                 640

Asn Gln Met Ile Asn Val Val Asn Ala Ile Leu Lys Asp Pro Asn Leu
                645                 650                 655

Gly Lys Pro Asp Glu Ile Arg Val Glu Met Ala Arg Glu Leu Lys Ala
            660                 665                 670

Asn Ala Glu Gln Arg Lys Asn Met Thr Ser Asn Ile Ala Ser Ala Thr
        675                 680                 685

Arg Asp His Glu Lys Tyr Arg Glu Ile Leu Lys Lys Glu Phe Gly Leu
    690                 695                 700

Lys Arg Val Thr Lys Asn Asp Leu Leu Arg Tyr Lys Leu Trp Leu Glu
705                 710                 715                 720

Thr Asp Gly Ile Ser Leu Tyr Thr Gly Lys Pro Ile Glu Ala Ser Lys
                725                 730                 735

Leu Phe Ser Lys Glu Tyr Asp Ile Glu His Ile Ile Pro Lys Thr Arg
            740                 745                 750

Leu Phe Asp Asp Ser Phe Ser Asn Lys Thr Ile Cys Glu Arg Gln Leu
        755                 760                 765

Asn Ile Asp Lys Ala Asn Val Thr Ala Phe Ser Phe Leu Gln Asn Lys
    770                 775                 780

Leu Ser Gly Asp Glu Phe Glu Gln Tyr Gln Ser Arg Val Lys Ser Leu
785                 790                 795                 800

Phe Gly Lys Leu Ser Lys Ala Lys Ile Gln Lys Leu Leu Met Ala Asn
                805                 810                 815
```

```
Asp Lys Ile Pro Glu Asp Phe Ile Ala Arg Gln Leu Gln Glu Thr Arg
            820                 825                 830

Tyr Ile Ser Lys Lys Ala Lys Glu Ile Leu Phe Glu Ile Thr Arg Arg
        835                 840                 845

Val Ser Val Thr Thr Gly Thr Ile Thr Asp Lys Leu Arg Glu Asp Trp
    850                 855                 860

Gly Leu Val Glu Ile Met Lys Glu Leu Asn Trp Glu Lys Tyr Asp Lys
865                 870                 875                 880

Leu Gly Leu Thr Tyr Thr Ile Glu Gly Lys His Gly Glu Arg Leu Asn
                885                 890                 895

Lys Ile Lys Asp Trp Ser Lys Arg Asn Asp His Arg His His Ala Met
            900                 905                 910

Asp Ala Leu Thr Val Ala Leu Thr Lys Pro Ala Tyr Ile Gln Tyr Leu
        915                 920                 925

Asn Asn Leu Asn Ala Lys Glu Leu Asn Gly Lys Lys Ser Thr Glu Ile
    930                 935                 940

Phe Ala Ile Glu Gln Lys Tyr Leu Lys Arg Glu Asn Gly Lys Leu Cys
945                 950                 955                 960

Phe Ile Pro Pro Val Glu Asn Ile Arg Thr Glu Ala Lys Lys His Leu
                965                 970                 975

Ser Lys Val Leu Ile Ser Tyr Lys Ala Lys Asn Lys Val Val Thr Ile
            980                 985                 990

Asn Lys Asn Arg Thr Asn Lys Lys  Ala Gly Phe Asn Glu  Gln Ile Ala
        995                 1000                1005

Leu Thr  Pro Arg Gly Gln Leu  His Lys Glu Thr Val  Tyr Gly Lys
```

```
    1010                1015                1020

Ala Phe  His Tyr Ser Thr Lys  Phe Glu Lys Ile Gly  Ala Ser Phe
    1025                1030                1035

Asp Val  Gln Lys Ile Asn Ala  Val Ala Lys Lys Glu  Glu Arg Glu
    1040                1045                1050

Ala Leu  Leu Lys Arg Leu Ala  Glu Asn Gly Asp Asp  Pro Lys Lys
    1055                1060                1065

Ala Phe  Thr Gly Lys Asn Ser  Leu Ser Lys Met Pro  Ile Tyr Leu
    1070                1075                1080

Asp Leu  Lys Arg Asn Ile Lys  Leu Pro Glu Lys Val  Lys Thr Val
    1085                1090                1095

Val Leu  Glu Gln Asn Tyr Thr  Ile Arg Lys Asn Ile  Asp Pro Asp
    1100                1105                1110

Leu Lys  Leu Asp Lys Val Ile  Asp Val Gly Val Lys  Arg Ile Leu
    1115                1120                1125

Glu Asn  Arg Leu Lys Glu Phe  Gly Gly Asn Ala Lys  Leu Ala Leu
    1130                1135                1140

Ser Asn  Leu Asp Glu Asn Pro  Ile Trp Leu Asn Lys  Glu Lys Gly
    1145                1150                1155

Ile Thr  Ile Lys Arg Val Lys  Ile Ser Gly Val Ser  Asn Val Glu
    1160                1165                1170

Ser Leu  His Val Lys Lys Asp  His Phe Gly Glu Pro  Ile Leu Asp
    1175                1180                1185

Gln Val  Gly Asn Glu Ile Pro  Val Asp Phe Val Ser  Thr Gly Asn
    1190                1195                1200
```

```
Asn His  His Val Ala Ile Tyr  Glu Asp Glu Lys Gly  Asn Leu Gln
    1205                 1210                 1215


Glu Glu  Val Val Ser Phe Phe  Glu Ala Val Val Arg  Gln Asn Gln
    1220                 1225                 1230


Gly Leu  Pro Ile Ile Asn Lys  Asn His Ser Leu Gly  Trp Lys Phe
    1235                 1240                 1245


Leu Phe  Thr Leu Lys Gln Asn  Glu Tyr Phe Val Phe  Pro Ser Asp
    1250                 1255                 1260


Asp Phe  Asp Pro Thr Asp Val  Asp Leu Met Asp Glu  Glu Asn Tyr
    1265                 1270                 1275


His Leu  Ile Ser Pro Asn Leu  Phe Arg Val Gln Lys  Phe Thr Thr
    1280                 1285                 1290


Lys Asp  Tyr Phe Phe Arg His  His Leu Glu Thr Thr  Val Glu Asp
    1295                 1300                 1305


Lys Ser  Glu Leu Lys Gly Val  Ser Phe Lys Arg Leu  Gly Leu Pro
    1310                 1315                 1320


Gly Leu  Asn Cys Ile Lys Lys  Ile Arg Ile Asn His  Leu Gly Lys
    1325                 1330                 1335


Ile Ile  Gln Val Gly Glu Tyr
    1340                 1345


<210>  541
<211>  1091
<212>  PRT
<213>  Mobiluncus mulieris

<400>  541

Met Asp Ser Arg Lys Tyr Arg Val Gly Ile Asp Val Gly Thr Asn Ser
1               5                  10                  15
```

```
Val Gly Phe Ala Ala Val Glu Glu Asp Asp Ser Gly Ser Pro Thr Arg
            20                  25                  30

Phe Leu Asn Thr Met Val Val Ile His Asp Ser Gly Val Asp Ser Glu
        35                  40                  45

Gln Lys Lys Tyr Ala Ile Thr Arg Leu Ala Ser Ala Gly Thr Ala Arg
    50                  55                  60

Arg Thr Arg Arg Leu Tyr Arg Thr Arg Arg Gln Arg Leu Arg Glu Leu
65                  70                  75                  80

Asp Asp Phe Ile Ser Asn Glu Leu Gly Tyr Pro Leu Val Asn Leu Glu
                85                  90                  95

Asn Phe Ala Asp Pro Tyr Glu Pro Trp Lys Val Arg Ala Asp Leu Ala
            100                 105                 110

Thr Thr Lys Leu Pro Asn Asp Glu Leu Pro Glu Ala Met Ser Ile Ala
        115                 120                 125

Leu Arg His Met Ala Arg His Arg Gly Trp Arg Ser Pro Tyr Gln Arg
    130                 135                 140

Val Glu Ala Leu His Leu His Ala Glu Ile Ser Lys Glu Phe Ala Ala
145                 150                 155                 160

Leu Lys Glu Arg Val Val Glu Lys Thr Gly Asp Val Phe Ser Asp Asp
                165                 170                 175

Ala Thr Pro Ala Glu Val Leu Val Asp Leu Met Gly Arg Gln Lys Val
            180                 185                 190

Arg Gly Ala Asp Gly Val Leu Ser Gly Lys Leu Arg Gln Ser Asp Asn
        195                 200                 205
```

```
Ala Asn Glu Leu Arg Lys Ile Ala Ser Val Gln Gly Ile Asp Asp Glu
    210                 215                 220

Thr Leu Asn Arg Ile Ile Asp Arg Val Phe Ser Ser Lys Ser Pro Lys
225                 230                 235                 240

Gly Lys Ala Ser Glu Arg Val Gly Met Asp Ala Leu Pro Gly Gln Gly
                245                 250                 255

Ser Lys Pro Arg Ala Leu Lys Ala Met Pro Ser Phe Gln Lys Phe Arg
            260                 265                 270

Val Val Ser Val Ile Cys Asn Leu Arg Ile Lys Asp Ser Gly Gly Asp
        275                 280                 285

Ala Arg Pro Leu Ser Met Glu Glu Lys Glu Lys Leu Ile Asp Tyr Leu
    290                 295                 300

Met Ser Ser Thr Thr Asp Asp His Val Thr Trp Thr Asp Val Ala Asp
305                 310                 315                 320

Leu Leu His Val Lys Arg Ser Gln Leu Gln Gly Thr Ala Lys Glu Gly
                325                 330                 335

Phe Asp Gly Glu Arg Pro Tyr Thr Arg Pro Pro Val Asn Ser Thr Trp
            340                 345                 350

Ser Lys Ile Lys Asp Ser Lys Ile Lys Ser Leu Val Ala Leu Trp Lys
        355                 360                 365

Thr Gly Asp Val Asp Val Gln Ser Ala Ile Val Glu Ala Leu Ser Asn
    370                 375                 380

Ala Ser Val Leu Glu Asp Ser Arg Pro Gly Ala Asp Ile Val Val Ala
385                 390                 395                 400

Tyr Leu Glu Ser Leu Asp Asp Lys Glu Leu Glu Ser Leu Asp Lys Val
                405                 410                 415
```

```
Gly Leu Pro Ala Gly Arg Ala Ser Tyr Ser Glu Asp Ser Leu Glu Arg
            420                 425                 430

Leu Thr Glu Arg Met Leu Arg Asp Asp Cys Asp Leu Phe Glu Ala Arg
        435                 440                 445

Lys Arg Glu Phe Asn Val Ala Asp Asp Trp Lys Pro Pro Ala Asp Pro
    450                 455                 460

Ile Tyr Ala Pro Val Gly Asn Pro Gly Val Asp Arg Val Leu Lys Ile
465                 470                 475                 480

Val Asn Arg Leu Leu Met Ala Ala Glu Arg Glu Trp Gly Ala Pro Thr
                485                 490                 495

Gln Ile Asn Ile Glu His Val Arg Ser Gly Phe Ser Ser Glu Leu Met
            500                 505                 510

Gln Arg Glu Phe Glu Arg Glu Asn Glu Arg Arg Arg Ala Gln Asn Glu
        515                 520                 525

Glu Ala Val Lys Ala Ile Leu Thr Glu Lys Gly Gly Asn Ser Arg Val
    530                 535                 540

Ser Lys Tyr Asp Ile Thr Arg Tyr Tyr Ala Val Lys Arg Gln His Cys
545                 550                 555                 560

Gln Cys Leu Tyr Cys Gly Thr Pro Ile Thr Phe Ser Asp Cys Glu Leu
                565                 570                 575

Asp His Ile Val Pro Arg Lys Gly Val Gly Ser Thr Asn Thr Arg Val
            580                 585                 590

Asn Leu Ala Ala Ala Cys Arg Ser Cys Asn Arg Asp Lys Ser Asn Leu
        595                 600                 605
```

```
Pro Phe Ala Val Trp Ala Gly Lys Ala Ser Asn Phe Asp Val Ser Ile
    610                 615                 620

Asp Asp Ala Val Ser Arg Val Lys Gln Trp Gln Arg Ser Gln Asn Glu
625                 630                 635                 640

Gly Val Arg Glu Phe Arg Ala Phe Gln Asn Glu Val Ile Ser Arg Leu
                645                 650                 655

Leu Lys Thr Thr Glu Asp Pro Glu Ile Asp Ser Arg Ser Leu Glu Ser
            660                 665                 670

Val Ala Trp Met Ala Arg Glu Leu His His Arg Val Glu Tyr Tyr Phe
        675                 680                 685

Gln Ser Lys Gly Ala Gln Thr Gln Val Ser Val Tyr Arg Gly Ala Val
    690                 695                 700

Thr Ala Gln Ala Arg Lys Ser Ser Gly Leu Glu Asp Lys Val Lys Met
705                 710                 715                 720

Ile Gly Gly Gly Gly Lys Thr Arg Leu Asp Arg Arg His His Ala Met
                725                 730                 735

Asp Ala Ala Thr Ile Ala Leu Met Thr Pro Gly Ile Ser Thr Thr Leu
            740                 745                 750

Ser Glu Lys Asn Asn Leu Arg Asp Ala Gln Lys Phe Thr Gly Gln Ser
        755                 760                 765

Glu Thr Trp Lys Asp Tyr Cys Gly Arg Thr Glu Thr Ala Arg Lys His
    770                 775                 780

Phe Ala Val Trp Lys Ser Asn Met Glu Arg Leu Thr Asp Leu Phe Asn
785                 790                 795                 800

Asp Lys Leu Glu Asn Asp Ala Ile Pro Val Val Gln Pro Leu Arg Leu
                805                 810                 815
```

```
Arg Leu Ser Asn Ser Lys Ala His Asp Asp Gly Ile Gly Lys Leu Asp
            820                 825                 830

Ser Lys Lys Leu Gly Ser Val Trp Ser Leu Ala Asp Ile Asp Arg Ala
        835                 840                 845

Ala Thr Pro Gln Ile Trp Thr Ala Leu Thr Arg Cys Asp Asp Phe Asp
    850                 855                 860

Pro Thr Lys Gly Leu Pro Glu Asn Ala Asn Arg Val Ile Arg Ala Gln
865                 870                 875                 880

Gly Val Lys Tyr Glu Ser Glu Asp Asn Ile Pro Val Phe Pro Ser Asn
                885                 890                 895

Val Ala Ala Ile Ala Val Arg Asp Gly Tyr Ala Glu Ile Gly Ser Thr
            900                 905                 910

Ile His His Ala Arg Ile Tyr Arg Ile Asp Asp Gly Lys Lys Thr Phe
        915                 920                 925

Tyr Ser Met Ile Arg Val Phe Ala Val Asp Leu Leu Lys His Gln Ala
    930                 935                 940

Glu Asp Leu Phe Thr Val Lys Leu Pro Pro Ser Ala Ile Ser Ile Arg
945                 950                 955                 960

Thr Cys Glu Asp Ser Leu Arg Arg Ala Leu Ser Asn Gly Thr Ala Glu
                965                 970                 975

Tyr Leu Gly Trp Leu Val Pro Gly Asp Glu Ile Ile Val Asp Thr Ser
            980                 985                 990

Asp Lys Ala Phe His Thr Gly Gln  Ile Gly Asp Leu Leu  Arg Asn Phe
        995                 1000                1005
```

```
Pro Val  Asn Ser Phe Arg Leu  Thr Gly Phe Pro Ser  Asn Ser Arg
    1010                1015                1020


Leu Arg  Leu Lys Pro Val Leu  Leu Ala Gly Glu Gly  Leu Arg Asp
    1025                1030                1035


Asp Ala  Glu Asp Ser Ile Lys  Lys Ile Leu Leu Gly  Gln Gly Trp
    1040                1045                1050


Arg Pro  Ala Ile Asn Val Leu  Phe Ser Lys Gly Lys  Pro Arg Ile
    1055                1060                1065


Val Arg  Arg Asn Ser Leu Gly  Ile Glu Arg Pro Ser  Ser Asn Asn
    1070                1075                1080


Gly Leu  Pro Phe Ser Trp Glu  Ala
    1085                1090


<210>  542
<211>  1233
<212>  PRT
<213>  Mycoplasma canis

<400>  542

Met Glu Lys Lys Arg Lys Val Thr Leu Gly Phe Asp Leu Gly Ile Ala
1               5                   10                  15


Ser Ile Gly Trp Ala Ile Val Asp Ser Glu Thr Asn Gln Val Tyr Lys
            20                  25                  30


Leu Gly Ser Arg Leu Phe Asp Ala Pro Asp Thr Asn Leu Glu Arg Arg
        35                  40                  45


Thr Gln Arg Gly Thr Arg Arg Leu Leu Arg Arg Arg Lys Tyr Arg Asn
    50                  55                  60


Gln Lys Phe Tyr Asn Leu Val Lys Arg Thr Glu Val Phe Gly Leu Ser
65                  70                  75                  80
```

```
Ser Arg Glu Ala Ile Glu Asn Arg Phe Arg Glu Leu Ser Ile Lys Tyr
                85                  90                  95

Pro Asn Ile Ile Glu Leu Lys Thr Lys Ala Leu Ser Gln Glu Val Cys
            100                 105                 110

Pro Asp Glu Ile Ala Trp Ile Leu His Asp Tyr Leu Lys Asn Arg Gly
        115                 120                 125

Tyr Phe Tyr Asp Glu Lys Glu Thr Lys Glu Asp Phe Asp Gln Gln Thr
    130                 135                 140

Val Glu Ser Met Pro Ser Tyr Lys Leu Asn Glu Phe Tyr Lys Lys Tyr
145                 150                 155                 160

Gly Tyr Phe Lys Gly Ala Leu Ser Gln Pro Thr Glu Ser Glu Met Lys
                165                 170                 175

Asp Asn Lys Asp Leu Lys Glu Ala Phe Phe Phe Asp Phe Ser Asn Lys
            180                 185                 190

Glu Trp Leu Lys Glu Ile Asn Tyr Phe Phe Asn Val Gln Lys Asn Ile
        195                 200                 205

Leu Ser Glu Thr Phe Ile Glu Glu Phe Lys Lys Ile Phe Ser Phe Thr
    210                 215                 220

Arg Asp Ile Ser Lys Gly Pro Gly Ser Asp Asn Met Pro Ser Pro Tyr
225                 230                 235                 240

Gly Ile Phe Gly Glu Phe Gly Asp Asn Gly Gln Gly Gly Arg Tyr Glu
                245                 250                 255

His Ile Trp Asp Lys Asn Ile Gly Lys Cys Ser Ile Phe Thr Asn Glu
            260                 265                 270

Gln Arg Ala Pro Lys Tyr Leu Pro Ser Ala Leu Ile Phe Asn Phe Leu
```

```
        275                 280                 285

Asn Glu Leu Ala Asn Ile Arg Leu Tyr Ser Thr Asp Lys Lys Asn Ile
    290                 295                 300

Gln Pro Leu Trp Lys Leu Ser Ser Ile Asp Lys Leu Asn Ile Leu Leu
305                 310                 315                 320

Asn Leu Phe Asn Leu Pro Ile Ser Glu Lys Lys Lys Lys Leu Thr Asn
                325                 330                 335

Ala Asn Ile Asn Asp Ile Val Lys Lys Glu Ser Thr Lys Ser Ile Met
            340                 345                 350

Leu Ser Val Glu Asp Ile Asp Met Ile Lys Asp Glu Trp Ala Gly Lys
        355                 360                 365

Glu Pro Asn Val Tyr Gly Val Gly Leu Ser Gly Leu Asn Ile Glu Glu
    370                 375                 380

Ser Ala Lys Glu Asn Lys Phe Lys Phe Gln Asp Leu Lys Ile Leu Asn
385                 390                 395                 400

Val Leu Ile Asn Leu Leu Asp Asn Val Gly Ile Lys Phe Glu Phe Lys
                405                 410                 415

Asp Arg Asn Asp Ile Ile Lys Asn Leu Glu Leu Leu Asp Asn Leu Tyr
            420                 425                 430

Leu Phe Leu Ile Tyr Gln Lys Glu Ser Asn Asn Lys Asp Ser Ser Ile
        435                 440                 445

Asp Leu Phe Ile Ala Lys Asn Glu Leu Leu Asn Ile Glu Asn Leu Lys
    450                 455                 460

Leu Lys Leu Lys Glu Phe Leu Leu Gly Ala Gly Asn Glu Phe Glu Asn
465                 470                 475                 480
```

```
His Asn Ser Lys Thr His Ser Leu Ser Lys Lys Ala Ile Asp Ala Ile
               485                 490                 495

Leu Pro Lys Leu Leu Asp Asn Asn Glu Gly Trp Asn Leu Glu Ala Ile
            500                 505                 510

Lys Asn Tyr Asp Glu Glu Ile Lys Ser Gln Ile Glu Asp Asn Ser Ser
        515                 520                 525

Leu Met Ala Lys Gln Asp Lys Lys Tyr Leu Asn Asp Asn Phe Leu Lys
    530                 535                 540

Asp Ala Ile Leu Pro Pro Asn Val Lys Val Thr Phe Gln Gln Ala Ile
545                 550                 555                 560

Leu Ile Phe Asn Lys Ile Ile Gln Lys Phe Ser Lys Asp Phe Glu Ile
               565                 570                 575

Asp Lys Val Val Ile Glu Leu Ala Arg Glu Met Thr Gln Asp Gln Glu
            580                 585                 590

Asn Asp Ala Leu Lys Gly Ile Ala Lys Ala Gln Lys Ser Lys Lys Ser
        595                 600                 605

Leu Val Glu Glu Arg Leu Glu Ala Asn Asn Ile Asp Lys Ser Val Phe
    610                 615                 620

Asn Asp Lys Tyr Glu Lys Leu Ile Tyr Lys Ile Phe Leu Trp Ile Ser
625                 630                 635                 640

Gln Asp Phe Lys Asp Pro Tyr Thr Gly Ala Gln Ile Ser Thr Asn Glu
               645                 650                 655

Ile Val Asn Asn Lys Val Glu Ile Asp His Ile Ile Pro Tyr Ser Leu
            660                 665                 670

Cys Phe Asp Asp Ser Ser Ala Asn Lys Val Leu Val His Lys Gln Ser
```

```
        675                 680                 685

Asn Gln Glu Lys Ser Asn Ser Leu Pro Tyr Glu Tyr Ile Lys Gln Gly
    690                 695                 700

His Ser Gly Trp Asn Trp Asp Glu Phe Thr Lys Tyr Val Lys Arg Val
705                 710                 715                 720

Phe Val Asn Asn Val Asp Ser Ile Leu Ser Lys Lys Glu Arg Leu Lys
                725                 730                 735

Lys Ser Glu Asn Leu Leu Thr Thr Ser Tyr Asp Gly Tyr Asp Lys Leu
            740                 745                 750

Gly Phe Leu Ala Arg Asn Leu Asn Asp Thr Arg Tyr Ala Thr Ile Leu
        755                 760                 765

Phe Arg Asp Gln Leu Asn Asn Tyr Ala Glu His His Leu Ile Asp Asn
    770                 775                 780

Lys Lys Met Phe Lys Val Ile Ala Met Asn Gly Ala Val Thr Ser Phe
785                 790                 795                 800

Ile Arg Lys Asn Met Ser Tyr Asp Asn Lys Leu Arg Leu Lys Asp Arg
                805                 810                 815

Ser Asp Phe Ser His His Ala Tyr Asp Ala Ala Ile Ile Ala Leu Phe
            820                 825                 830

Ser Asn Lys Thr Lys Thr Leu Tyr Asn Leu Ile Asp Pro Ser Leu Asn
        835                 840                 845

Gly Ile Ile Ser Lys Arg Ser Glu Gly Tyr Trp Val Ile Glu Asp Arg
    850                 855                 860

Tyr Thr Gly Glu Ile Lys Glu Leu Lys Lys Glu Asp Trp Thr Ser Ile
865                 870                 875                 880
```

```
Lys Asn Asn Val Gln Ala Arg Lys Ile Ala Lys Glu Ile Glu Glu Tyr
               885                 890                 895


Leu Ile Asp Leu Asp Asp Glu Val Phe Phe Ser Arg Lys Thr Lys Arg
            900                 905                 910


Lys Thr Asn Arg Gln Leu Tyr Asn Glu Thr Ile Tyr Gly Ile Ala Ala
        915                 920                 925


Lys Thr Asp Glu Asp Gly Ile Thr Asn Tyr Tyr Lys Lys Glu Lys Phe
    930                 935                 940


Ser Ile Leu Asp Asp Lys Asp Ile Tyr Leu Arg Leu Leu Arg Glu Arg
945                 950                 955                 960


Glu Lys Phe Val Ile Asn Gln Ser Asn Pro Glu Val Ile Asp Gln Ile
               965                 970                 975


Ile Glu Ile Ile Glu Ser Tyr Gly Lys Glu Asn Asn Ile Pro Ser Arg
            980                 985                 990


Asp Glu Ala Ile Asn Ile Lys Tyr  Thr Lys Asn Lys Ile  Asn Tyr Asn
        995                 1000                1005


Leu Tyr  Leu Lys Gln Tyr Met  Arg Ser Leu Thr Lys  Ser Leu Asp
    1010                1015                1020


Gln Phe  Ser Glu Glu Phe Ile  Asn Gln Met Ile Ala  Asn Lys Thr
    1025                1030                1035


Phe Val  Leu Tyr Asn Pro Thr  Lys Asn Thr Thr Arg  Lys Ile Lys
    1040                1045                1050


Phe Leu  Arg Leu Val Asn Asp  Val Lys Ile Asn Asp  Ile Arg Lys
    1055                1060                1065


Asn Gln  Val Ile Asn Lys Phe  Asn Gly Lys Asn Asn  Glu Pro Lys
```

```
    1070                1075                1080

Ala Phe  Tyr Glu Asn Ile Asn  Ser Leu Gly Ala Ile  Val Phe Lys
    1085                1090                1095

Asn Ser  Ala Asn Asn Phe Lys  Thr Leu Ser Ile Asn  Thr Gln Ile
    1100                1105                1110

Ala Ile  Phe Gly Asp Lys Asn  Trp Asp Ile Glu Asp  Phe Lys Thr
    1115                1120                1125

Tyr Asn  Met Glu Lys Ile Glu  Lys Tyr Lys Glu Ile  Tyr Gly Ile
    1130                1135                1140

Asp Lys  Thr Tyr Asn Phe His  Ser Phe Ile Phe Pro  Gly Thr Ile
    1145                1150                1155

Leu Leu  Asp Lys Gln Asn Lys  Glu Phe Tyr Tyr Ile  Ser Ser Ile
    1160                1165                1170

Gln Thr  Val Arg Asp Ile Ile  Glu Ile Lys Phe Leu  Asn Lys Ile
    1175                1180                1185

Glu Phe  Lys Asp Glu Asn Lys  Asn Pro Asp Thr Ser  Lys Thr Pro
    1190                1195                1200

Lys Arg  Leu Met Phe Gly Ile  Lys Ser Ile Met Asn  Asn Tyr Glu
    1205                1210                1215

Gln Val  Asp Ile Ser Pro Phe  Gly Ile Asn Lys Lys  Ile Phe Glu
    1220                1225                1230
```

<210> 543
<211> 1233
<212> PRT
<213> Mycoplasma canis

<400> 543

```
Met Glu Lys Lys Arg Lys Val Thr Leu Gly Phe Asp Leu Gly Ile Ala
1               5                   10                  15

Ser Val Gly Trp Ala Ile Val Asp Ser Glu Thr Asn Gln Val Tyr Lys
            20                  25                  30

Leu Gly Ser Arg Leu Phe Asp Ala Pro Asp Thr Asn Leu Glu Arg Arg
        35                  40                  45

Thr Gln Arg Gly Thr Arg Arg Leu Leu Arg Arg Arg Lys Tyr Arg Asn
    50                  55                  60

Gln Lys Phe Tyr Asn Leu Val Lys Arg Thr Glu Val Phe Gly Leu Ser
65                  70                  75                  80

Ser Arg Glu Ala Ile Glu Asn Arg Phe Arg Glu Leu Ser Ile Lys Tyr
                85                  90                  95

Pro Asn Ile Ile Glu Leu Lys Thr Lys Ala Leu Ser Gln Glu Val Cys
            100                 105                 110

Pro Asp Glu Ile Ala Trp Ile Leu His Asp Tyr Leu Lys Asn Arg Gly
        115                 120                 125

Tyr Phe Tyr Asp Glu Lys Glu Thr Lys Glu Asp Phe Asp Gln Gln Thr
    130                 135                 140

Ile Glu Ser Met Pro Ser Tyr Lys Leu Asn Glu Phe Tyr Lys Lys Tyr
145                 150                 155                 160

Gly Tyr Phe Lys Gly Ala Leu Ser Gln Pro Thr Glu Ser Glu Met Lys
                165                 170                 175

Asp Asn Lys Asp Leu Lys Glu Ala Phe Phe Phe Asp Phe Ser Asn Lys
            180                 185                 190

Glu Trp Leu Lys Glu Ile Asn Tyr Phe Phe Asn Val Gln Lys Asn Ile
        195                 200                 205
```

```
Leu Ser Glu Thr Phe Ile Glu Glu Phe Lys Lys Ile Phe Ser Phe Thr
    210                 215                 220

Arg Asp Ile Ser Lys Gly Pro Gly Ser Asp Asn Met Pro Ser Pro Tyr
225                 230                 235                 240

Gly Ile Phe Gly Glu Phe Gly Asp Asn Gly Gln Gly Gly Arg Tyr Glu
                245                 250                 255

His Ile Trp Asp Lys Asn Ile Gly Lys Cys Ser Ile Phe Thr Asn Glu
            260                 265                 270

Gln Arg Ala Pro Lys Tyr Leu Pro Ser Ala Leu Ile Phe Asn Phe Leu
        275                 280                 285

Asn Glu Leu Ala Asn Ile Arg Leu Tyr Ser Thr Asp Lys Lys Asn Ile
    290                 295                 300

Gln Pro Leu Trp Lys Leu Ser Ser Ile Asp Lys Leu Asn Ile Leu Leu
305                 310                 315                 320

Asn Leu Phe Asn Leu Pro Ile Ser Glu Lys Lys Lys Lys Leu Thr Ser
                325                 330                 335

Ala Asn Ile Asn Asp Ile Val Lys Lys Glu Ser Thr Lys Ser Ile Met
            340                 345                 350

Leu Ser Val Glu Asp Ile Asp Met Ile Lys Asp Glu Trp Ala Gly Lys
        355                 360                 365

Glu Pro Asn Val Tyr Gly Val Gly Leu Ser Gly Leu Asn Ile Glu Glu
    370                 375                 380

Ser Ala Lys Glu Asn Lys Phe Lys Phe Gln Asp Leu Lys Ile Leu Asn
385                 390                 395                 400
```

```
Val Leu Ile Asn Leu Leu Asp Asn Val Gly Ile Lys Phe Glu Phe Lys
                405                 410                 415

Asp Arg Asn Asp Ile Ile Lys Asn Leu Glu Leu Leu Asp Asn Leu Tyr
            420                 425                 430

Leu Phe Leu Ile Tyr Gln Lys Glu Ser Asn Asn Lys Asp Ser Ser Ile
        435                 440                 445

Asp Leu Phe Ile Ala Lys Asn Glu Ser Leu Asn Ile Glu Asn Leu Lys
    450                 455                 460

Leu Lys Leu Lys Glu Phe Leu Leu Gly Ala Gly Asn Glu Phe Glu Asn
465                 470                 475                 480

His Asn Ser Lys Thr His Ser Leu Ser Lys Lys Ala Ile Asp Ala Ile
                485                 490                 495

Leu Pro Lys Leu Leu Asp Asn Asn Glu Gly Trp Asn Leu Glu Ala Ile
            500                 505                 510

Lys Asn Tyr Asp Glu Glu Ile Lys Ser Gln Ile Glu Asp Asn Ser Phe
        515                 520                 525

Leu Met Ala Lys Gln Asp Lys Lys Tyr Leu Asn Asp Asn Phe Leu Lys
    530                 535                 540

Asp Ala Ile Leu Pro Pro Asn Val Lys Val Thr Phe Gln Gln Ala Ile
545                 550                 555                 560

Leu Ile Phe Asn Lys Ile Ile Gln Lys Phe Ser Lys Asp Phe Glu Ile
                565                 570                 575

Asp Lys Val Val Ile Glu Leu Ala Arg Glu Met Thr Gln Asp Gln Glu
            580                 585                 590

Asn Asp Ala Leu Lys Gly Ile Ala Lys Ala Gln Lys Ser Lys Lys Ser
        595                 600                 605
```

```
Leu Val Glu Glu Arg Leu Glu Ala Asn Asn Ile Asp Lys Ser Val Phe
    610                 615                 620

Asn Glu Lys Tyr Glu Lys Leu Ile Tyr Lys Ile Phe Leu Trp Ile Ser
625                 630                 635                 640

Gln Asp Phe Lys Asp Pro Tyr Thr Gly Ala Lys Ile Ser Ala Asn Glu
                645                 650                 655

Ile Val Asp Asn Lys Val Glu Ile Asp His Ile Ile Pro Tyr Ser Leu
            660                 665                 670

Cys Phe Asp Asp Ser Ser Ala Asn Lys Val Leu Val His Lys Gln Ser
        675                 680                 685

Asn Gln Glu Lys Ser Asn Ser Leu Pro Tyr Glu Tyr Ile Lys Gln Gly
    690                 695                 700

His Ser Gly Trp Asn Trp Asp Glu Phe Thr Lys Tyr Val Lys Arg Val
705                 710                 715                 720

Phe Val Asn Asn Val Asp Ser Ile Leu Ser Lys Lys Glu Arg Leu Lys
                725                 730                 735

Lys Ser Glu Asn Leu Leu Thr Thr Ser Tyr Asp Gly Tyr Asp Lys Leu
            740                 745                 750

Gly Phe Leu Ala Arg Asn Leu Asn Asp Thr Arg Tyr Ala Thr Ile Leu
        755                 760                 765

Phe Arg Asp Gln Leu Asn Asn Tyr Ala Glu His His Leu Ile Asp Asp
    770                 775                 780

Lys Lys Met Phe Lys Val Ile Ala Met Asn Gly Ala Val Thr Ser Phe
785                 790                 795                 800
```

```
Ile Arg Lys Asn Met Ser Tyr Asp Asn Lys Leu Arg Leu Lys Asn Arg
                805                 810                 815

Asn Asp Phe Ser His His Ala Tyr Asp Ala Ala Ile Ile Ala Leu Phe
            820                 825                 830

Ser Asn Lys Thr Lys Thr Leu Tyr Asn Leu Ile Asp Pro Ser Leu Asn
        835                 840                 845

Gly Ile Ile Ser Lys Arg Ser Glu Gly Tyr Trp Val Ile Glu Asp Arg
    850                 855                 860

Tyr Thr Gly Glu Ile Lys Glu Leu Lys Lys Glu Asp Trp Thr Ser Ile
865                 870                 875                 880

Lys Asn Asn Val Gln Ala Arg Lys Ile Ala Lys Glu Ile Glu Glu Tyr
                885                 890                 895

Leu Ile Asp Leu Asp Asp Glu Val Phe Phe Ser Arg Lys Thr Lys Arg
            900                 905                 910

Lys Thr Asn Arg Gln Leu Tyr Asn Glu Thr Ile Tyr Gly Ile Ala Ala
        915                 920                 925

Lys Thr Asp Glu Asp Gly Ile Thr Asn Tyr Tyr Lys Lys Glu Lys Leu
    930                 935                 940

Ser Ile Leu Asp Asp Lys Asp Ile Tyr Leu Arg Leu Leu Arg Glu Arg
945                 950                 955                 960

Glu Lys Phe Val Ile Asn Gln Ser Asn Pro Glu Val Ile Asp Gln Ile
                965                 970                 975

Ile Glu Ile Ile Glu Ser Tyr Gly Lys Glu Asn Asn Ile Pro Ser Arg
            980                 985                 990

Asp Glu Ala Ile Asn Ile Lys Tyr  Thr Lys Asn Lys Ile  Asn Tyr Asn
        995                 1000                1005
```

```
Leu Tyr  Leu Lys Gln Tyr Met  Arg Ser Leu Thr Lys  Ser Leu Asp
    1010                1015                1020

Gln Phe  Ser Glu Glu Phe Ile  Asn Gln Met Ile Ala  Asn Lys Thr
    1025                1030                1035

Phe Val  Leu Tyr Asn Pro Thr  Lys Asn Thr Thr Arg  Lys Ile Lys
    1040                1045                1050

Phe Leu  Arg Leu Val Asn Asp  Val Lys Ile Asn Asp  Ile Arg Lys
    1055                1060                1065

Asn Gln  Val Ile Asn Lys Phe  Asn Gly Lys Asn Asn  Glu Pro Lys
    1070                1075                1080

Ala Phe  Tyr Glu Asn Ile Asn  Ser Leu Gly Ala Ile  Val Phe Lys
    1085                1090                1095

Asn Ser  Ala Asn Asn Phe Lys  Thr Leu Ser Ile Asn  Thr Gln Ile
    1100                1105                1110

Ala Ile  Phe Gly Asp Lys Asn  Trp Asp Ile Glu Asp  Phe Lys Thr
    1115                1120                1125

Tyr Asn  Met Glu Lys Ile Glu  Lys Tyr Lys Glu Ile  Tyr Gly Ile
    1130                1135                1140

Asp Lys  Thr Tyr Asn Phe His  Ser Phe Ile Phe Pro  Gly Thr Ile
    1145                1150                1155

Leu Leu  Asp Lys Gln Asn Lys  Glu Phe Tyr Tyr Ile  Ser Ser Ile
    1160                1165                1170

Gln Thr  Val Arg Asp Ile Ile  Glu Ile Lys Phe Leu  Asn Lys Ile
    1175                1180                1185
```

```
Glu Phe  Lys Asp Glu Asn Lys  Asn Gln Asp Thr Ser  Lys Thr Pro
    1190                1195                1200


Lys Arg  Leu Met Phe Gly Ile  Lys Ser Ile Met Asn  Asn Tyr Glu
    1205                1210                1215


Gln Val  Asp Ile Ser Pro Phe  Gly Ile Asn Lys Lys  Ile Phe Glu
    1220                1225                1230
```

<210> 544
<211> 1233
<212> PRT
<213> Mycoplasma canis

<400> 544

```
Met Glu Lys Lys Arg Lys Val Thr Leu Gly Phe Asp Leu Gly Ile Ala
1               5                   10                  15


Ser Val Gly Trp Ala Ile Val Asp Ser Glu Thr Asn Gln Val Tyr Lys
            20                  25                  30


Leu Gly Ser Arg Leu Phe Asp Ala Pro Asp Thr Asn Leu Glu Arg Arg
        35                  40                  45


Thr Gln Arg Gly Thr Arg Arg Leu Leu Arg Arg Arg Lys Tyr Arg Asn
    50                  55                  60


Gln Lys Phe Tyr Asn Leu Val Lys Arg Thr Glu Val Phe Gly Leu Ser
65                  70                  75                  80


Ser Arg Glu Ala Ile Glu Asn Arg Phe Arg Glu Leu Ser Ile Lys Tyr
                85                  90                  95


Pro Asn Ile Ile Glu Leu Lys Thr Lys Ala Leu Ser Gln Glu Val Cys
            100                 105                 110


Pro Asp Glu Ile Ala Trp Ile Leu His Asp Tyr Leu Lys Asn Arg Gly
        115                 120                 125
```

```
Tyr Phe Tyr Asp Glu Lys Glu Thr Lys Glu Asp Phe Asp Gln Gln Thr
    130                 135                 140

Val Glu Ser Met Pro Ser Tyr Lys Leu Asn Glu Phe Tyr Lys Lys Tyr
145                 150                 155                 160

Gly Tyr Phe Lys Gly Ala Leu Ser Gln Pro Thr Glu Ser Glu Met Lys
                165                 170                 175

Asp Asn Lys Asp Leu Lys Glu Ala Phe Phe Phe Asp Phe Ser Asn Lys
            180                 185                 190

Glu Trp Leu Lys Glu Ile Asn Tyr Phe Phe Asn Val Gln Lys Asn Ile
        195                 200                 205

Leu Ser Glu Thr Phe Ile Glu Glu Phe Lys Lys Ile Phe Ser Phe Thr
    210                 215                 220

Arg Asp Ile Ser Lys Gly Pro Gly Ser Asp Asn Met Pro Ser Pro Tyr
225                 230                 235                 240

Gly Ile Phe Gly Glu Phe Gly Asp Asn Gly Gln Gly Gly Arg Tyr Glu
                245                 250                 255

His Ile Trp Asp Lys Asn Ile Gly Lys Cys Ser Ile Phe Thr Asn Glu
            260                 265                 270

Gln Arg Ala Pro Lys Tyr Leu Pro Ser Ala Leu Ile Phe Asn Phe Leu
        275                 280                 285

Asn Glu Leu Ala Asn Ile Arg Leu Tyr Ser Thr Asp Lys Lys Asn Ile
    290                 295                 300

Gln Pro Leu Trp Lys Leu Ser Ser Val Asp Lys Leu Asn Ile Leu Leu
305                 310                 315                 320

Asn Leu Phe Asn Leu Pro Ile Ser Glu Lys Lys Lys Lys Leu Thr Ser
```

```
                325                 330                 335

Thr Asn Ile Asn Asp Ile Val Lys Lys Glu Ser Ile Lys Ser Ile Met
            340                 345                 350

Ile Ser Val Glu Asp Ile Asp Met Ile Lys Asp Glu Trp Ala Gly Lys
        355                 360                 365

Glu Pro Asn Val Tyr Gly Val Gly Leu Ser Gly Leu Asn Ile Glu Glu
    370                 375                 380

Ser Ala Lys Glu Asn Lys Phe Lys Phe Gln Asp Leu Lys Ile Leu Asn
385                 390                 395                 400

Val Leu Ile Asn Leu Leu Asp Asn Val Gly Ile Lys Phe Glu Phe Lys
                405                 410                 415

Asp Arg Asn Asp Ile Ile Lys Asn Leu Glu Leu Leu Asp Asn Leu Tyr
            420                 425                 430

Leu Phe Leu Ile Tyr Gln Lys Glu Ser Asn Asn Lys Asp Ser Ser Ile
        435                 440                 445

Asp Leu Phe Ile Ala Lys Asn Glu Ser Leu Asn Ile Glu Asn Leu Lys
    450                 455                 460

Leu Lys Leu Lys Glu Phe Leu Leu Gly Ala Gly Asn Glu Phe Glu Asn
465                 470                 475                 480

His Asn Ser Lys Thr His Ser Leu Ser Lys Lys Ala Ile Asp Glu Ile
                485                 490                 495

Leu Pro Lys Leu Leu Asp Asn Asn Glu Gly Trp Asn Leu Glu Ala Ile
            500                 505                 510

Lys Asn Tyr Asp Glu Glu Ile Lys Ser Gln Ile Glu Asp Asn Ser Ser
        515                 520                 525
```

```
Leu Met Ala Lys Gln Asp Lys Lys Tyr Leu Asn Asp Asn Phe Leu Lys
    530                 535                 540

Asp Ala Ile Leu Pro Pro Asn Val Lys Val Thr Phe Gln Gln Ala Ile
545                 550                 555                 560

Leu Ile Phe Asn Lys Ile Ile Gln Lys Phe Ser Lys Asp Phe Glu Ile
                565                 570                 575

Asp Lys Val Val Ile Glu Leu Ala Arg Glu Met Thr Gln Asp Gln Glu
            580                 585                 590

Asn Asp Ala Leu Lys Gly Ile Ala Lys Ala Gln Lys Ser Lys Lys Ser
        595                 600                 605

Leu Val Glu Glu Arg Leu Glu Ala Asn Asn Ile Asp Lys Ser Val Phe
    610                 615                 620

Asn Asp Lys Tyr Glu Lys Leu Ile Tyr Lys Ile Phe Leu Trp Ile Ser
625                 630                 635                 640

Gln Asp Phe Lys Asp Pro Tyr Thr Gly Ala Gln Ile Ser Val Asn Glu
                645                 650                 655

Ile Val Asn Asn Lys Val Glu Ile Asp His Ile Ile Pro Tyr Ser Leu
            660                 665                 670

Cys Phe Asp Asp Ser Ser Ala Asn Lys Val Leu Val His Lys Gln Ser
        675                 680                 685

Asn Gln Glu Lys Ser Asn Ser Leu Pro Tyr Glu Tyr Ile Lys Gln Gly
    690                 695                 700

His Ser Gly Trp Asn Trp Asp Glu Phe Thr Lys Tyr Val Lys Arg Val
705                 710                 715                 720

Phe Val Asn Asn Val Asp Ser Ile Leu Ser Lys Lys Glu Arg Leu Lys
```

```
                725                 730                 735

Lys Ser Glu Asn Leu Leu Thr Ala Ser Tyr Asp Gly Tyr Asp Lys Leu
            740                 745                 750

Gly Phe Leu Ala Arg Asn Leu Asn Asp Thr Arg Tyr Ala Thr Ile Leu
        755                 760                 765

Phe Arg Asp Gln Leu Asn Asn Tyr Ala Glu His His Leu Ile Asp Asn
    770                 775                 780

Lys Lys Met Phe Lys Val Ile Ala Met Asn Gly Ala Val Thr Ser Phe
785                 790                 795                 800

Ile Arg Lys Asn Met Ser Tyr Asp Asn Lys Leu Arg Leu Lys Asp Arg
                805                 810                 815

Ser Asp Phe Ser His His Ala Tyr Asp Ala Ala Ile Ile Ala Leu Phe
            820                 825                 830

Ser Asn Lys Thr Lys Thr Leu Tyr Asn Leu Ile Asp Pro Ser Leu Asn
        835                 840                 845

Gly Ile Ile Ser Lys Arg Ser Glu Gly Tyr Trp Val Ile Glu Asp Arg
    850                 855                 860

Tyr Thr Gly Glu Ile Lys Glu Leu Lys Lys Glu Asp Trp Thr Ser Ile
865                 870                 875                 880

Lys Asn Asn Val Gln Ala Arg Lys Ile Ala Lys Glu Ile Glu Glu Tyr
                885                 890                 895

Leu Ile Asp Leu Asp Asp Glu Val Phe Phe Ser Arg Lys Thr Lys Arg
            900                 905                 910

Lys Thr Asn Arg Gln Leu Tyr Asn Glu Thr Ile Tyr Gly Ile Ala Thr
        915                 920                 925
```

```
Lys Thr Asp Glu Asp Gly Ile Thr Asn Tyr Tyr Lys Lys Glu Lys Phe
    930                 935                 940

Ser Ile Leu Asp Asp Lys Asp Ile Tyr Leu Arg Leu Leu Arg Glu Arg
945                 950                 955                 960

Glu Lys Phe Val Ile Asn Gln Ser Asn Pro Glu Val Ile Asp Gln Ile
                965                 970                 975

Ile Glu Ile Ile Glu Ser Tyr Gly Lys Glu Asn Asn Ile Pro Ser Arg
            980                 985                 990

Asp Glu Ala Ile Asn Ile Lys Tyr  Thr Lys Asn Lys Ile  Asn Tyr Asn
        995                 1000                1005

Leu Tyr  Leu Lys Gln Tyr Met  Arg Ser Leu Thr Lys  Ser Leu Asp
    1010                1015                1020

Gln Phe  Ser Glu Glu Phe Ile  Asn Gln Met Ile Ala  Asn Lys Thr
    1025                1030                1035

Phe Val  Leu Tyr Asn Pro Thr  Lys Asn Thr Thr Arg  Lys Ile Lys
    1040                1045                1050

Phe Leu  Arg Leu Val Asn Asp  Val Lys Ile Asn Asp  Ile Arg Lys
    1055                1060                1065

Asn Gln  Val Ile Asn Lys Phe  Asn Gly Lys Asn Asn  Glu Pro Lys
    1070                1075                1080

Ala Phe  Tyr Glu Asn Ile Asn  Ser Leu Gly Ala Ile  Val Phe Lys
    1085                1090                1095

Asn Ser  Ala Asn Asn Phe Lys  Thr Leu Ser Ile Asn  Thr Gln Ile
    1100                1105                1110

Ala Ile  Phe Gly Asp Lys Asn  Trp Asp Ile Glu Asp  Phe Lys Thr
```

```
    1115                1120                1125


Tyr Asn  Met Glu Lys Ile Glu  Lys Tyr Lys Glu Ile  Tyr Gly Ile
    1130                1135                1140


Asp Lys  Thr Tyr Asn Phe His  Ser Phe Ile Phe Pro  Gly Thr Ile
    1145                1150                1155


Leu Leu  Asp Lys Gln Asn Lys  Glu Phe Tyr Tyr Ile  Ser Ser Ile
    1160                1165                1170


Gln Thr  Val Arg Asp Ile Ile  Glu Ile Lys Phe Leu  Asn Lys Ile
    1175                1180                1185


Glu Phe  Lys Asp Glu Asn Lys  Asn Gln Asp Thr Ser  Lys Thr Pro
    1190                1195                1200


Lys Arg  Leu Met Phe Gly Ile  Lys Ser Ile Met Asn  Asn Tyr Glu
    1205                1210                1215


Gln Val  Asp Ile Ser Pro Phe  Gly Ile Asn Lys Lys  Ile Phe Glu
    1220                1225                1230


<210>  545
<211>  1233
<212>  PRT
<213>  Mycoplasma canis

<400>  545

Met Glu Lys Lys Arg Lys Val Thr Leu Gly Phe Asp Leu Gly Ile Ala
1               5                   10                  15


Ser Val Gly Trp Ala Ile Val Asp Ser Glu Thr Asn Gln Val Tyr Lys
            20                  25                  30


Leu Gly Ser Arg Leu Phe Asp Ala Pro Asp Thr Asn Leu Glu Arg Arg
        35                  40                  45
```

```
Thr Gln Arg Gly Thr Arg Arg Leu Leu Arg Arg Arg Lys Tyr Arg Asn
    50                  55                  60

Gln Lys Phe Tyr Asn Leu Val Lys Arg Thr Glu Val Phe Gly Leu Ser
65                  70                  75                  80

Ser Arg Glu Ala Ile Glu Asn Arg Phe Arg Glu Leu Ser Ile Lys Tyr
                85                  90                  95

Pro Asn Ile Ile Glu Leu Lys Thr Lys Ala Leu Ser Gln Glu Val Cys
            100                 105                 110

Pro Asp Glu Ile Ala Trp Ile Leu His Asp Tyr Leu Lys Asn Arg Gly
        115                 120                 125

Tyr Phe Tyr Asp Glu Lys Glu Thr Lys Glu Asp Phe Asp Gln Gln Thr
    130                 135                 140

Val Glu Ser Met Pro Ser Tyr Lys Leu Asn Glu Phe Tyr Lys Lys Tyr
145                 150                 155                 160

Gly Tyr Phe Lys Gly Ala Leu Ser Gln Pro Thr Glu Ser Glu Met Lys
                165                 170                 175

Asp Asn Lys Asp Leu Lys Glu Ala Phe Phe Phe Asp Phe Ser Asn Lys
            180                 185                 190

Glu Trp Leu Lys Glu Ile Asn Tyr Phe Phe Asn Val Gln Lys Asn Ile
        195                 200                 205

Leu Ser Glu Thr Phe Ile Glu Glu Phe Lys Lys Ile Phe Ser Phe Thr
    210                 215                 220

Arg Asp Ile Ser Lys Gly Pro Gly Ser Asp Asn Met Pro Ser Pro Tyr
225                 230                 235                 240

Gly Ile Phe Gly Glu Phe Gly Asp Asn Gly Gln Gly Gly Arg Tyr Glu
                245                 250                 255
```

```
His Ile Trp Asp Lys Asn Ile Gly Lys Cys Ser Ile Phe Thr Asn Glu
            260                 265                 270

Gln Arg Ala Pro Lys Tyr Leu Pro Ser Ala Leu Ile Phe Asn Phe Leu
        275                 280                 285

Asn Glu Leu Ala Asn Ile Arg Leu Tyr Ser Thr Asp Lys Lys Asn Ile
    290                 295                 300

Gln Pro Leu Trp Lys Leu Ser Ser Val Asp Lys Leu Asn Ile Leu Leu
305                 310                 315                 320

Asn Leu Phe Asn Leu Pro Ile Ser Glu Lys Lys Lys Lys Leu Thr Ser
                325                 330                 335

Thr Asn Ile Asn Asp Ile Val Lys Lys Glu Ser Ile Lys Ser Ile Met
            340                 345                 350

Ile Ser Val Glu Asp Ile Asp Met Ile Lys Asp Glu Trp Ala Gly Lys
        355                 360                 365

Glu Pro Asn Val Tyr Gly Val Gly Leu Ser Gly Leu Asn Ile Glu Glu
    370                 375                 380

Asn Ala Lys Glu Asn Lys Phe Lys Phe Gln Asp Leu Lys Ile Leu Asn
385                 390                 395                 400

Val Leu Ile Asn Leu Leu Asp Asn Val Gly Ile Lys Phe Glu Phe Lys
                405                 410                 415

Asp Arg Asn Asp Ile Ile Lys Asn Leu Glu Leu Leu Asp Asn Leu Tyr
            420                 425                 430

Leu Phe Leu Ile Tyr Gln Lys Glu Ser Asn Asn Lys Asp Ser Ser Ile
        435                 440                 445
```

```
Asp Leu Phe Ile Ala Lys Asn Lys Ser Leu Asn Ile Glu Asn Leu Lys
    450                 455                 460

Leu Lys Leu Lys Glu Phe Leu Leu Gly Ala Gly Asn Glu Phe Glu Asn
465                 470                 475                 480

His Asn Ser Lys Ser His Ser Leu Ser Lys Lys Ala Ile Asp Ala Ile
                485                 490                 495

Leu Pro Lys Leu Leu Asp Asn Asn Glu Gly Trp Asn Leu Glu Ala Ile
            500                 505                 510

Lys Asn Tyr Asp Glu Glu Ile Lys Ser Gln Ile Glu Asp Asn Ser Ser
        515                 520                 525

Leu Met Ala Lys Gln Asp Lys Lys Tyr Leu Asn Asp Asn Phe Leu Lys
    530                 535                 540

Asp Ala Ile Leu Pro Pro Asn Val Lys Val Thr Phe Gln Gln Ala Ile
545                 550                 555                 560

Leu Ile Phe Asn Lys Ile Ile Gln Lys Phe Ser Lys Asp Phe Glu Ile
                565                 570                 575

Asp Lys Val Val Ile Glu Leu Ala Arg Glu Met Thr Gln Asp Gln Glu
            580                 585                 590

Asn Asp Ala Leu Lys Gly Met Ala Lys Ala Gln Lys Ser Lys Lys Ser
        595                 600                 605

Leu Val Glu Glu Arg Leu Glu Ala Asn Asn Ile Asp Lys Ser Val Phe
    610                 615                 620

Asn Asp Lys Tyr Glu Lys Leu Ile Tyr Lys Ile Phe Leu Trp Ile Ser
625                 630                 635                 640

Gln Asp Phe Lys Asp Pro Tyr Thr Gly Ala Gln Ile Ser Val Asn Glu
                645                 650                 655
```

```
Ile Val Asn Asn Lys Val Glu Ile Asp His Ile Ile Pro Tyr Ser Leu
            660                 665                 670

Cys Phe Asp Asp Ser Ser Ala Asn Lys Val Leu Val His Lys Gln Ser
        675                 680                 685

Asn Gln Glu Lys Ser Asn Ser Leu Pro Tyr Glu Tyr Ile Lys Gln Gly
    690                 695                 700

His Ser Gly Trp Asn Trp Asp Glu Phe Thr Lys Tyr Val Lys Arg Val
705                 710                 715                 720

Phe Val Asn Asn Val Asp Ser Ile Leu Ser Lys Lys Glu Arg Leu Lys
                725                 730                 735

Lys Ser Glu Asn Leu Leu Thr Thr Ser Tyr Asp Gly Tyr Asp Lys Leu
            740                 745                 750

Gly Phe Leu Ala Arg Asn Leu Asn Asp Thr Arg Tyr Ala Thr Ile Leu
        755                 760                 765

Phe Arg Asp Gln Leu Asn Asn Tyr Ala Glu His His Leu Ile Asp Asn
    770                 775                 780

Lys Lys Met Phe Lys Val Ile Ala Met Asn Gly Ala Val Thr Ser Phe
785                 790                 795                 800

Ile Arg Lys Asn Met Ser Tyr Asp Asn Lys Leu Arg Leu Lys Asp Arg
                805                 810                 815

Ser Asp Phe Ser His His Ala Tyr Asp Ala Ala Ile Ile Ala Leu Phe
            820                 825                 830

Ser Asn Lys Thr Lys Thr Leu Tyr Asn Leu Ile Asp Pro Ser Leu Asn
        835                 840                 845
```

```
Gly Ile Ile Ser Lys Arg Ser Glu Gly Tyr Trp Val Ile Glu Asp Arg
    850                 855                 860

Tyr Thr Gly Glu Ile Lys Glu Leu Lys Lys Glu Asp Trp Thr Ser Ile
865                 870                 875                 880

Lys Asn Asn Val Gln Ala Arg Lys Ile Ala Lys Glu Ile Glu Glu Tyr
                885                 890                 895

Leu Ile Asp Leu Asp Asp Glu Val Phe Phe Ser Arg Lys Thr Lys Arg
            900                 905                 910

Lys Thr Asn Arg Gln Leu Tyr Asn Glu Thr Ile Tyr Gly Ile Ala Ala
        915                 920                 925

Lys Thr Asp Glu Asp Gly Ile Thr Asn Tyr Tyr Lys Lys Glu Lys Phe
    930                 935                 940

Ser Ile Leu Asp Asp Lys Asp Ile Tyr Leu Arg Leu Leu Arg Glu Arg
945                 950                 955                 960

Glu Lys Phe Val Ile Asn Gln Ser Asn Pro Glu Val Ile Asp Gln Ile
                965                 970                 975

Ile Glu Ile Ile Glu Ser Tyr Gly Lys Glu Asn Asn Ile Pro Ser Arg
            980                 985                 990

Asp Glu Ala Ile Asn Ile Lys Tyr  Thr Lys Asn Lys Ile  Asn Tyr Asn
        995                 1000                1005

Leu Tyr  Leu Lys Gln Tyr Met  Arg Ser Leu Thr Lys  Ser Leu Asp
    1010                1015                1020

Lys Phe  Ser Glu Glu Phe Ile  Asn Gln Met Ile Ala  Asn Lys Thr
    1025                1030                1035

Phe Val  Leu Tyr Asn Pro Thr  Lys Asn Thr Thr Arg  Lys Ile Lys
    1040                1045                1050
```

```
Phe Leu  Arg Leu Val Asn Asp  Val Lys Ile Asn Asp  Ile Arg Lys
    1055                1060                1065

Asn Gln  Val Ile Asn Lys Phe  Asn Gly Lys Asn Asn  Glu Pro Lys
    1070                1075                1080

Ala Phe  Tyr Glu Asn Ile Asn  Ser Leu Gly Ala Ile  Val Phe Lys
    1085                1090                1095

Asn Ser  Ala Asn Asn Phe Lys  Thr Leu Ser Ile Asn  Thr Gln Ile
    1100                1105                1110

Ala Ile  Phe Gly Asp Lys Asn  Trp Asp Ile Glu Asp  Phe Lys Thr
    1115                1120                1125

Tyr Asn  Met Glu Lys Ile Glu  Lys Tyr Lys Glu Ile  Tyr Gly Ile
    1130                1135                1140

Asp Lys  Thr Tyr Asn Phe His  Ser Phe Ile Phe Pro  Gly Thr Ile
    1145                1150                1155

Leu Leu  Asp Lys Gln Asn Lys  Glu Phe Tyr Tyr Ile  Ser Ser Ile
    1160                1165                1170

Gln Thr  Val Arg Asp Ile Ile  Glu Ile Lys Phe Leu  Asn Lys Ile
    1175                1180                1185

Glu Phe  Lys Asp Glu Asn Lys  Asn Gln Asp Thr Ser  Lys Thr Pro
    1190                1195                1200

Lys Arg  Leu Met Phe Gly Ile  Lys Ser Ile Met Asn  Asn Tyr Glu
    1205                1210                1215

Gln Val  Asp Ile Ser Pro Phe  Gly Ile Asn Lys Lys  Ile Phe Glu
    1220                1225                1230
```

<210> 546
<211> 1233
<212> PRT
<213> Mycoplasma canis

<400> 546

```
Met Glu Lys Lys Arg Lys Val Thr Leu Gly Phe Asp Leu Gly Ile Ala
1               5                   10                  15


Ser Val Gly Trp Ala Ile Val Asp Ser Glu Thr Asn Gln Val Tyr Lys
            20                  25                  30


Leu Gly Ser Arg Leu Phe Asp Ala Pro Asp Thr Asn Leu Glu Arg Arg
        35                  40                  45


Thr Gln Arg Gly Thr Arg Arg Leu Leu Arg Arg Arg Lys Tyr Arg Asn
    50                  55                  60


Gln Lys Phe Tyr Asn Leu Val Lys Arg Thr Glu Val Phe Gly Leu Ser
65                  70                  75                  80


Ser Arg Glu Ala Ile Glu Asn Arg Phe Arg Glu Leu Ser Ile Lys Tyr
                85                  90                  95


Pro Asn Ile Ile Glu Leu Lys Thr Lys Ala Leu Ser Gln Glu Val Cys
            100                 105                 110


Pro Asp Glu Ile Ala Trp Ile Leu His Asp Tyr Leu Lys Asn Arg Gly
        115                 120                 125


Tyr Phe Tyr Asp Glu Lys Glu Thr Lys Glu Asp Phe Asp Gln Gln Thr
    130                 135                 140


Val Glu Ser Met Pro Ser Tyr Lys Leu Asn Glu Phe Tyr Lys Lys Tyr
145                 150                 155                 160


Gly Tyr Phe Lys Gly Ala Leu Ser Gln Pro Thr Glu Ser Glu Met Lys
                165                 170                 175
```

```
Asp Asn Lys Asp Leu Lys Glu Ala Phe Phe Phe Asp Phe Ser Asn Lys
            180                 185                 190

Glu Trp Leu Lys Glu Ile Asn Tyr Phe Phe Asn Val Gln Lys Asn Ile
        195                 200                 205

Leu Ser Glu Thr Phe Ile Glu Glu Phe Lys Lys Ile Phe Ser Phe Thr
    210                 215                 220

Arg Asp Ile Ser Lys Gly Pro Gly Ser Asp Asn Met Pro Ser Pro Tyr
225                 230                 235                 240

Gly Ile Phe Gly Glu Phe Gly Asp Asn Gly Gln Gly Gly Arg Tyr Glu
                245                 250                 255

His Ile Trp Asp Lys Asn Ile Gly Lys Cys Ser Ile Phe Thr Asn Glu
            260                 265                 270

Gln Arg Ala Pro Lys Tyr Leu Pro Ser Ala Leu Ile Phe Asn Phe Leu
        275                 280                 285

Asn Glu Leu Ala Asn Ile Arg Leu Tyr Ser Thr Asp Lys Lys Asn Ile
    290                 295                 300

Gln Pro Leu Trp Lys Leu Ser Ser Val Asp Lys Leu Asn Ile Leu Leu
305                 310                 315                 320

Asn Leu Phe Asn Leu Pro Ile Ser Glu Lys Lys Lys Lys Leu Thr Ser
                325                 330                 335

Thr Asn Ile Asn Asp Ile Val Lys Lys Glu Ser Ile Lys Ser Ile Met
            340                 345                 350

Leu Ser Val Glu Asp Ile Asp Met Ile Lys Tyr Glu Trp Ala Gly Lys
        355                 360                 365

Glu Pro Asn Val Tyr Gly Val Gly Leu Ser Gly Leu Asn Ile Glu Glu
```

```
    370                 375                 380

Ser Ala Lys Glu Asn Lys Phe Lys Phe Gln Asp Leu Lys Ile Leu Asn
385                 390                 395                 400

Val Leu Ile Asn Leu Leu Asp Asn Val Gly Ile Lys Phe Glu Phe Lys
                405                 410                 415

Asp Arg Asn Asp Ile Ile Lys Asn Leu Glu Leu Leu Asp Asn Leu Tyr
            420                 425                 430

Leu Phe Leu Ile Tyr Gln Lys Glu Ser Asn Asn Lys Asp Ser Ser Ile
        435                 440                 445

Asp Leu Phe Ile Ala Lys Asn Lys Ser Leu Asn Ile Glu Asn Leu Lys
    450                 455                 460

Leu Lys Leu Lys Glu Phe Leu Leu Gly Ala Gly Asn Glu Phe Glu Asn
465                 470                 475                 480

His Asn Ser Lys Thr His Ser Leu Ser Lys Lys Ala Ile Asp Ala Ile
                485                 490                 495

Leu Pro Lys Leu Leu Asp Asn Asn Glu Gly Trp Asn Leu Glu Ala Ile
            500                 505                 510

Lys Asn Tyr Asp Glu Glu Ile Lys Ser Gln Ile Glu Asp Asn Ser Ser
        515                 520                 525

Leu Met Ala Lys Gln Asp Lys Lys Tyr Leu Asn Asp Asn Phe Leu Lys
    530                 535                 540

Asp Ala Ile Leu Pro Pro Asn Val Lys Val Thr Phe Gln Gln Ala Ile
545                 550                 555                 560

Leu Ile Phe Asn Lys Ile Ile Gln Lys Phe Ser Lys Asp Phe Glu Ile
                565                 570                 575
```

```
Asp Lys Val Val Ile Glu Leu Ala Arg Glu Met Thr Gln Asp Gln Glu
            580                 585                 590

Asn Asp Ala Leu Lys Gly Ile Ala Lys Ala Gln Lys Ser Lys Lys Ser
        595                 600                 605

Leu Val Glu Glu Arg Leu Glu Ala Asn Asn Ile Asp Lys Ser Val Phe
    610                 615                 620

Asp Asp Lys Tyr Glu Lys Leu Ile Tyr Lys Ile Phe Leu Trp Ile Ser
625                 630                 635                 640

Gln Asp Phe Lys Asp Pro Tyr Thr Gly Ala Lys Ile Ser Ala Asn Glu
                645                 650                 655

Ile Val Asn Asn Lys Val Glu Ile Asp His Ile Ile Pro Tyr Ser Leu
            660                 665                 670

Cys Phe Asp Asp Ser Ser Ala Asn Lys Val Leu Val His Lys Gln Ser
        675                 680                 685

Asn Gln Glu Lys Ser Asn Ser Leu Pro Tyr Glu Tyr Ile Lys Gln Gly
    690                 695                 700

His Ser Gly Trp Asn Trp Asp Glu Phe Thr Lys Tyr Val Lys Arg Val
705                 710                 715                 720

Phe Val Asn Asn Val Asp Ser Ile Leu Ser Lys Lys Glu Arg Leu Lys
                725                 730                 735

Lys Ser Glu Asn Leu Leu Thr Thr Ser Tyr Asp Gly Tyr Asp Lys Leu
            740                 745                 750

Gly Phe Leu Ala Arg Asn Leu Asn Asp Thr Arg Tyr Ala Thr Ile Leu
        755                 760                 765

Phe Arg Asp Gln Leu Asn Asn Tyr Ala Glu His His Leu Ile Asp Asn
```

```
    770                 775                 780

Lys Lys Met Phe Lys Val Ile Ala Met Asn Gly Ala Val Thr Ser Phe
785                 790                 795                 800

Ile Arg Lys Asn Met Ser Tyr Asp Asn Lys Leu Arg Leu Lys Asp Arg
                805                 810                 815

Ser Asp Phe Ser His His Ala Tyr Asp Ala Ala Ile Ile Ala Leu Phe
            820                 825                 830

Ser Asn Lys Thr Lys Thr Leu Tyr Asn Leu Ile Asp Pro Ser Leu Asn
        835                 840                 845

Gly Ile Ile Ser Lys Arg Ser Glu Gly Tyr Trp Val Ile Glu Asp Arg
    850                 855                 860

Tyr Thr Gly Glu Ile Lys Glu Leu Lys Lys Glu Asp Trp Thr Ser Ile
865                 870                 875                 880

Lys Asn Asn Val Gln Ala Arg Lys Ile Ala Lys Glu Ile Glu Glu Tyr
                885                 890                 895

Leu Ile Asp Leu Asp Asp Glu Val Phe Phe Ser Arg Lys Thr Lys Arg
            900                 905                 910

Lys Thr Asn Arg Gln Leu Tyr Asn Glu Thr Ile Tyr Gly Ile Ala Ala
        915                 920                 925

Lys Thr Asp Glu Asp Gly Ile Thr Asn Tyr Tyr Lys Lys Glu Lys Phe
    930                 935                 940

Ser Ile Leu Asp Asp Lys Asp Ile Tyr Leu Arg Leu Leu Arg Glu Arg
945                 950                 955                 960

Glu Lys Phe Val Ile Asn Gln Ser Asn Pro Glu Val Ile Asp Gln Ile
                965                 970                 975
```

```
Ile Glu Ile Ile Glu Ser Tyr Gly Lys Glu Asn Asn Ile Pro Ser Arg
            980                 985                 990


Asp Glu Ala Ile Asn Ile Lys Tyr  Thr Lys Asn Lys Ile  Asn Tyr Asn
        995                 1000                1005


Leu Tyr  Leu Lys Gln Tyr Met  Arg Ser Leu Thr Lys  Ser Leu Asp
    1010                1015                1020


Gln Phe  Ser Glu Glu Phe Ile  Asn Gln Met Ile Ala  Asn Lys Thr
    1025                1030                1035


Phe Val  Leu Tyr Asn Pro Thr  Lys Asn Thr Thr Arg  Lys Ile Lys
    1040                1045                1050


Phe Leu  Arg Leu Val Asn Asp  Val Lys Ile Asn Asp  Ile Arg Lys
    1055                1060                1065


Asn Gln  Val Ile Asn Lys Phe  Asn Gly Lys Asn Asn  Glu Pro Lys
    1070                1075                1080


Ala Phe  Tyr Glu Asn Ile Asn  Ser Leu Gly Ala Ile  Val Phe Lys
    1085                1090                1095


Asn Ser  Ala Asn Asn Phe Lys  Thr Leu Ser Ile Asn  Thr Gln Ile
    1100                1105                1110


Ala Ile  Phe Gly Asp Lys Asn  Trp Asp Ile Glu Asp  Phe Lys Thr
    1115                1120                1125


Tyr Asn  Met Glu Lys Ile Glu  Lys Tyr Lys Glu Ile  Tyr Gly Ile
    1130                1135                1140


Asp Lys  Thr Tyr Asn Phe His  Ser Phe Ile Phe Pro  Gly Thr Ile
    1145                1150                1155


Leu Leu  Asp Lys Gln Asn Lys  Glu Phe Tyr Tyr Ile  Ser Ser Ile
```

```
    1160                1165                1170

Gln Thr  Val Arg Asp Ile Ile  Glu Ile Lys Phe Leu  Asn Lys Ile
    1175                1180                1185

Glu Phe  Lys Asp Glu Asn Lys  Asn Gln Asp Thr Ser  Lys Thr Pro
    1190                1195                1200

Lys Arg  Leu Met Phe Gly Ile  Lys Ser Ile Met Asn  Asn Tyr Glu
    1205                1210                1215

Gln Val  Asp Ile Ser Pro Phe  Gly Ile Asn Lys Lys  Ile Phe Glu
    1220                1225                1230
```

<210> 547
<211> 1239
<212> PRT
<213> Mycoplasma cynos

<400> 547

```
Met Glu Glu Lys Arg Lys Val Thr Leu Gly Phe Asp Leu Gly Val Ala
1               5                   10                  15

Ser Val Gly Trp Ala Ile Val Asp Ser Glu Thr Asn Glu Val Tyr Lys
            20                  25                  30

Leu Gly Ser Arg Leu Phe Asp Ile Pro Asp Thr Asn Ile Asp Arg Arg
        35                  40                  45

Ala Lys Arg Gly Ser Arg Arg Leu Val Arg Arg Arg Ser Tyr Arg Asn
    50                  55                  60

Gln Lys Phe Tyr Asn Leu Ile Lys Arg Thr Lys Thr Phe Gly Phe Leu
65                  70                  75                  80

Asp Lys Glu Ala Ile Glu Lys Glu Phe Val Leu Leu Ser Ile Lys Tyr
                85                  90                  95
```

```
Pro Asn Ile Ile Glu Leu Lys Val Lys Gly Leu Gln Glu Glu Val Ser
            100                 105                 110

Lys Ser Glu Ala Val Trp Ile Leu His Asp Tyr Leu Lys Asn Arg Gly
        115                 120                 125

Tyr Phe Tyr Asp Asp Lys Glu Glu Lys Asp Asp Leu Glu Asn Pro Ser
    130                 135                 140

Ile Glu Ser Met Pro Ser Tyr Lys Leu Tyr Glu Phe Tyr Lys Glu Tyr
145                 150                 155                 160

Gly Tyr Phe Lys Gly Ala Leu Ser Ser Pro Thr Glu Ser Glu Lys Asn
                165                 170                 175

Lys Asp Ser Asp Leu Glu Lys Ala Ile Phe Phe Asn Phe Ser Asn Lys
            180                 185                 190

Glu Trp Thr Lys Glu Ile Asn His Phe Phe Lys Ile Gln Lys Asn Ile
        195                 200                 205

Phe Ser Glu Asp Phe Lys Ala Lys Phe Met Glu Phe Phe Ser Phe Ile
    210                 215                 220

Arg Asp Ile Ser Lys Gly Pro Gly Ser Glu Asn Met Pro Ser Gln Tyr
225                 230                 235                 240

Ser Ile Phe Gly Lys Tyr Gly Asp Asp Gly Met Gly Gly Lys Tyr Gln
                245                 250                 255

His Ile Trp Asp Lys Asn Ile Gly Lys Cys Ser Ile Phe Lys Asp Lys
            260                 265                 270

Val Arg Ala Pro Lys Tyr Leu Pro Ser Ala Leu Phe Phe Asn Leu Leu
        275                 280                 285

Asn Glu Leu Ser Asn Ile Arg Leu Tyr Ser Val Asp Lys Arg Glu Lys
    290                 295                 300
```

```
Ser Val Leu Trp Arg Leu Ser Ser Lys Asp Lys Ile Asn Ile Ile Leu
305                 310                 315                 320

Asn Ile Leu Gln Ile Ile Leu Phe Lys Asn Asp Gly Lys Ile Ser Asn
                325                 330                 335

Leu Asp Ile Asn Lys Ile Val Lys Asn Glu Ser Ile Lys Ser Ile Ile
            340                 345                 350

Leu Asn Glu Ile Asp Leu Asp Leu Ile Lys Asp Met Trp Phe Glu Lys
        355                 360                 365

Glu Pro Asn Val Tyr Gly Ile Gly Leu Ser Gly Leu Asn Ile Glu Glu
    370                 375                 380

Asn Lys Lys Glu Asn Arg Phe Lys Phe Gln Asp Leu Lys Ile Phe Ser
385                 390                 395                 400

Val Phe Ile Asp Leu Leu Lys Lys Ser Asn Ile Asn Ile Glu Phe Asn
                405                 410                 415

Asn Glu Lys Asp Ile Ile His Asn Leu Lys Leu Leu Asp Glu Leu Tyr
            420                 425                 430

Phe Phe Leu Ile Thr Gln Lys Tyr Ser Arg Asp Lys Tyr Gly Ser Ile
        435                 440                 445

Lys Lys Phe Ile Leu Asn Asn Lys Ser Phe Asn Ile Asp Asn Leu Asp
    450                 455                 460

Glu Lys Leu Asn Ile Phe Leu Ser Ile Ser Asp Asp Glu Phe Asp Asn
465                 470                 475                 480

His Asn Ser Lys Thr His Ser Leu Ser Lys Glu Ala Ile Tyr Phe Ile
                485                 490                 495
```

```
Phe Pro Lys Leu Leu His Asn Asn Glu Gly Trp Asn Leu Glu Ala Ile
            500                 505                 510

Lys Asn Tyr Asp Ile Asp Val Arg Glu Glu Ile Ser Lys His Ser Phe
        515                 520                 525

Gly Ile Lys Lys Gln Asp Lys Lys Tyr Leu Asp Asp Ala Phe Leu Asp
    530                 535                 540

Asp Ala Ile Leu Pro Pro Ser Val Lys Val Thr Ile Lys Gln Ser Ile
545                 550                 555                 560

Leu Ile Phe Asn Lys Ile Ile Lys Lys Phe Ser Asn Lys Phe Gln Ile
                565                 570                 575

Asp Asn Val Val Ile Glu Leu Ala Arg Glu Met Thr Gln Glu Lys Glu
            580                 585                 590

Met Asp Ala Gln Lys Ser Leu Asn Arg Leu Lys Lys Ser Arg Lys Lys
        595                 600                 605

Ile Ile Glu Glu Arg Leu Asn Ala Asn Asn Ile Asp Ser Lys Met Phe
    610                 615                 620

Arg Asp Lys Thr Gly Glu Ile Ser Pro Asn Tyr Ile Tyr Lys Ile Tyr
625                 630                 635                 640

Leu Trp Ile Ser Gln Asn Phe Lys Asp Pro Tyr Thr Gly Glu Asn Ile
                645                 650                 655

Ser Ala Asn Asp Ile Leu Lys Asn Asn Val Glu Ile Asp His Ile Ile
            660                 665                 670

Pro Tyr Ser Leu Cys Phe Asp Asp Ser Ser Ser Asn Lys Val Leu Val
        675                 680                 685

Phe Lys His Ser Asn Gln Ser Lys Gly Asn Phe Leu Pro Phe Asp Met
    690                 695                 700
```

```
Ile Ser Thr Phe Ser Glu Asn Ser Val Trp Asn Trp Lys Glu Tyr Thr
705                 710                 715                 720

Gln Tyr Val Glu Lys Thr Phe Lys Thr Asn Leu Glu Ser Ile Leu Asp
                725                 730                 735

Lys Lys Glu Arg Val Lys Lys Ala Asp Asn Leu Leu Thr Ser Ser Tyr
            740                 745                 750

Asp Gly Tyr Asp Lys Leu Gly Phe Leu Ala Arg Asn Leu Asn Asp Thr
        755                 760                 765

Arg Tyr Ala Thr Ile Leu Phe Arg Asp Gln Leu Ile Asn Tyr Ser Glu
    770                 775                 780

Asn His Leu Ile Asp Ser Lys Lys Met Phe Lys Val Ile Ala Met Asn
785                 790                 795                 800

Gly Gly Val Thr Ser Phe Ile Arg Lys Asn Met Ser Phe Asp Ser Gly
                805                 810                 815

Leu Lys Val Lys Asp Arg Ser Ile Phe Ser His His Ala Tyr Asp Ala
            820                 825                 830

Ala Ile Ile Ala Leu Phe Ser Asn Lys Thr Lys Ile Leu Tyr Asn Leu
        835                 840                 845

Ile Asn Pro Ser Leu Asp Gly Ile Ile Ser Lys Arg Ser Glu Gly Tyr
    850                 855                 860

Trp Val Leu Glu Asp Arg Leu Thr Gly Glu Ile Arg Lys Leu Asn Tyr
865                 870                 875                 880

Asn Asp Trp Gln Ser Ile Lys Asn Asn Val Glu Val Lys Lys Ile Ala
                885                 890                 895
```

```
Arg Glu Ile Glu Ser His Leu Ser Asn Leu Asp Asn Val Val Met Phe
            900                 905                 910

Ser Arg Lys Ser Lys Arg Lys Thr Asn Lys Glu Leu Tyr Asn Glu Thr
        915                 920                 925

Leu Tyr Gly Ile Ala Thr Arg Ile Asp Glu Asn Gly Ile Lys Asn Tyr
    930                 935                 940

Tyr Lys Lys Glu Lys Phe Asn Ile Leu Glu Asp Glu Asn Ile Tyr Leu
945                 950                 955                 960

Arg Leu Leu Asn Glu Arg Glu Asn Phe Ile Ile Asn Arg Ser Asn Pro
                965                 970                 975

Glu Val Ile Asp Ala Ile Ile Glu Ile Phe Glu Thr Ile Asp Lys Asn
            980                 985                 990

Lys Ile Pro Ala Arg Asp Val Ala  Lys Asn Ile Lys Tyr  Thr Asp Asn
        995                 1000                1005

Lys Ile  Lys Tyr Asn Leu Tyr  Leu Lys Asp Tyr Met  Arg Lys Leu
    1010                1015                1020

Val Asp  Glu Phe Pro Asp Lys  Phe Arg Lys Asp Phe  Ile Glu Gln
    1025                1030                1035

Met Ile  Ala Lys Lys Ile Phe  Ile Leu Phe Asn Pro  Ile Lys Asn
    1040                1045                1050

Thr Thr  Arg Lys Ile Lys Ser  Leu Arg Ser Ile Asn  Asn Asn Lys
    1055                1060                1065

Ile Glu  Asp Ile Arg Lys Lys  Gln Val Leu Glu Lys  Phe Asn Thr
    1070                1075                1080

Ala Lys  Asn Glu Pro Arg Ser  Phe Tyr Glu Ser Leu  Asn Ser Leu
    1085                1090                1095
```

```
Gly Ala  Ile Ile Phe Lys Asn  Asn Leu Asn Ile Tyr  Lys Lys Met
    1100                1105                1110

Ser Ile  Ser Ser Gln Ile Ala  Thr Phe Gly Asp Lys  Asn Trp Lys
    1115                1120                1125

Ile Asp  Asp Ile Asn Thr Tyr  Asn Lys Glu Lys Leu  Asn Lys Tyr
    1130                1135                1140

Lys Glu  Ile Tyr Gly Ile Asp  Glu Thr Tyr Asp Phe  Tyr Ser Phe
    1145                1150                1155

Ile Phe  Pro Gly Thr Ile Leu  Leu Asp Glu Lys Asn  Lys Glu Phe
    1160                1165                1170

Leu Tyr  Ile Ser Ser Ile Gln  Thr Leu Lys Asp Lys  Ile Glu Leu
    1175                1180                1185

Lys Phe  Leu Asp Arg Ile Glu  Phe Glu Lys Lys Asn  Val Asn Ser
    1190                1195                1200

Asn Leu  Lys Pro Lys Ile Lys  Arg Glu Ile Ile Ser  Thr Lys Lys
    1205                1210                1215

Leu Met  Ser Asp Tyr Lys Ile  Ile Lys Ile Ser Pro  Leu Gly Ile
    1220                1225                1230

Asn Lys  Lys Ile Phe Glu
    1235
```

<210> 548
<211> 1269
<212> PRT
<213> Mycoplasma gallisepticum

<400> 548

```
Met Asn Asn Ser Ile Lys Ser Lys Pro Glu Val Thr Ile Gly Leu Asp
```

```
1               5                   10                  15

Leu Gly Val Gly Ser Val Gly Trp Ala Ile Val Asp Asn Glu Thr Asn
            20                  25                  30

Ile Ile His His Leu Gly Ser Arg Leu Phe Ser Gln Ala Lys Thr Ala
        35                  40                  45

Glu Asp Arg Arg Ser Phe Arg Gly Ala Arg Arg Leu Ile Arg Arg Arg
    50                  55                  60

Lys Tyr Lys Leu Lys Arg Phe Ile Asn Leu Ile Trp Lys Tyr Asn Ser
65                  70                  75                  80

Tyr Phe Gly Phe Lys Asn Lys Glu Asp Ile Leu Asn Asn Tyr Gln Glu
                85                  90                  95

Gln Gln Lys Leu His Asn Thr Val Leu Asn Leu Lys Leu Glu Ala Leu
            100                 105                 110

Asn Ala Lys Ile Asp Pro Lys Ala Leu Ser Trp Ile Leu His Asp Tyr
        115                 120                 125

Leu Lys Asn Arg Gly His Phe Tyr Glu Asp Asn Arg Asp Phe Asn Val
    130                 135                 140

Tyr Pro Thr Glu Glu Leu Ala Asn Tyr Phe Gly Glu Tyr Gly Tyr Tyr
145                 150                 155                 160

Lys Gly Ile Ile Asp Ser Lys Glu Asp Asn Asp Asp Lys Leu Glu Glu
                165                 170                 175

Gly Leu Thr Lys Tyr Lys Phe Ser Asn Gln His Trp Leu Glu Glu Ile
            180                 185                 190

Lys Lys Val Leu Ser Asn Gln Thr Gly Leu Pro Glu Lys Phe Lys Glu
        195                 200                 205
```

```
Glu Tyr Glu Ser Leu Phe Ser Tyr Val Arg Asn Tyr Ser Glu Gly Pro
    210                 215                 220

Gly Ser Ile Asn Ser Val Ser Pro Tyr Gly Ile Tyr His Leu Asp Glu
225                 230                 235                 240

Lys Glu Gly Lys Val Val Gln Lys Tyr Asn Asn Ile Trp Asp Lys Thr
                245                 250                 255

Ile Gly Lys Cys Ser Ile Phe Pro Asp Glu Tyr Arg Ala Pro Lys Asn
            260                 265                 270

Ser Pro Ile Ala Met Ile Phe Asn Glu Ile Asn Glu Leu Ser Thr Ile
        275                 280                 285

Arg Ser Tyr Ser Ile Tyr Leu Thr Gly Trp Phe Ile Asn Gln Glu Phe
    290                 295                 300

Lys Lys Ala Tyr Leu Asn Lys Leu Leu Asp Leu Leu Ile Lys Thr Asn
305                 310                 315                 320

Ser Glu Lys Pro Ile Asp Ala Arg Gln Phe Lys Lys Leu Arg Glu Glu
                325                 330                 335

Thr Ile Ala Glu Ser Ile Gly Lys Glu Thr Leu Lys Asp Val Glu Arg
            340                 345                 350

Glu Glu Lys Leu Glu Lys Glu Asp His Lys Trp Lys Leu Lys Gly Leu
        355                 360                 365

Lys Leu Asn Thr Asn Gly Lys Ile Gln Tyr Asn Asp Leu Ser Ser Leu
    370                 375                 380

Ala Lys Phe Val His Lys Leu Lys Gln His Leu Lys Leu Asp Phe Leu
385                 390                 395                 400

Leu Glu Asp Gln Tyr Thr Thr Leu Asp Lys Ile Asn Phe Leu Gln Ser
```

```
                405                 410                 415

Leu Phe Val Tyr Leu Gly Lys His Leu Arg Tyr Ser Asn Arg Val Asp
            420                 425                 430

Ser Ala Asn Leu Lys Glu Phe Ser Asp Ser Asn Lys Leu Phe Glu Arg
        435                 440                 445

Val Leu Gln Glu Gln Lys Asp Asp Leu Phe Lys Leu Phe Glu Gln Thr
    450                 455                 460

Asp Lys Asp Asp Glu Lys Ile Leu Ala Gln Thr His Ser Leu Ser Thr
465                 470                 475                 480

Lys Ala Met Leu Leu Ala Ile Thr Arg Met Thr Asn Leu Asp Asn Asp
                485                 490                 495

Glu Asp Asn Gln Lys Asn Asn Asp Lys Gly Trp Asn Phe Glu Ala Ile
            500                 505                 510

Lys Asn Phe Asp Gln Lys Phe Ile Asp Ile Thr Lys Lys Asn Asn Asn
        515                 520                 525

Leu Ser Leu Lys Gln Asp Lys Arg Tyr Leu Asp Asp Arg Phe Ile Asn
    530                 535                 540

Asp Ala Ile Leu Ser Pro Gly Val Lys Arg Ile Leu Arg Glu Ala Thr
545                 550                 555                 560

Lys Val Phe Asn Ala Ile Leu Lys Gln Phe Ser Glu Glu Tyr Asp Val
                565                 570                 575

Thr Lys Val Val Ile Glu Leu Ala Arg Glu Leu Ser Glu Glu Lys Glu
            580                 585                 590

Leu Glu Asn Thr Lys Asn Tyr Glu Lys Leu Ile Lys Lys Asn Ser Asp
        595                 600                 605
```

```
Lys Ile Ser Glu Arg Leu Glu Ala Leu Asp Ile Ala Glu Asp Lys Ile
    610                 615                 620

Glu Asp Ile Leu Lys Ser Pro Thr Lys Ser Tyr Lys Val Leu Leu Trp
625                 630                 635                 640

Leu Gln Gln Asp His Ile Asp Pro Tyr Ser Gln Lys Glu Ile Ala Phe
                645                 650                 655

Glu Asp Ile Leu Thr Lys Thr Glu Lys Thr Glu Ile Asp His Ile Ile
            660                 665                 670

Pro Tyr Ser Ile Ser Phe Asp Asp Ser Ser Ser Asn Lys Leu Leu Val
        675                 680                 685

Leu Ala Glu Ser Asn Gln Ala Lys Ser Asn Gln Thr Pro Tyr Glu Phe
    690                 695                 700

Ile Thr Ser Gly Asn Ala Gly Ile Lys Trp Glu Asp Tyr Glu Ala Tyr
705                 710                 715                 720

Cys Arg Lys Phe Lys Asp Gly Asp Thr Ser Leu Leu Asp Ser Thr Gln
                725                 730                 735

Arg Ser Lys Lys Phe Ala Lys Met Met Lys Thr Asp Thr Ser Ser Lys
            740                 745                 750

Tyr Asp Ile Gly Phe Leu Ala Arg Asn Leu Asn Asp Thr Arg Tyr Ala
        755                 760                 765

Thr Ile Val Phe Arg Asp Ala Leu Lys Asp Tyr Ala Asn Asn His Leu
    770                 775                 780

Val Glu Asp Lys Pro Met Phe Lys Val Val Cys Ile Asn Gly Gly Val
785                 790                 795                 800

Thr Ser Phe Leu Arg Lys Asn Phe Asp Lys Ser Trp Tyr Ala Lys Lys
```

```
                805                 810                 815

Asp Arg Asp Lys Asn Ile His His Ala Val Asp Ala Ser Ile Ile Ser
            820                 825                 830

Ile Phe Ser Asn Glu Thr Lys Thr Leu Phe Asn Gln Leu Thr Gln Phe
        835                 840                 845

Ala Asp Tyr Lys Leu Phe Lys Asn Thr Asp Gly Ser Trp Lys Lys Ile
    850                 855                 860

Asp Pro Lys Thr Gly Val Val Thr Glu Val Thr Asp Glu Asn Trp Lys
865                 870                 875                 880

Gln Ile Arg Val Arg Asn Gln Val Ser Glu Ile Ala Lys Val Ile Asn
                885                 890                 895

Lys Cys Ile Gln Asp Ser Asn Ile Glu Arg Lys Ala Arg Tyr Ser Arg
            900                 905                 910

Lys Ile Glu Asn Lys Thr Asn Ile Ser Leu Phe Asn Asp Thr Val Tyr
        915                 920                 925

Ser Ala Lys Lys Val Gly Tyr Glu Asp Gln Ile Lys Arg Lys Asn Leu
    930                 935                 940

Lys Thr Leu Asp Ile His Glu Ser Ala Glu Glu Asn Lys Asn Ser Lys
945                 950                 955                 960

Val Lys Lys Gln Phe Val Tyr Arg Lys Leu Val Asn Val Ser Leu Leu
                965                 970                 975

Asn Asn Asp Lys Leu Ala Asp Leu Phe Ala Glu Lys Glu Asp Ile Leu
            980                 985                 990

Met Tyr Arg Ala Asn Pro Trp Val  Ile Asn Leu Ala Glu  Gln Ile Phe
        995                 1000                1005
```

```
Asn Glu  Tyr Thr Glu Asn Lys  Lys Ile Lys Ser Gln  Asn Val Phe
    1010                1015                1020

Glu Lys  Tyr Met Leu Asp Leu  Thr Lys Glu Phe Pro  Glu Lys Phe
    1025                1030                1035

Ser Glu  Ala Phe Val Lys Ser  Met Leu Arg Asn Lys  Thr Ala Ile
    1040                1045                1050

Ile Tyr  Asn Val Glu Lys Lys  Val Val His Arg Ile  Lys Arg Leu
    1055                1060                1065

Lys Ile  Leu Ser Ser Glu Leu  Lys Glu Asn Lys Leu  Ser Asn Val
    1070                1075                1080

Ile Ile  Arg Ser Lys Asn Glu  Ser Gly Thr Lys Leu  Ser Tyr Gln
    1085                1090                1095

Asp Thr  Ile Asn Ser Ile Ala  Leu Met Ile Met Arg  Ser Ile Asp
    1100                1105                1110

Pro Thr  Ala Lys Lys Gln Tyr  Ile Arg Val Pro Leu  Asn Thr Leu
    1115                1120                1125

Asn Leu  His Leu Gly Asp Gln  Asp Phe Asp Leu His  Asn Ile Asp
    1130                1135                1140

Ala Tyr  Leu Lys Lys Pro Lys  Phe Val Lys Tyr Leu  Lys Ala Asn
    1145                1150                1155

Glu Ile  Gly Asp Glu Tyr Lys  Pro Trp Arg Val Leu  Thr Ser Gly
    1160                1165                1170

Thr Leu  Leu Ile His Lys Lys  Asp Lys Lys Leu Met  Tyr Ile Ser
    1175                1180                1185

Ser Phe  Gln Asn Leu Lys Asp  Val Ile Glu Ile Lys  Asn Leu Ile
```

```
    1190                1195                1200

Glu Thr  Glu Tyr Lys Glu Asn  Asp Asp Ser Asp Pro  Lys Lys Lys
    1205                1210                1215

Lys Lys  Ala Asn Arg Phe Leu  Met Thr Leu Ser Thr  Ile Leu Asn
    1220                1225                1230

Asp Tyr  Ile Leu Leu Asp Ala  Lys Asp Asn Phe Asp  Ile Leu Gly
    1235                1240                1245

Leu Ser  Lys Asn Arg Ile Asp  Glu Ile Leu Asn Ser  Lys Leu Gly
    1250                1255                1260

Leu Asp  Lys Ile Thr Lys
    1265
```

<210> 549
<211> 1224
<212> PRT
<213> Mycoplasma gallisepticum

<400> 549

```
Met Asn Asn Ser Ile Lys Ser Lys Pro Glu Val Thr Ile Gly Leu Asp
1               5                   10                  15

Leu Gly Val Gly Ser Val Gly Trp Ala Ile Val Asp Asn Glu Thr Asn
            20                  25                  30

Ile Ile His His Leu Gly Ser Arg Leu Phe Ser Gln Ala Lys Thr Ala
        35                  40                  45

Glu Asp Arg Arg Ser Phe Arg Gly Ala Arg Arg Leu Ile Arg Arg Arg
    50                  55                  60

Lys Tyr Lys Leu Lys Arg Phe Ile Asn Leu Ile Trp Lys Tyr Asn Ser
65                  70                  75                  80
```

```
Tyr Phe Gly Phe Lys Asn Lys Glu Asp Ile Leu Asn Asn Tyr Gln Glu
                85                  90                  95

Gln Gln Lys Leu His Asn Thr Val Leu Asn Leu Lys Leu Glu Ala Leu
            100                 105                 110

Asn Ala Lys Ile Asp Pro Lys Ala Leu Ser Trp Ile Leu His Asp Tyr
        115                 120                 125

Leu Lys Asn Arg Gly His Phe Tyr Glu Asp Asn Arg Asp Phe Asn Val
    130                 135                 140

Tyr Pro Thr Glu Glu Leu Ala Asn Tyr Phe Gly Glu Tyr Gly Tyr Tyr
145                 150                 155                 160

Lys Gly Ile Ile Asp Ser Lys Glu Asp Asn Asp Asp Lys Leu Glu Glu
                165                 170                 175

Gly Leu Thr Lys Tyr Lys Phe Ser Asn Gln His Trp Leu Glu Glu Ile
            180                 185                 190

Lys Lys Val Leu Ser Asn Gln Thr Gly Leu Pro Glu Lys Phe Lys Glu
        195                 200                 205

Glu Tyr Glu Ser Leu Phe Ser Tyr Val Arg Asn Tyr Ser Glu Gly Pro
    210                 215                 220

Gly Ser Ile Asn Ser Val Ser Pro Tyr Gly Ile Tyr His Leu Asp Glu
225                 230                 235                 240

Lys Glu Gly Lys Val Val Gln Lys Tyr Asn Asn Ile Trp Asp Lys Thr
                245                 250                 255

Ile Gly Lys Cys Ser Ile Phe Pro Asp Glu Tyr Arg Ala Pro Lys Asn
            260                 265                 270

Ser Pro Ile Ala Met Ile Phe Asn Glu Ile Asn Glu Leu Ser Thr Ile
        275                 280                 285
```

```
Arg Ser Tyr Ser Ile Tyr Leu Thr Gly Trp Phe Ile Asn Gln Glu Phe
    290                 295                 300

Lys Lys Ala Tyr Leu Asn Lys Leu Leu Asp Leu Leu Ile Lys Thr Asn
305                 310                 315                 320

Ser Glu Lys Pro Ile Asp Ala Arg Gln Phe Lys Lys Leu Arg Glu Glu
                325                 330                 335

Thr Ile Ala Glu Ser Ile Gly Lys Glu Thr Leu Lys Asp Val Glu Arg
            340                 345                 350

Glu Glu Lys Leu Glu Lys Glu Asp His Lys Trp Lys Leu Lys Gly Leu
        355                 360                 365

Lys Leu Asn Thr Asn Gly Lys Ile Gln Tyr Asn Asp Leu Ser Ser Leu
    370                 375                 380

Ala Lys Phe Val His Lys Leu Lys Gln His Leu Lys Leu Asp Phe Leu
385                 390                 395                 400

Leu Glu Asp Gln Tyr Thr Thr Leu Asp Lys Ile Asn Phe Leu Gln Ser
                405                 410                 415

Leu Phe Val Tyr Leu Gly Lys His Leu Arg Tyr Ser Asn Arg Val Asp
            420                 425                 430

Ser Ala Asn Leu Lys Glu Phe Ser Asp Ser Asn Lys Leu Phe Glu Arg
        435                 440                 445

Val Leu Gln Glu Gln Lys Asp Asp Leu Phe Lys Leu Phe Glu Gln Thr
    450                 455                 460

Asp Lys Asp Asp Glu Lys Ile Leu Ala Gln Thr His Ser Leu Ser Thr
465                 470                 475                 480
```

```
Lys Ala Met Leu Leu Ala Ile Thr Arg Met Thr Asn Leu Asp Asn Asp
                485                 490                 495

Glu Asp Asn Gln Lys Asn Asn Asp Lys Gly Trp Asn Phe Glu Ala Ile
            500                 505                 510

Lys Asn Phe Asp Gln Lys Phe Ile Asp Ile Thr Lys Lys Asn Asn Asn
        515                 520                 525

Leu Ser Leu Lys Gln Asp Lys Arg Tyr Leu Asp Asp Arg Phe Ile Asn
    530                 535                 540

Asp Ala Ile Leu Ser Pro Gly Val Lys Arg Ile Leu Arg Glu Ala Thr
545                 550                 555                 560

Lys Val Phe Asn Ala Ile Leu Lys Gln Phe Ser Glu Glu Tyr Asp Val
                565                 570                 575

Thr Lys Val Val Ile Glu Leu Ala Arg Glu Leu Ser Glu Glu Lys Glu
            580                 585                 590

Leu Glu Asn Thr Lys Asn Tyr Glu Lys Leu Ile Lys Lys Asn Ser Asp
        595                 600                 605

Lys Ile Ser Glu Arg Leu Glu Ala Leu Asp Ile Ala Glu Asp Lys Ile
    610                 615                 620

Glu Asp Ile Leu Lys Ser Pro Thr Lys Ser Tyr Lys Val Leu Leu Trp
625                 630                 635                 640

Leu Gln Gln Asp His Ile Asp Pro Tyr Ser Gln Lys Glu Ile Ala Phe
                645                 650                 655

Glu Asp Ile Leu Thr Lys Thr Glu Lys Thr Glu Ile Asp His Ile Ile
            660                 665                 670

Pro Tyr Ser Ile Ser Phe Asp Asp Ser Ser Ser Asn Lys Leu Leu Val
        675                 680                 685
```

```
Leu Ala Glu Ser Asn Gln Ala Lys Ser Asn Gln Thr Pro Tyr Glu Phe
    690                 695                 700

Ile Thr Ser Gly Asn Ala Gly Ile Lys Trp Glu Asp Tyr Glu Ala Tyr
705                 710                 715                 720

Cys Arg Lys Phe Lys Asp Gly Asp Thr Ser Leu Leu Asp Ser Thr Gln
                725                 730                 735

Arg Ser Lys Lys Phe Ala Lys Met Met Lys Thr Asp Thr Ser Ser Lys
            740                 745                 750

Tyr Asp Ile Gly Phe Leu Ala Arg Asn Leu Asn Asp Thr Arg Tyr Ala
        755                 760                 765

Thr Ile Val Phe Arg Asp Ala Leu Lys Asp Tyr Ala Asn Asn His Leu
    770                 775                 780

Val Glu Asp Lys Pro Met Phe Lys Val Val Cys Ile Asn Gly Gly Val
785                 790                 795                 800

Thr Ser Phe Leu Arg Lys Asn Phe Asp Lys Ser Trp Tyr Ala Lys Lys
                805                 810                 815

Asp Arg Asp Lys Asn Ile His His Ala Val Asp Ala Ser Ile Ile Ser
            820                 825                 830

Ile Phe Ser Asn Glu Thr Lys Thr Leu Phe Asn Gln Leu Thr Gln Phe
        835                 840                 845

Ala Asp Tyr Lys Leu Phe Lys Asn Thr Asp Gly Ser Trp Lys Lys Ile
    850                 855                 860

Asp Pro Lys Thr Gly Val Val Thr Glu Val Thr Asp Glu Asn Trp Lys
865                 870                 875                 880
```

```
Gln Ile Arg Val Arg Asn Gln Val Ser Glu Ile Ala Lys Val Ile Asn
               885                 890                 895

Lys Cys Ile Gln Asp Ser Asn Ile Glu Arg Lys Ala Arg Tyr Ser Arg
           900                 905                 910

Lys Ile Glu Asn Lys Thr Asn Ile Ser Leu Phe Asn Asp Thr Val Tyr
        915                 920                 925

Ser Ala Lys Lys Val Gly Tyr Glu Asp Gln Ile Lys Arg Lys Asn Leu
    930                 935                 940

Lys Thr Leu Asp Ile His Glu Ser Ala Glu Glu Asn Lys Asn Ser Lys
945                 950                 955                 960

Val Lys Lys Gln Phe Val Tyr Arg Lys Leu Val Asn Val Ser Leu Leu
               965                 970                 975

Asn Asn Asp Lys Leu Ala Asp Leu Phe Ala Glu Lys Glu Asp Ile Leu
           980                 985                 990

Met Tyr Arg Ala Asn Pro Trp Val  Ile Asn Leu Ala Glu  Gln Ile Phe
        995                 1000                1005

Asn Glu  Tyr Thr Glu Asn Lys  Lys Ile Lys Ser Gln  Asn Val Phe
    1010                1015                1020

Glu Lys  Tyr Met Leu Asp Leu  Thr Lys Glu Phe Pro  Glu Lys Phe
    1025                1030                1035

Ser Glu  Ala Phe Val Lys Ser  Met Leu Arg Asn Lys  Thr Ala Ile
    1040                1045                1050

Ile Tyr  Asn Val Glu Lys Lys  Val Val His Arg Ile  Lys Arg Leu
    1055                1060                1065

Lys Ile  Leu Ser Ser Glu Leu  Lys Glu Asn Lys Leu  Ser Asn Val
    1070                1075                1080
```

```
Ile Ile  Arg Ser Lys Asn Glu  Ser Gly Thr Lys Leu  Ser Tyr Gln
    1085                1090                1095


Asp Thr  Ile Asn Ser Ile Ala  Leu Met Ile Met Arg  Ser Ile Asp
    1100                1105                1110


Pro Thr  Ala Lys Lys Gln Tyr  Ile Arg Val Pro Leu  Asn Thr Leu
    1115                1120                1125


Asn Leu  His Leu Gly Asp Gln  Asp Phe Asp Leu His  Asn Ile Asp
    1130                1135                1140


Ala Tyr  Leu Lys Lys Pro Lys  Phe Val Lys Tyr Leu  Lys Ala Asn
    1145                1150                1155


Glu Ile  Gly Asp Glu Tyr Lys  Pro Trp Arg Val Leu  Thr Ser Gly
    1160                1165                1170


Thr Leu  Leu Ile His Lys Lys  Asp Lys Lys Leu Met  Tyr Ile Ser
    1175                1180                1185


Ser Phe  Gln Asn Leu Lys Asp  Val Ile Glu Ile Lys  Asn Leu Ile
    1190                1195                1200


Glu Thr  Glu Tyr Lys Glu Asn  Asp Asp Ser Asp Pro  Lys Lys Arg
    1205                1210                1215


Arg Lys  Gln Ile Gly Ser
    1220


<210>  550
<211>  1269
<212>  PRT
<213>  Mycoplasma gallisepticum

<400>  550

Met Asn Asn Ser Ile Lys Ser Lys Pro Glu Val Thr Ile Gly Leu Asp
```

```
1               5                   10                  15

Leu Gly Val Gly Ser Val Gly Trp Ala Ile Val Asp Asn Glu Thr Asn
            20                  25                  30

Ile Ile His His Leu Gly Ser Arg Leu Phe Ser Gln Ala Lys Thr Ala
        35                  40                  45

Glu Asp Arg Arg Ser Phe Arg Gly Val Arg Arg Leu Ile Arg Arg Arg
    50                  55                  60

Lys Tyr Lys Leu Lys Arg Phe Val Asn Leu Ile Trp Lys Tyr Asn Ser
65                  70                  75                  80

Tyr Phe Gly Phe Lys Asn Lys Glu Asp Ile Leu Asn Asn Tyr Gln Glu
                85                  90                  95

Gln Gln Lys Leu His Asn Thr Val Leu Asn Leu Lys Ser Glu Ala Leu
            100                 105                 110

Asn Ala Lys Ile Asp Pro Lys Ala Leu Ser Trp Ile Leu His Asp Tyr
        115                 120                 125

Leu Lys Asn Arg Gly His Phe Tyr Glu Asp Asn Arg Asp Phe Asn Val
    130                 135                 140

Tyr Pro Thr Lys Glu Leu Ala Lys Tyr Phe Asp Lys Tyr Gly Tyr Tyr
145                 150                 155                 160

Lys Gly Ile Ile Asp Ser Lys Glu Asp Asn Asp Asn Lys Leu Glu Glu
                165                 170                 175

Glu Leu Thr Lys Tyr Lys Phe Ser Asn Lys His Trp Leu Glu Glu Val
            180                 185                 190

Lys Lys Val Leu Ser Asn Gln Thr Gly Leu Pro Glu Lys Phe Lys Glu
        195                 200                 205
```

```
Glu Tyr Glu Ser Leu Phe Ser Tyr Val Arg Asn Tyr Ser Glu Gly Pro
    210                 215                 220

Gly Ser Ile Asn Ser Val Ser Pro Tyr Gly Ile Tyr His Leu Asp Glu
225                 230                 235                 240

Lys Glu Gly Lys Val Val Gln Lys Tyr Asn Asn Ile Trp Asp Lys Thr
                245                 250                 255

Ile Gly Lys Cys Asn Ile Phe Pro Asp Glu Tyr Arg Ala Pro Lys Asn
            260                 265                 270

Ser Pro Ile Ala Met Ile Phe Asn Glu Ile Asn Glu Leu Ser Thr Ile
        275                 280                 285

Arg Ser Tyr Ser Ile Tyr Leu Thr Gly Trp Phe Ile Asn Gln Glu Phe
    290                 295                 300

Lys Lys Ala Tyr Leu Asn Lys Leu Leu Asp Leu Leu Ile Lys Thr Asn
305                 310                 315                 320

Gly Glu Lys Pro Ile Asp Ala Arg Gln Phe Lys Lys Leu Arg Glu Glu
                325                 330                 335

Thr Ile Ala Glu Ser Ile Gly Lys Glu Thr Leu Lys Asp Val Glu Asn
            340                 345                 350

Glu Glu Lys Leu Glu Lys Glu Asp His Lys Trp Lys Leu Lys Gly Leu
        355                 360                 365

Lys Leu Asn Thr Asn Gly Lys Ile Gln Tyr Asn Asp Leu Ser Ser Leu
    370                 375                 380

Ala Lys Phe Val His Lys Leu Lys Gln His Leu Lys Leu Asp Phe Leu
385                 390                 395                 400

Leu Glu Asp Gln Tyr Ala Thr Leu Asp Lys Ile Asn Phe Leu Gln Ser
```

```
                405                 410                 415

Leu Phe Val Tyr Leu Gly Lys His Leu Arg Tyr Ser Asn Arg Val Asp
            420                 425                 430

Ser Ala Asn Leu Lys Glu Phe Ser Asp Ser Asn Lys Leu Phe Glu Arg
        435                 440                 445

Ile Leu Gln Lys Gln Lys Asp Gly Leu Phe Lys Leu Phe Glu Gln Thr
    450                 455                 460

Asp Lys Asp Asp Glu Lys Ile Leu Ala Gln Thr His Ser Leu Ser Thr
465                 470                 475                 480

Lys Ala Met Leu Leu Ala Ile Thr Arg Met Thr Asn Leu Asp Asn Asp
                485                 490                 495

Glu Asp Asn Gln Lys Asn Asn Asp Lys Gly Trp Asn Phe Glu Ala Ile
            500                 505                 510

Lys Asn Phe Asp Gln Lys Phe Ile Asp Ile Thr Lys Lys Asn Asn Asn
        515                 520                 525

Leu Ser Leu Lys Gln Asn Lys Arg Tyr Leu Asp Asp Arg Phe Ile Asn
    530                 535                 540

Asp Ala Ile Leu Ser Pro Gly Val Lys Arg Ile Leu Arg Glu Ala Thr
545                 550                 555                 560

Lys Val Phe Asn Ala Ile Leu Lys Gln Phe Ser Glu Glu Tyr Asp Val
                565                 570                 575

Thr Lys Val Val Ile Glu Leu Ala Arg Glu Leu Ser Glu Glu Lys Glu
            580                 585                 590

Leu Glu Asn Thr Lys Asn Tyr Lys Lys Leu Ile Lys Lys Asn Gly Asp
        595                 600                 605
```

```
Lys Ile Ser Glu Gly Leu Lys Ala Leu Gly Ile Ser Glu Asp Glu Ile
    610                 615                 620

Lys Asp Ile Leu Lys Ser Pro Thr Lys Ser Tyr Lys Phe Leu Leu Trp
625                 630                 635                 640

Leu Gln Gln Asp His Ile Asp Pro Tyr Ser Leu Lys Glu Ile Ala Phe
                645                 650                 655

Asp Asp Ile Phe Thr Lys Thr Glu Lys Phe Glu Ile Asp His Ile Ile
            660                 665                 670

Pro Tyr Ser Ile Ser Phe Asp Asp Ser Ser Ser Asn Lys Leu Leu Val
        675                 680                 685

Leu Ala Glu Ser Asn Gln Ala Lys Ser Asn Gln Thr Pro Tyr Glu Phe
    690                 695                 700

Ile Ser Ser Gly Asn Ala Gly Ile Lys Trp Glu Asp Tyr Glu Ala Tyr
705                 710                 715                 720

Cys Arg Lys Phe Lys Asp Gly Asp Ser Ser Leu Leu Asp Ser Thr Gln
                725                 730                 735

Arg Ser Lys Lys Phe Ala Lys Met Met Lys Thr Asp Thr Ser Ser Lys
            740                 745                 750

Tyr Asp Ile Gly Phe Leu Ala Arg Asn Leu Asn Asp Thr Arg Tyr Ala
        755                 760                 765

Thr Ile Val Phe Arg Asp Ala Leu Glu Asp Tyr Ala Asn Asn His Leu
    770                 775                 780

Val Glu Asp Lys Pro Met Phe Lys Val Val Cys Ile Asn Gly Ser Val
785                 790                 795                 800

Thr Ser Phe Leu Arg Lys Asn Phe Asp Asp Ser Ser Tyr Ala Lys Lys
```

```
                805                 810                 815

Asp Arg Asp Lys Asn Ile His His Ala Val Asp Ala Ser Ile Ile Ser
            820                 825                 830

Ile Phe Ser Asn Glu Thr Lys Thr Leu Phe Asn Gln Leu Thr Gln Phe
        835                 840                 845

Ala Asp Tyr Lys Leu Phe Lys Asn Thr Asp Gly Ser Trp Lys Lys Ile
    850                 855                 860

Asp Pro Lys Thr Gly Val Val Thr Glu Val Thr Asp Glu Asn Trp Lys
865                 870                 875                 880

Gln Ile Arg Val Arg Asn Gln Val Ser Glu Ile Ala Lys Val Ile Glu
                885                 890                 895

Lys Tyr Ile Gln Asp Ser Asn Ile Glu Arg Lys Ala Arg Tyr Ser Arg
            900                 905                 910

Lys Ile Glu Asn Lys Thr Asn Ile Ser Leu Phe Asn Asp Thr Val Tyr
        915                 920                 925

Ser Ala Lys Lys Val Gly Tyr Glu Asp Gln Ile Lys Arg Lys Asn Leu
    930                 935                 940

Lys Thr Leu Asp Ile His Glu Ser Ala Lys Glu Asn Lys Asn Ser Lys
945                 950                 955                 960

Val Lys Arg Gln Phe Val Tyr Arg Lys Leu Val Asn Val Ser Leu Leu
                965                 970                 975

Asn Asn Asp Lys Leu Ala Asp Leu Phe Ala Glu Lys Glu Asp Ile Leu
            980                 985                 990

Met Tyr Arg Ala Asn Pro Trp Val  Ile Asn Leu Ala Glu  Gln Ile Phe
        995                 1000                1005
```

```
Asn Glu  Tyr Thr Glu Asn Lys  Lys Ile Lys Ser Gln  Asn Val Phe
    1010                1015                1020

Glu Lys  Tyr Met Leu Asp Leu  Thr Lys Glu Phe Pro  Glu Lys Phe
    1025                1030                1035

Ser Glu  Phe Leu Val Lys Ser  Met Leu Arg Asn Lys  Thr Ala Ile
    1040                1045                1050

Ile Tyr  Asp Asp Lys Lys Asn  Ile Val His Arg Ile  Lys Arg Leu
    1055                1060                1065

Lys Met  Leu Ser Ser Glu Leu  Lys Glu Asn Lys Leu  Ser Asn Val
    1070                1075                1080

Ile Ile  Arg Ser Lys Asn Gln  Ser Gly Thr Lys Leu  Ser Tyr Gln
    1085                1090                1095

Asp Thr  Ile Asn Ser Leu Ala  Leu Met Ile Met Arg  Ser Ile Asp
    1100                1105                1110

Pro Thr  Ala Lys Lys Gln Tyr  Ile Arg Val Pro Leu  Asn Thr Leu
    1115                1120                1125

Asn Leu  His Leu Gly Asp His  Asp Phe Asp Leu His  Asn Met Asp
    1130                1135                1140

Ala Tyr  Leu Lys Lys Pro Lys  Phe Val Lys Tyr Leu  Lys Ala Asn
    1145                1150                1155

Glu Ile  Gly Asp Glu Tyr Lys  Pro Trp Arg Val Leu  Thr Ser Gly
    1160                1165                1170

Thr Leu  Leu Ile His Lys Lys  Asp Lys Lys Leu Met  Tyr Ile Ser
    1175                1180                1185

Ser Phe  Gln Asn Leu Asn Asp  Val Ile Glu Ile Lys  Asn Leu Ile
```

```
    1190                1195                1200

Glu Thr  Glu Tyr Lys Glu Asn  Asp Asp Ser Asp Ser  Lys Lys Lys
    1205                1210                1215

Lys Lys  Ala Asn Arg Phe Leu  Met Thr Leu Ser Thr  Ile Leu Asn
    1220                1225                1230

Asp Tyr  Ile Leu Leu Asp Ala  Lys Asp Asn Phe Asp  Ile Leu Gly
    1235                1240                1245

Leu Ser  Lys Asn Arg Ile Asp  Glu Ile Leu Asn Ser  Lys Leu Gly
    1250                1255                1260

Leu Asp  Lys Ile Val Lys
    1265


<210>  551
<211>  226
<212>  PRT
<213>  Mycoplasma iowae

<400>  551

Met Ser Asn Lys Lys Lys Ile Thr Ile Gly Leu Asp Ile Gly Val Ser
1               5                   10                  15

Ser Val Gly Trp Ser Ile Leu Arg Glu Asp Asn Val Leu Ile Asp Tyr
            20                  25                  30

Gly Ser Arg Leu Phe Pro Asp Ala Ala Asn Ala Lys Asp Gly Lys Leu
        35                  40                  45

Glu Asn Glu Ala Arg Arg Ser His Arg Ser Met Arg Arg Arg Ile Arg
    50                  55                  60

Arg Ile Lys Thr Arg Lys Asn Asp Leu Ile Lys Leu Leu Ile Lys Tyr
65                  70                  75                  80
```

```
Asn Ile Ile Ser Asp Gln Asp Glu Leu Ala Lys Ile Leu Glu Gln Gly
                85                  90                  95

Ile Val Asn Glu Thr Gly Asn Val Pro Ile Val Glu Ile Lys Tyr Lys
            100                 105                 110

Gly Leu Lys Glu Lys Leu Ser Lys Glu Glu Leu Leu Ile Cys Leu Tyr
        115                 120                 125

His Tyr Ile His Lys Arg Gly Tyr Phe Tyr Ile Thr Glu Glu Asp Leu
    130                 135                 140

Lys Glu Asn Gly Glu Asn Ile Asn Arg Leu Pro Thr Glu Ile Gln Tyr
145                 150                 155                 160

Asp Phe Tyr Met Lys Asn Gly Tyr Tyr Ile Gly Asn Glu Asp Asn Gln
                165                 170                 175

Lys Phe Ser Asn Leu Ile Trp Val Lys Glu Ile Glu Lys Phe Leu Ser
            180                 185                 190

Lys Gln Ser Leu Asp Ser Asn Phe Val Asp Glu Tyr Ile Ser Leu Phe
        195                 200                 205

Arg Arg Val Arg Asp Tyr Ser Asp Gly Pro Gly Ser Glu Lys Ser Pro
    210                 215                 220

Thr Pro
225
```

<210> 552
<211> 1304
<212> PRT
<213> Mycoplasma synoviae

<400> 552

```
Met Leu Asn Asn Val Gln Asn Leu Trp Lys Tyr Leu Leu Leu Leu Ile
1               5                   10                  15
```

```
Phe Asp Lys Lys Ile Ile Phe Leu Phe Lys Ile Lys Val Ile Leu Ile
            20                  25                  30

Arg Arg Tyr Met Glu Asn Asn Asn Lys Glu Lys Ile Val Ile Gly Phe
        35                  40                  45

Asp Leu Gly Val Ala Ser Val Gly Trp Ser Ile Val Asn Ala Glu Thr
    50                  55                  60

Lys Glu Val Ile Asp Leu Gly Val Arg Leu Phe Ser Glu Pro Glu Lys
65                  70                  75                  80

Ala Asp Tyr Arg Arg Ala Lys Arg Thr Thr Arg Arg Leu Leu Arg Arg
                85                  90                  95

Lys Lys Phe Lys Arg Glu Lys Phe His Lys Leu Ile Leu Lys Asn Ala
            100                 105                 110

Glu Ile Phe Gly Leu Gln Ser Arg Asn Glu Ile Leu Asn Val Tyr Lys
        115                 120                 125

Asp Gln Ser Ser Lys Tyr Arg Asn Ile Leu Lys Leu Lys Ile Asn Ala
    130                 135                 140

Leu Lys Glu Glu Ile Lys Pro Ser Glu Leu Val Trp Ile Leu Arg Asp
145                 150                 155                 160

Tyr Leu Gln Asn Arg Gly Tyr Phe Tyr Lys Asn Glu Lys Leu Thr Asp
                165                 170                 175

Glu Phe Val Ser Asn Ser Phe Pro Ser Lys Lys Leu His Glu His Tyr
            180                 185                 190

Glu Lys Tyr Gly Phe Phe Arg Gly Ser Val Lys Leu Asp Asn Lys Leu
        195                 200                 205

Asp Asn Lys Lys Asp Lys Ala Lys Glu Lys Asp Glu Glu Glu Glu Ser
```

```
    210                 215                 220

Asp Ala Lys Lys Glu Ser Glu Glu Leu Ile Phe Ser Asn Lys Gln Trp
225                 230                 235                 240

Ile Asn Glu Ile Val Lys Val Phe Glu Asn Gln Ser Tyr Leu Thr Glu
                245                 250                 255

Ser Phe Lys Glu Glu Tyr Leu Lys Leu Phe Asn Tyr Val Arg Pro Phe
            260                 265                 270

Asn Lys Gly Pro Gly Ser Lys Asn Ser Arg Thr Ala Tyr Gly Val Phe
        275                 280                 285

Ser Thr Asp Ile Asp Pro Glu Thr Asn Lys Phe Lys Asp Tyr Ser Asn
    290                 295                 300

Ile Trp Asp Lys Thr Ile Gly Lys Cys Ser Leu Phe Glu Glu Glu Ile
305                 310                 315                 320

Arg Ala Pro Lys Asn Leu Pro Ser Ala Leu Ile Phe Asn Leu Gln Asn
                325                 330                 335

Glu Ile Cys Thr Ile Lys Asn Glu Phe Thr Glu Phe Lys Asn Trp Trp
            340                 345                 350

Leu Asn Ala Glu Gln Lys Ser Glu Ile Leu Lys Phe Val Phe Thr Glu
        355                 360                 365

Leu Phe Asn Trp Lys Asp Lys Lys Tyr Ser Asp Lys Lys Phe Asn Lys
    370                 375                 380

Asn Leu Gln Asp Lys Ile Lys Lys Tyr Leu Leu Asn Phe Ala Leu Glu
385                 390                 395                 400

Asn Phe Asn Leu Asn Glu Glu Ile Leu Lys Asn Arg Asp Leu Glu Asn
                405                 410                 415
```

```
Asp Thr Val Leu Gly Leu Lys Gly Val Lys Tyr Tyr Glu Lys Ser Asn
            420                 425                 430

Ala Thr Ala Asp Ala Ala Leu Glu Phe Ser Ser Leu Lys Pro Leu Tyr
        435                 440                 445

Val Phe Ile Lys Phe Leu Lys Glu Lys Lys Leu Asp Leu Asn Tyr Leu
    450                 455                 460

Leu Gly Leu Glu Asn Thr Glu Ile Leu Tyr Phe Leu Asp Ser Ile Tyr
465                 470                 475                 480

Leu Ala Ile Ser Tyr Ser Ser Asp Leu Lys Glu Arg Asn Glu Trp Phe
                485                 490                 495

Lys Lys Leu Leu Lys Glu Leu Tyr Pro Lys Ile Lys Asn Asn Asn Leu
            500                 505                 510

Glu Ile Ile Glu Asn Val Glu Asp Ile Phe Glu Ile Thr Asp Gln Glu
        515                 520                 525

Lys Phe Glu Ser Phe Ser Lys Thr His Ser Leu Ser Arg Glu Ala Phe
    530                 535                 540

Asn His Ile Ile Pro Leu Leu Leu Ser Asn Asn Glu Gly Lys Asn Tyr
545                 550                 555                 560

Glu Ser Leu Lys His Ser Asn Glu Glu Leu Lys Lys Arg Thr Glu Lys
                565                 570                 575

Ala Glu Leu Lys Ala Gln Gln Asn Gln Lys Tyr Leu Lys Asp Asn Phe
            580                 585                 590

Leu Lys Glu Ala Leu Val Pro Leu Ser Val Lys Thr Ser Val Leu Gln
        595                 600                 605

Ala Ile Lys Ile Phe Asn Gln Ile Ile Lys Asn Phe Gly Lys Lys Tyr
```

```
    610                 615                 620

Glu Ile Ser Gln Val Val Ile Glu Met Ala Arg Glu Leu Thr Lys Pro
625                 630                 635                 640

Asn Leu Glu Lys Leu Leu Asn Asn Ala Thr Asn Ser Asn Ile Lys Ile
                645                 650                 655

Leu Lys Glu Lys Leu Asp Gln Thr Glu Lys Phe Asp Asp Phe Thr Lys
            660                 665                 670

Lys Lys Phe Ile Asp Lys Ile Glu Asn Ser Val Val Phe Arg Asn Lys
        675                 680                 685

Leu Phe Leu Trp Phe Glu Gln Asp Arg Lys Asp Pro Tyr Thr Gln Leu
    690                 695                 700

Asp Ile Lys Ile Asn Glu Ile Glu Asp Glu Thr Glu Ile Asp His Val
705                 710                 715                 720

Ile Pro Tyr Ser Lys Ser Ala Asp Asp Ser Trp Phe Asn Lys Leu Leu
                725                 730                 735

Val Lys Lys Ser Thr Asn Gln Leu Lys Lys Asn Lys Thr Val Trp Glu
            740                 745                 750

Tyr Tyr Gln Asn Glu Ser Asp Pro Glu Ala Lys Trp Asn Lys Phe Val
        755                 760                 765

Ala Trp Ala Lys Arg Ile Tyr Leu Val Gln Lys Ser Asp Lys Glu Ser
    770                 775                 780

Lys Asp Asn Ser Glu Lys Asn Ser Ile Phe Lys Asn Lys Lys Pro Asn
785                 790                 795                 800

Leu Lys Phe Lys Asn Ile Thr Lys Lys Leu Phe Asp Pro Tyr Lys Asp
                805                 810                 815
```

```
Leu Gly Phe Leu Ala Arg Asn Leu Asn Asp Thr Arg Tyr Ala Thr Lys
            820                 825                 830

Val Phe Arg Asp Gln Leu Asn Asn Tyr Ser Lys His His Ser Lys Asp
        835                 840                 845

Asp Glu Asn Lys Leu Phe Lys Val Val Cys Met Asn Gly Ser Ile Thr
    850                 855                 860

Ser Phe Leu Arg Lys Ser Met Trp Arg Lys Asn Glu Glu Gln Val Tyr
865                 870                 875                 880

Arg Phe Asn Phe Trp Lys Lys Asp Arg Asp Gln Phe Phe His His Ala
                885                 890                 895

Val Asp Ala Ser Ile Ile Ala Ile Phe Ser Leu Leu Thr Lys Thr Leu
            900                 905                 910

Tyr Asn Lys Leu Arg Val Tyr Glu Ser Tyr Asp Val Gln Arg Arg Glu
        915                 920                 925

Asp Gly Val Tyr Leu Ile Asn Lys Glu Thr Gly Glu Val Lys Lys Ala
    930                 935                 940

Asp Lys Asp Tyr Trp Lys Asp Gln His Asn Phe Leu Lys Ile Arg Glu
945                 950                 955                 960

Asn Ala Ile Glu Ile Lys Asn Val Leu Asn Asn Val Asp Phe Gln Asn
                965                 970                 975

Gln Val Arg Tyr Ser Arg Lys Ala Asn Thr Lys Leu Asn Thr Gln Leu
            980                 985                 990

Phe Asn Glu Thr Leu Tyr Gly Val  Lys Glu Phe Glu Asn  Asn Phe Tyr
        995                 1000                1005

Lys Leu  Glu Lys Val Asn Leu  Phe Ser Arg Lys Asp  Leu Arg Lys
```

```
    1010                1015                1020

Phe Ile  Leu Glu Asp Leu Asn  Glu Glu Ser Glu Lys  Asn Lys Lys
    1025                1030                1035

Asn Glu  Asn Gly Ser Arg Lys  Arg Ile Leu Thr Glu  Lys Tyr Ile
    1040                1045                1050

Val Asp  Glu Ile Leu Gln Ile  Leu Glu Asn Glu Glu  Phe Lys Asp
    1055                1060                1065

Ser Lys  Ser Asp Ile Asn Ala  Leu Asn Lys Tyr Met  Asp Ser Leu
    1070                1075                1080

Pro Ser  Lys Phe Ser Glu Phe  Phe Ser Gln Asp Phe  Ile Asn Lys
    1085                1090                1095

Cys Lys  Lys Glu Asn Ser Leu  Ile Leu Thr Phe Asp  Ala Ile Lys
    1100                1105                1110

His Asn  Asp Pro Lys Lys Val  Ile Lys Ile Lys Asn  Leu Lys Phe
    1115                1120                1125

Phe Arg  Glu Asp Ala Thr Leu  Lys Asn Lys Gln Ala  Val His Lys
    1130                1135                1140

Asp Ser  Lys Asn Gln Ile Lys  Ser Phe Tyr Glu Ser  Tyr Lys Cys
    1145                1150                1155

Val Gly  Phe Ile Trp Leu Lys  Asn Lys Asn Asp Leu  Glu Glu Ser
    1160                1165                1170

Ile Phe  Val Pro Ile Asn Ser  Arg Val Ile His Phe  Gly Asp Lys
    1175                1180                1185

Asp Lys  Asp Ile Phe Asp Phe  Asp Ser Tyr Asn Lys  Glu Lys Leu
    1190                1195                1200
```

```
Leu Asn  Glu Ile Asn Leu Lys  Arg Pro Glu Asn Lys  Lys Phe Asn
    1205                1210                1215


Ser Ile  Asn Glu Ile Glu Phe  Val Lys Phe Val Lys  Pro Gly Ala
    1220                1225                1230


Leu Leu  Leu Asn Phe Glu Asn  Gln Gln Ile Tyr Tyr  Ile Ser Thr
    1235                1240                1245


Leu Glu  Ser Ser Ser Leu Arg  Ala Lys Ile Lys Leu  Leu Asn Lys
    1250                1255                1260


Met Asp  Lys Gly Lys Ala Val  Ser Met Lys Lys Ile  Thr Asn Pro
    1265                1270                1275


Asp Glu  Tyr Lys Ile Ile Glu  His Val Asn Pro Leu  Gly Ile Asn
    1280                1285                1290


Leu Asn  Trp Thr Lys Lys Leu  Glu Asn Asn Asn
    1295                1300
```

<210> 553
<211> 1401
<212> PRT
<213> Myroides injenensis

<400> 553

```
Met Lys Arg Ile Leu Gly Leu Asp Leu Gly Thr Thr Ser Ile Gly Trp
1               5                   10                  15


Ala Tyr Val His Glu Ala Glu Asn Val Asn Glu Thr Ser Ser Ile Gln
            20                  25                  30


Lys Val Gly Val Arg Val Asn Pro Leu Thr Thr Glu Glu Gln Thr Asn
        35                  40                  45


Phe Glu Lys Gly Lys Pro Ile Thr Thr Asn Ala Ser Arg Thr Leu Ala
    50                  55                  60
```

```
Arg Ser Ala Arg Arg Asn Leu Gln Arg Tyr Lys Leu Arg Arg Asp Asn
65                  70                  75                  80

Leu Ile Gln Ile Leu Lys Glu Asn Asn Trp Ile Asn Asn Thr Thr Ser
                85                  90                  95

Leu Thr Glu Thr Gly Asn His Ser Thr Phe Glu Thr Tyr Glu Leu Arg
            100                 105                 110

Asn Lys Ala Ala Ser Glu Lys Leu Thr Leu Asp Gln Leu Ser Arg Val
        115                 120                 125

Leu Leu Met Leu Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Val
    130                 135                 140

Asn Ser Lys Glu Glu Gly Gln Leu Ile Asp Gly Met Glu Val Ala Lys
145                 150                 155                 160

Lys Leu Tyr His Glu Gln Leu Thr Pro Gly Gln Leu Ser Leu Gln Leu
                165                 170                 175

Met Asn Gln Gly Val Lys Lys Leu Pro Asp Tyr Tyr Arg Ser Asp Leu
            180                 185                 190

Asn Gln Glu Leu Glu Ser Ile Trp Asn Phe Gln Gln Gln Phe Tyr Pro
        195                 200                 205

Asn Ile Leu Thr Asp Lys Phe Lys Glu Glu Ile Asn Gly Lys Gly Leu
    210                 215                 220

Thr Ser Thr Ser Ser Ala Phe Trp Asn Ile Tyr Asn Phe Asn Thr Ala
225                 230                 235                 240

Glu Asn Lys Gly Ser Arg Asp Glu Lys Lys Lys Gln Ala Leu Gln Trp
                245                 250                 255
```

```
Arg Ser Glu Ala Leu Ser Lys Gln Leu Ser Lys Glu Ile Val Ala Tyr
            260                 265                 270

Ile Ile Ala Asp Leu Asn Gly Gln Ile Tyr Asn Ser Ser Gly Tyr Leu
        275                 280                 285

Gly Ala Ile Ser Asp Arg Ser Lys Glu Leu Tyr Phe Asn Asn Leu Thr
    290                 295                 300

Val Gly Gln Tyr Leu Phe Lys Gln Leu Lys Ser Asn Pro His Thr Ser
305                 310                 315                 320

Leu Lys Asn Gln Val Phe Tyr Arg Gln Asp Tyr Leu Asn Glu Phe Glu
                325                 330                 335

Lys Ile Trp Glu Thr Gln Ser Lys Phe Tyr Pro Lys Glu Leu Thr Ala
            340                 345                 350

Ala Leu Lys Arg Glu Ile Arg Asp Val Ile Ile Phe Tyr Gln Arg Lys
        355                 360                 365

Leu Lys Ser Gln Lys Gly Leu Ile Ser Phe Cys Glu Phe Glu Gln Lys
    370                 375                 380

Gln Lys Thr Ile Asn Gly Lys Thr Lys Thr Ile Gly His Arg Val Ile
385                 390                 395                 400

Pro Lys Ser Ser Pro Leu Phe Gln Glu Phe Lys Ile Trp Gln Gln Leu
                405                 410                 415

His Asn Val Val Leu Arg Asn Lys Lys Thr Asn Glu Ile Val Ser Leu
            420                 425                 430

Ala Asp Glu Gln Lys Val His Leu Phe Glu Glu Leu Asn Leu Lys Gly
        435                 440                 445

Lys Leu Lys Ser Asn Gln Val Leu Lys Leu Ile Glu Asn Lys Pro Lys
    450                 455                 460
```

```
Asp Trp Glu Leu Asn Tyr Thr Glu Leu Glu Gly Asn Asn Thr Asn Lys
465                 470                 475                 480

Ala Leu Tyr Asn Ala Tyr Leu Asp Ile Leu Asp Ile Glu Gly Tyr Asp
                485                 490                 495

Val Arg Asn Glu Leu Lys Val Lys Leu Asn Lys Asp Asp Ile Glu Leu
            500                 505                 510

Ser Asp Leu Asp Val Asn Ala Ser Glu Ile Lys Glu Met Ile Phe Ser
        515                 520                 525

Val Phe Lys His Leu Gly Ile Asn Thr Glu Ile Leu Glu Phe Asp Ala
    530                 535                 540

Thr Leu Glu Asp Lys Val Phe Glu Lys Gln Ala Ser Tyr Gln Leu Trp
545                 550                 555                 560

His Leu Leu Tyr Ser Tyr Glu Glu Asp Asn Ser Pro Thr Gly Leu Asp
                565                 570                 575

Arg Leu Tyr Asn Leu Leu His Lys Lys Phe Gly Phe Lys Leu Asn His
            580                 585                 590

Ala Lys Leu Ile Gly Asn Val Leu Phe Gln Asp Asp Tyr Gly Ser Leu
        595                 600                 605

Ser Ser Lys Ala Ile Lys Asn Ile Phe Pro Tyr Ile Thr Glu Asn Asn
    610                 615                 620

Tyr Tyr Thr Ala Cys Glu Leu Ala Gly Tyr Lys His Ser Lys His Ser
625                 630                 635                 640

Leu Thr Lys Glu Glu Asn Glu Thr Arg Glu Leu Lys Asn Arg Leu Thr
                645                 650                 655
```

```
Ile Leu Pro Lys Asn Ser Leu Arg Asn Pro Val Val Glu Lys Ile Ile
            660                 665                 670

Asn Gln Met Ile Asn Val Val Asn Thr Leu Ile Asp Glu Glu Asn Asn
        675                 680                 685

Ile Leu Ile Ala Gln Gly Lys Glu Pro Asn Phe Gln Phe Asp Glu Ile
    690                 695                 700

Arg Ile Glu Leu Ala Arg Glu Leu Lys Lys Asn Ala Lys Glu Arg Glu
705                 710                 715                 720

Glu Leu Thr Lys Ser Ile Asn Lys Ser Lys Thr Asp His Glu Lys Ile
                725                 730                 735

Ile Lys Ile Leu Gln Lys Glu Asp Gly Ile Lys Asn Pro Thr Arg Asn
            740                 745                 750

Asp Ile Val Arg Phe Lys Leu Tyr Ser Glu Leu Lys Asn Asn Gly Tyr
        755                 760                 765

Lys Asp Leu Tyr Thr Asn Glu Tyr Ile Glu Arg Lys Asp Ile Phe Thr
    770                 775                 780

Lys Glu Tyr Asp Ile Glu His Ile Ile Pro Gln Ser Lys Leu Phe Asp
785                 790                 795                 800

Asp Ser Phe Ser Asn Lys Thr Leu Val Arg Arg Asn Val Asn Leu Lys
                805                 810                 815

Lys Gly Asn Gln Thr Ala Tyr Asp Phe Ile Leu Cys Glu Tyr Gly Gln
            820                 825                 830

Glu Lys Ala Asn Glu Phe Glu Thr Arg Ile Thr Asn Leu Tyr Asn Leu
        835                 840                 845

Gly Lys Asp Glu Gly Ile Ser Lys Ser Lys Phe Lys Lys Leu Leu Met
    850                 855                 860
```

```
Gln Glu Ser Glu Ile Gly Asn Gly Phe Ile Glu Arg Asp Leu Arg Glu
865                 870                 875                 880


Thr Gln Tyr Ile Ala Lys Lys Ala Lys Ser Leu Leu Leu Glu Ile Thr
                885                 890                 895


Arg Asn Val Ile Ser Thr Ser Gly Ser Ile Thr Asp Arg Leu Arg Glu
            900                 905                 910


Asp Trp Gly Leu Ile Asn Val Met Lys Glu Leu Asn Leu Gln Lys Tyr
        915                 920                 925


Arg Asp Ala Gly Leu Thr Glu Phe Val Lys Met Lys Asp Gly Asn Lys
    930                 935                 940


Lys Glu Val Ile Ile Asp Trp Thr Lys Arg Asn Asp His Arg His His
945                 950                 955                 960


Ala Met Asp Ala Leu Thr Ile Ala Phe Thr Lys His Asn His Ile Gln
                965                 970                 975


Tyr Leu Asn His Leu Asn Ala Arg Lys Asn Val Asn Asn Glu Leu His
            980                 985                 990


Asn Asn Ile Ile Ala Ile Glu Lys  Leu Glu Thr Thr Leu  Val Ser Asp
        995                 1000                1005


Glu Arg  Gly Asn Lys Lys Arg  Ile Phe Lys Glu Pro  Ile Ala Asn
    1010                1015                1020


Phe Arg  Thr Ile Ala Lys Ser  His Leu Glu Ala Ile  Leu Val Ser
    1025                1030                1035


His Lys  Ala Lys Asn Lys Val  Val Thr Lys Asn Ile  Asn Lys Ile
    1040                1045                1050
```

```
Ser Gly  Lys Lys Ile Ser Gln  Gln Thr Leu Thr Pro  Arg Gly Gln
    1055                1060                1065

Leu His  Lys Glu Thr Ile Tyr  Gly Lys Ile Arg Gln  Tyr Val Ser
    1070                1075                1080

Lys Gln  Glu Lys Val Gly Pro  Lys Phe Thr Ile Glu  Val Ile Glu
    1085                1090                1095

Gln Val  Ser Asn Pro Thr Tyr  Arg Asn Leu Leu Leu  Lys Arg Leu
    1100                1105                1110

Glu Glu  Asn Asn Asn Asp Pro  Lys Lys Ala Phe Gly  Gly Lys Asn
    1115                1120                1125

Ser Leu  Asn Lys Asn Pro Ile  Tyr Ile Asn Leu Glu  Lys Asn Ile
    1130                1135                1140

Lys Val  Pro Glu Val Leu Lys  Leu Val Trp Leu Glu  Asp Asn Tyr
    1145                1150                1155

Thr Ile  Arg Lys Glu Ile Ser  Pro Asp Leu Lys Ile  Asp Lys Val
    1160                1165                1170

Ile Asp  Gln Gly Val Lys Gln  Ile Leu Gln Asn Arg  Leu Ala Gln
    1175                1180                1185

Tyr Lys  Gly Asp Ser Lys Leu  Ala Phe Ser Asn Leu  Asp Ala Asn
    1190                1195                1200

Pro Ile  Trp Leu Asn Glu Asp  Lys Gly Ile Ala Ile  Lys Arg Val
    1205                1210                1215

Thr Ile  Ser Gly Ile Ala Thr  Ala Gln Pro Leu His  Arg Lys Lys
    1220                1225                1230

Asp His  Leu Gly Gln Pro Ile  Leu Asp His Asn Gly  Gln Glu Ile
    1235                1240                1245
```

```
Pro Val  Asp Phe Ile Ser Thr  Gly Asn Asn His His  Val Ala Ile
    1250                1255                1260


Tyr Glu  Asp Glu Asn Gly Lys  Leu Gln Glu Ser Val  Val Ser His
    1265                1270                1275


Phe Glu  Ala Val Glu Arg Val  Asn Gln Lys Leu Pro  Ile Ile Asp
    1280                1285                1290


Lys Thr  Phe Asn Gln His Leu  Gly Trp Lys Phe Leu  Phe Thr Met
    1295                1300                1305


Lys Gln  Asn Glu Leu Phe Leu  Phe Pro Ser Asp Asp  Phe Asn Pro
    1310                1315                1320


Asn Glu  Ile Asp Leu Phe Asp  Lys Gln Asn Tyr Thr  Val Ile Ser
    1325                1330                1335


Lys His  Leu Phe Arg Ile Gln  Lys Leu Ser Thr Lys  Asp Tyr Ser
    1340                1345                1350


Phe Arg  His His Leu Glu Thr  Asn Val Glu Glu Ile  Lys Asp Leu
    1355                1360                1365


Lys Thr  Ile Thr Trp Arg Arg  Glu Gly Leu Asn Gly  Ile Gln Asn
    1370                1375                1380


Ile Ile  Lys Val Arg Thr Asn  His Leu Gly Glu Ile  Ile His Ile
    1385                1390                1395


Gly Glu  Tyr
    1400
```

<210> 554
<211> 1466
<212> PRT
<213> Myroides odoratus

<400> 554

```
Met Lys Asn Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                  10                  15

Ala Leu Val Lys Glu Asp Phe Glu Asn Lys Gln Gly Glu Ile Leu Gly
            20                  25                  30

Leu Gly Ser Arg Ile Ile Pro Met Ser Gln Asp Ile Leu Gly Glu Phe
        35                  40                  45

Gly Arg Gly Asn Ser Ile Ser Gln Thr Ala Asp Arg Thr Gly Tyr Arg
    50                  55                  60

Gly Val Arg Arg Leu Arg Glu Arg His Leu Leu Arg Arg Glu Arg Leu
65                  70                  75                  80

His Arg Val Leu Asn Ile Leu Gly Phe Leu Pro Asn His Tyr Ala Lys
                85                  90                  95

Glu Ile Asp Phe Thr Lys Arg Leu Gly Lys Phe Ile Asn His Ala Glu
            100                 105                 110

Pro Lys Leu Ser Phe Asp Lys Glu Phe Ile Phe Lys Asp Ser Phe Asn
        115                 120                 125

Glu Met Leu Lys Asp Phe Gln Gln Asn Gln Pro Gly Phe Ile Ile Asn
    130                 135                 140

Lys His Gly Glu Glu Ala Leu Val Pro Tyr Asp Trp Thr Ile Tyr Tyr
145                 150                 155                 160

Leu Arg Lys Lys Ala Leu Thr Gln Lys Ile Asp Lys Glu Glu Leu Ala
                165                 170                 175

Trp Ile Leu Leu Asn Phe Asn Gln Lys Arg Gly Tyr Tyr Gln Leu Arg
            180                 185                 190
```

```
Gly Glu Glu Glu Glu Glu Asn Thr Asn Lys Leu Val Glu Phe Tyr Ser
        195                 200                 205

Leu Lys Ile Ile Asp Val Ile Ala Asp Asn Glu Val Asn Lys Lys Gly
    210                 215                 220

Glu Val Trp Tyr Ser Leu His Leu Glu Asn Gly Trp Ile Tyr Arg Arg
225                 230                 235                 240

Ser Ser Lys Ile Ser Leu Val Asp Trp Lys Asp Lys Val Arg Asp Phe
                245                 250                 255

Ile Val Thr Thr Asp Val Asn Asp Asp Gly Ser Glu Lys Leu Asp Lys
            260                 265                 270

Asp Gly Val Val Lys Arg Ser Phe Arg Ala Pro Ser Ala Asp Asp Trp
        275                 280                 285

Thr Leu Leu Lys Lys Lys Thr Glu Gln Asp Ile Asp Asn Ser Asn Lys
    290                 295                 300

Thr Val Gly Ala Tyr Ile Tyr Glu Asn Leu Leu Leu Asn Pro Lys Gln
305                 310                 315                 320

Lys Ile Lys Gly Lys Leu Val Arg Thr Ile Glu Arg Lys Phe Tyr Lys
                325                 330                 335

Asp Glu Leu Lys Gln Ile Leu Glu Lys Gln Lys Glu Phe His Gln Glu
            340                 345                 350

Leu Gln Asn Glu Gln Leu Leu Gln Asp Cys Val Arg Glu Leu Tyr Lys
        355                 360                 365

Tyr Asn Glu Gln His Gln Gln Met Leu Glu Ser Lys Asp Phe Val His
    370                 375                 380

Leu Phe Leu Asn Asp Ile Ile Phe Tyr Gln Arg Pro Leu Arg Ser Gln
```

```
385                 390                 395                 400

Lys Ser Leu Ile Ser Asn Cys Thr Leu Glu Lys Arg Val Ser Arg Asp
                405                 410                 415

Gly Val Val Phe Pro Ile Lys Val Ile Ser Lys Ser Asn Pro Tyr Tyr
            420                 425                 430

Gln Glu Phe Arg Leu Leu Gln Trp Leu Gln Asn Leu Ala Ile Tyr Arg
        435                 440                 445

Lys Asp Asp Asp Val Asn Val Thr Gln Glu Phe Leu Asn Ser Ile Glu
    450                 455                 460

Ser Trp Glu Asn Leu Leu Gln Phe Leu Asn Ala Lys Lys Glu Ile Lys
465                 470                 475                 480

Gln Glu Gln Leu Ile Lys Phe Leu Leu Glu Gln Lys Gly Leu Lys Gly
                485                 490                 495

Asn Ser Leu Lys Thr Ala Ile Leu Thr Tyr Arg Trp Asn Tyr Val Thr
            500                 505                 510

Asp Lys Val Tyr Pro Met Asn Glu Thr Arg Ser Leu Ile Gln Asp Lys
        515                 520                 525

Leu Lys Lys Val Glu Asn Val Ala Thr Asp Phe Leu Ser Phe Asp Asn
    530                 535                 540

Glu Met Ala Leu Trp His Ile Ile Tyr Ser Val Asn Asp Lys Ile Glu
545                 550                 555                 560

Tyr Glu Lys Ala Leu Ala Lys Phe Ala Ser Lys His Asn Leu Asp Glu
                565                 570                 575

Ile Ser Phe Val Glu Ser Phe Lys Lys Phe Pro Pro Phe Lys Ser Asp
            580                 585                 590
```

```
Tyr Gly Ser Phe Ser Glu Lys Ala Ile Lys Lys Leu Leu Pro Leu Met
        595                 600                 605

Arg Phe Gly Ser Val Trp Asn Lys Asn Asn Ile Val Pro Ser Val Leu
    610                 615                 620

Asp Arg Ile Asp Lys Ile Leu Thr Gly Glu Tyr Asp Glu Lys Ile Lys
625                 630                 635                 640

Ile Arg Val Arg Glu Lys Ala Glu Gln Phe Gln Leu Asn Gln Ile Glu
                645                 650                 655

Asp Phe Gln Asn Leu Pro Leu Trp Leu Ala Gln Tyr Val Val Tyr Asp
            660                 665                 670

Arg His Ser Glu Ala Glu Ile Ala Gly Lys Trp Asn Ser Val Lys Asp
        675                 680                 685

Leu Glu Asn Tyr Leu Lys Glu Phe Lys Gln His Ser Leu Arg Asn Pro
    690                 695                 700

Ile Val Glu Gln Ile Ile Thr Glu Thr Leu Arg Val Val Lys Asp Ile
705                 710                 715                 720

Trp Gln Gln Tyr Gly Asn Gly Val Gln Asn Phe Phe Asp Glu Ile His
                725                 730                 735

Ile Glu Leu Gly Arg Glu Met Lys Asn Thr Ala Asp Glu Arg Lys Arg
            740                 745                 750

Ile Thr Asn Ser Val Thr Glu Asn Glu Asn Thr Asn Leu Arg Ile Lys
        755                 760                 765

Ala Leu Leu Val Glu Leu Lys Glu Asp Thr Asn Ile Glu Asn Val Arg
    770                 775                 780

Pro His Ser Pro Met Gln Gln Glu Ile Leu Lys Ile Tyr Glu Glu Gly
```

785 790 795 800

Val Leu Asn Ala Val Glu Asn Ile Asp Glu Asp Ile Leu Lys Ile Ser
805 810 815

Lys Thr Ala Gln Pro Ser Lys Ser Glu Leu Ile Arg Tyr Lys Leu Trp
820 825 830

Leu Glu Gln Lys Tyr Gln Ser Pro Tyr Thr Gly Glu Met Ile Pro Leu
835 840 845

Ser Arg Leu Phe Thr Ser Asp Tyr Glu Ile Glu His Val Ile Pro Gln
850 855 860

Ser Arg Tyr Phe Asp Asp Ser Leu Ser Asn Lys Val Ile Cys Glu Ala
865 870 875 880

Ala Val Asn Lys Arg Lys Asp Asn Gln Leu Gly Leu Glu Phe Ile Lys
885 890 895

Asn His His Ser Glu Lys Ile Glu Leu Gly Asn Gly Arg Thr Ala Gln
900 905 910

Val Leu Glu Val Glu Ala Tyr Glu Ser Phe Val Lys Lys Asn Tyr Asp
915 920 925

Lys Asn Arg Gly Lys Arg Asn Lys Leu Leu Leu Glu Asp Val Pro Glu
930 935 940

Lys Met Ile Glu Arg Gln Leu Asn Asp Thr Arg Tyr Ile Ser Lys Phe
945 950 955 960

Val Thr His Leu Leu Ser Asn Ile Val Arg Lys Asp Glu Val Asn Ser
965 970 975

Lys Asp Asp Gly Ile Asn Ser Lys Asn Ile Ile Pro Gly Asn Gly Lys
980 985 990

```
Ile Thr Ser Gln Leu Lys Gln Asp  Trp Gly Leu Asn Asp  Val Trp Asn
        995                 1000                1005


Glu Leu  Ile Leu Pro Arg Phe  Glu Arg Met Asn Asn  Leu Thr Asn
    1010                1015                1020


Ser Thr  Asp Phe Thr Ser Thr  Asn Thr Asn Gly Lys  Ile Ile Pro
    1025                1030                1035


Thr Val  Pro Leu Glu Tyr Ser  Lys Gly Phe Ser Lys  Lys Arg Ile
    1040                1045                1050


Asp His  Arg His His Ala Leu  Asp Ala Leu Val Ile  Ala Leu Ala
    1055                1060                1065


Thr Arg  Asp His Val Asn Leu  Leu Asn Asn Glu Ser  Ala Leu Pro
    1070                1075                1080


Lys Lys  Asp Arg Thr Lys Glu  Glu Gln Lys Ser Phe  Arg Phe Asp
    1085                1090                1095


Leu Gln  Val Asn Leu Arg Asn  Lys Glu Lys Tyr Phe  Asn Val Lys
    1100                1105                1110


Glu Gly  Arg Glu Lys Glu Lys  Phe Thr Thr Phe Lys  Lys Pro Trp
    1115                1120                1125


Asn Thr  Leu Thr Gln Asp Thr  Arg Asp Ala Leu Glu  Asn Met Val
    1130                1135                1140


Val Ser  Phe Lys Gln Asn Leu  Arg Val Ile Asn Lys  Ala Thr Asn
    1145                1150                1155


Tyr Tyr  Glu Ser Tyr Thr Asp  Glu Asn Gly Asn Leu  Arg Leu Asp
    1160                1165                1170


Lys Tyr  Gly Asn Pro Lys Lys  Glu Leu Ile Ser Gln  Lys Gly Thr
```

```
    1175                1180                1185

Asn Trp  Ala Ile Arg Lys Ser  Leu His Lys Glu Thr  Val Ser Gly
    1190                1195                1200

Gln Ile  His Leu Asp Arg Val  Lys Val Thr Lys Gly  Lys Ile Val
    1205                1210                1215

Thr Ala  Thr Arg Lys Ser Leu  Asp Ser Ser Phe Asn  Glu Lys Ser
    1220                1225                1230

Ile Glu  Ser Ile Thr Asp Thr  Gly Ile Gln Lys Ile  Leu Arg Asn
    1235                1240                1245

Tyr Leu  Lys Ala Lys Asp Asn  Lys Pro Asp Val Ala  Phe Ser Pro
    1250                1255                1260

Glu Gly  Ile Glu Glu Leu Asn  Lys Ser Ile Ser Val  Tyr Asn Glu
    1265                1270                1275

Gly Lys  Asn His Gln Pro Ile  Ile Lys Val Arg Ile  Phe Glu Gln
    1280                1285                1290

Gly Ser  Lys Phe Pro Val Gly  Glu Thr Gly Asn Lys  Ile Ala Lys
    1295                1300                1305

Phe Val  Glu Ala Ala Lys Gly  Thr Asn Leu Phe Phe  Gly Ile Tyr
    1310                1315                1320

Gln Asp  Lys Thr Gly Lys Arg  Ser Tyr Asp Thr Ile  Pro Leu Asn
    1325                1330                1335

Leu Val  Ile Glu Arg Leu Lys  Gln Gly Leu Ser Pro  Val Pro Glu
    1340                1345                1350

Thr Asn  Glu Lys Gly His Gln  Leu Leu Phe His Leu  Ser Pro Asn
    1355                1360                1365
```

```
Asp Leu  Val Tyr Val Pro Thr  Ile Asp Asp Asn Glu  Gln Leu Asp
    1370                1375                1380


Ser Asn  Arg Val Tyr Lys Phe  Thr Asp Ser Ser Asp  Thr Thr Cys
    1385                1390                1395


Asn Phe  Ile Pro Ser Asn Ile  Ser Ala Ile Ile Phe  Asn Ile Asn
    1400                1405                1410


Ser Lys  Glu Gln Glu Lys Arg  Gly Ile Asn Tyr Pro  Ile Gln Asn
    1415                1420                1425


Glu Leu  Gly Val Gly Ser Pro  Gln Ser Lys Asn Gln  Lys Ser Phe
    1430                1435                1440


Asp Gly  Phe Met Ile Lys Glu  Val Cys Ile Lys Leu  Lys Val Asp
    1445                1450                1455


Arg Leu  Gly Asn Ile Ser Lys  Thr
    1460                1465
```

<210> 555
<211> 241
<212> PRT
<213> Neisseria lactamica

<400> 555

```
Met Ala Ala Phe Lys Pro Asn Pro Met Asn Tyr Ile Leu Gly Leu Asp
1               5                   10                  15


Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Lys Glu
            20                  25                  30


Glu Asn Pro Ile Arg Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
        35                  40                  45


Ala Glu Met Pro Lys Thr Gly Asp Ser Leu Ala Met Ala Arg Arg Leu
    50                  55                  60
```

```
Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65                  70                  75                  80

Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Asp Ala Asp
                85                  90                  95

Phe Asp Glu Asn Gly Leu Val Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100                 105                 110

Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Cys Leu Glu Trp Ser
        115                 120                 125

Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160

Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Asn Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Val Ser Asp Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Ala
```

<210> 556
<211> 666
<212> PRT
<213> Neisseria lactamica

<400> 556

Met Ala Ala Phe Lys Pro Asn Pro Met Asn Tyr Ile Leu Gly Leu Asp
1 5 10 15

Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Val Asp Glu Glu
20 25 30

Glu Asn Pro Ile Arg Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
35 40 45

Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Met Ala Arg Arg Leu
50 55 60

Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65 70 75 80

Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Asp Ala Asp
85 90 95

Phe Asp Glu Asn Gly Leu Val Lys Ser Leu Pro Asn Thr Pro Trp Gln
100 105 110

Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Cys Leu Glu Trp Ser
115 120 125

Ala Val Leu Leu His Leu Val Lys His Arg Gly Tyr Leu Ser Gln Arg
130 135 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145 150 155 160

Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
165 170 175

```
Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Asn Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Val Ser Asp Gly Leu Lys Glu Asp Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Ala Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Asn Leu Ser Thr Glu Leu Gln Asp Glu Ile Gly Thr
```

```
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Lys Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Val Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Cys Lys Lys Asn Ala Glu Glu Lys Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Cys Val Val Arg Arg Tyr Gly
                485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Val
                565                 570                 575
```

```
Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Asn Asn Gly Phe Cys Cys Lys Asn
                645                 650                 655

Ser Met Lys Lys Asp Leu Lys Asn Ala Thr
            660                 665
```

<210> 557
<211> 828
<212> PRT
<213> Neisseria lactamica

<400> 557

```
Met Leu Gly His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys
1               5                   10                  15

Asn Thr Tyr Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn
            20                  25                  30

Leu Arg Ile Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu
        35                  40                  45

Arg Ala Thr Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr
    50                  55                  60

Ala Gln Ala Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys
65                  70                  75                  80
```

```
Gly Leu Arg Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu
               85                  90                  95

Met Lys Ala Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu
            100                 105                 110

Lys Asp Lys Lys Ser Pro Leu Asn Leu Ser Thr Glu Leu Gln Asp Glu
        115                 120                 125

Ile Gly Thr Ala Phe Ser Leu Phe Lys Thr Asp Lys Asp Ile Thr Gly
    130                 135                 140

Arg Leu Lys Asp Arg Val Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys
145                 150                 155                 160

His Ile Ser Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg
               165                 170                 175

Arg Ile Val Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys
            180                 185                 190

Ala Glu Ile Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys
        195                 200                 205

Ile Tyr Leu Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val
    210                 215                 220

Leu Arg Ala Leu Ser Gln Ala Arg Lys Val Ile Asn Ala Val Val Arg
225                 230                 235                 240

Arg Tyr Asp Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val
               245                 250                 255

Gly Lys Ser Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu
            260                 265                 270
```

```
Asn Arg Lys Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe
        275                 280                 285

Pro Asn Phe Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg
    290                 295                 300

Leu Tyr Glu Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile
305                 310                 315                 320

Asn Leu Val Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala
                325                 330                 335

Leu Pro Phe Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu
            340                 345                 350

Val Leu Gly Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu
        355                 360                 365

Tyr Phe Asn Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala
    370                 375                 380

Arg Val Glu Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu
385                 390                 395                 400

Leu Gln Lys Phe Asp Glu Glu Gly Phe Lys Glu Arg Asn Leu Asn Asp
                405                 410                 415

Thr Arg Tyr Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp His Ile
            420                 425                 430

Leu Leu Thr Gly Lys Gly Lys Arg Arg Val Phe Ala Ser Asn Gly Gln
        435                 440                 445

Ile Thr Asn Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala
    450                 455                 460

Glu Asn Asp Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser
465                 470                 475                 480
```

```
Thr Val Ala Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu
                485                 490                 495

Met Asn Ala Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val
            500                 505                 510

Leu His Gln Lys Ala His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln
        515                 520                 525

Glu Val Met Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe
    530                 535                 540

Glu Glu Ala Asp Thr Ser Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys
545                 550                 555                 560

Leu Ser Ser Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe
                565                 570                 575

Val Ser Arg Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu
            580                 585                 590

Thr Val Lys Ser Ala Lys Arg Leu Asp Glu Gly Ile Ser Val Leu Arg
        595                 600                 605

Val Pro Leu Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn
    610                 615                 620

Arg Glu Arg Glu Pro Lys Leu Tyr Asp Ala Leu Lys Ala Gln Leu Glu
625                 630                 635                 640

Thr His Lys Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys
                645                 650                 655

Tyr Asp Lys Ala Gly Ser Arg Thr Gln Gln Val Lys Ala Val Arg Ile
            660                 665                 670
```

```
Glu Gln Val Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile
        675                 680                 685

Ala Asp Asn Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Gly Gly
    690                 695                 700

Lys Tyr Tyr Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile
705                 710                 715                 720

Leu Pro Asp Arg Ala Val Val Ala Phe Lys Asp Glu Glu Asp Trp Thr
                725                 730                 735

Val Met Asp Asp Ser Phe Glu Phe Arg Phe Val Leu Tyr Ala Asn Asp
            740                 745                 750

Leu Ile Lys Ala Glu Leu Lys Lys Glu Thr Phe Phe Gly Tyr Phe Ser
        755                 760                 765

Gly Leu Asp Arg Ser Thr Gly Asn Ile Ser Leu Arg Ser His Asp Leu
    770                 775                 780

Asp Lys Thr Lys Gly Lys Asp Gly Val Tyr Arg Ile Gly Ile Lys Thr
785                 790                 795                 800

Ala Leu Ser Phe Gln Lys His Gln Ile Asp Glu Leu Gly Lys Glu Ile
                805                 810                 815

Arg Pro Cys Arg Leu Lys Lys Arg Pro Pro Val Arg
            820                 825


<210>  558
<211>  408
<212>  PRT
<213>  Neisseria lactamica

<400>  558

Met Asn Asp Thr Arg Tyr Val Asn Arg Phe Leu Cys Gln Phe Val Ala
1               5                   10                  15
```

```
Asp His Ile Leu Leu Thr Gly Lys Gly Lys Arg Arg Val Phe Ala Ser
            20                  25                  30

Asn Gly Gln Ile Thr Asn Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys
        35                  40                  45

Val Arg Thr Glu Asn Asp Arg His His Ala Leu Asp Ala Val Val Val
    50                  55                  60

Ala Cys Ser Thr Val Ala Met Gln Gln Lys Ile Thr Arg Phe Val Arg
65                  70                  75                  80

Tyr Lys Glu Met Asn Ala Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr
                85                  90                  95

Gly Glu Val Leu His Gln Lys Ala His Phe Pro Gln Pro Trp Glu Phe
            100                 105                 110

Phe Ala Gln Glu Val Met Ile Arg Val Phe Gly Lys Pro Asp Gly Lys
        115                 120                 125

Pro Glu Phe Glu Glu Ala Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu
    130                 135                 140

Ala Glu Lys Leu Ser Ser Arg Pro Glu Ala Val His Glu Tyr Val Thr
145                 150                 155                 160

Pro Leu Phe Val Ser Arg Ala Pro Asn Arg Lys Met Ser Gly Gln Gly
                165                 170                 175

His Met Glu Thr Val Lys Ser Ala Lys Arg Leu Asp Glu Gly Ile Ser
            180                 185                 190

Val Leu Arg Val Pro Leu Thr Gln Leu Lys Leu Lys Gly Leu Glu Lys
        195                 200                 205

Met Val Asn Arg Glu Arg Glu Pro Lys Leu Tyr Asp Ala Leu Lys Ala
```

```
    210                 215                 220

Gln Leu Glu Thr His Lys Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro
225                 230                 235                 240

Phe Tyr Lys Tyr Asp Lys Ala Gly Ser Arg Thr Gln Gln Val Lys Ala
                245                 250                 255

Val Arg Ile Glu Gln Val Gln Lys Thr Gly Val Trp Val Arg Asn His
            260                 265                 270

Asn Gly Ile Ala Asp Asn Ala Thr Met Val Arg Val Asp Val Phe Glu
        275                 280                 285

Lys Gly Gly Lys Tyr Tyr Leu Val Pro Ile Tyr Ser Trp Gln Val Ala
    290                 295                 300

Lys Gly Ile Leu Pro Asp Arg Ala Val Val Ala Phe Lys Asp Glu Glu
305                 310                 315                 320

Asp Trp Thr Val Met Asp Asp Ser Phe Glu Phe Arg Phe Val Leu Tyr
                325                 330                 335

Ala Asn Asp Leu Ile Lys Leu Thr Ala Lys Lys Asn Glu Phe Leu Gly
            340                 345                 350

Tyr Phe Val Ser Leu Asn Arg Ala Thr Gly Ala Ile Asp Ile Arg Thr
        355                 360                 365

His Asp Thr Asp Ser Thr Lys Gly Lys Asn Gly Ile Phe Gln Ser Val
    370                 375                 380

Gly Val Lys Thr Ala Leu Ser Phe Gln Lys Thr Lys Ser Thr Asn Ser
385                 390                 395                 400

Ala Lys Lys Ser Asp His Ala Val
                405
```

<210> 559
<211> 1082
<212> PRT
<213> Neisseria meningitidis

<400> 559

```
Met Ala Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
1               5                   10                  15


Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Asp
            20                  25                  30


Glu Asn Pro Ile Cys Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
        35                  40                  45


Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Ala Ala Arg Arg Leu
    50                  55                  60


Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65                  70                  75                  80


Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
                85                  90                  95


Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100                 105                 110


Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
        115                 120                 125


Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140


Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160


Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175
```

```
Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Ile Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Val Ser Gly Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365
```

```
Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Val Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
                485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Gly
                565                 570                 575
```

```
Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655

Phe Asp Glu Asp Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp Arg Met Arg Leu Thr
        675                 680                 685

Gly Lys Gly Lys Lys Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700

Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala Glu Asn Asp
705                 710                 715                 720

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
                725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765
```

```
Lys Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
                805                 810                 815

Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
        835                 840                 845

Ser Ala Lys Arg Leu Asp Glu Gly Val Ser Val Leu Arg Val Pro Leu
    850                 855                 860

Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Glu Arg
865                 870                 875                 880

Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
                885                 890                 895

Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910

Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Val Glu Gln Val
        915                 920                 925

Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940

Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Gly Asp Lys Tyr Tyr
945                 950                 955                 960

Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
                965                 970                 975
```

```
Arg Ala Val Val Gln Gly Lys Asp Glu Glu Asp Trp Gln Leu Ile Asp
            980                 985                 990


Asp Ser Phe Asn Phe Lys Phe Ser  Leu His Pro Asn Asp  Leu Val Glu
        995                 1000                1005


Val Ile  Thr Lys Lys Ala Arg  Met Phe Gly Tyr Phe  Ala Ser Cys
    1010                1015                1020


His Arg  Gly Thr Gly Asn Ile  Asn Ile Arg Ile His  Asp Leu Asp
    1025                1030                1035


His Lys  Ile Gly Lys Asn Gly  Ile Leu Glu Gly Ile  Gly Val Lys
    1040                1045                1050


Thr Ala  Leu Ser Phe Gln Lys  Tyr Gln Ile Asp Glu  Leu Gly Lys
    1055                1060                1065


Glu Ile  Arg Pro Cys Arg Leu  Lys Lys Arg Pro Pro  Val Arg
    1070                1075                1080


<210>  560
<211>  976
<212>  PRT
<213>  Neisseria meningitidis

<400>  560

Met Ala Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
1               5                   10                  15


Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Asp
            20                  25                  30


Glu Asn Pro Ile Cys Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
        35                  40                  45


Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Ala Ala Arg Arg Leu
```

```
    50                  55                  60

Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65                  70                  75                  80

Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
                85                  90                  95

Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100                 105                 110

Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
        115                 120                 125

Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160

Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Ile Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Val Ser Gly Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255
```

```
His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Ile Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys Ile Tyr Leu
```

```
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
                485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Gly
                565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655
```

```
Phe Asp Glu Asp Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp Arg Met Arg Leu Thr
        675                 680                 685

Gly Lys Gly Lys Lys Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700

Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala Glu Asn Asp
705                 710                 715                 720

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
                725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765

Lys Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
                805                 810                 815

Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
        835                 840                 845

Ser Ala Lys Arg Leu Asp Glu Gly Val Ser Val Leu Arg Val Pro Leu
```

```
    850                 855                 860

Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Glu Arg
865                 870                 875                 880

Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
                885                 890                 895

Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910

Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Val Glu Gln Val
        915                 920                 925

Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940

Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Gly Asp Lys Tyr Tyr
945                 950                 955                 960

Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Phe Ala Gly
                965                 970                 975
```

<210> 561
<211> 1081
<212> PRT
<213> Neisseria meningitidis

<400> 561

```
Met Ala Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
1               5                   10                  15

Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Asp
            20                  25                  30

Glu Asn Pro Ile Cys Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
        35                  40                  45
```

```
Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Ala Ala Arg Arg Leu
    50                  55                  60

Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65                  70                  75                  80

Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
                85                  90                  95

Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100                 105                 110

Leu Arg Ser Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
        115                 120                 125

Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160

Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Arg Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Asp Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Ile Ser Asp Asp Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255
```

```
His Cys Thr Phe Glu Pro Thr Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Val Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Glu Leu Asp Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Val Gln Pro Glu Ile Leu Glu Val Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445
```

```
Tyr Gly Asp His Asp Gly Lys Lys Asn Thr Glu Glu Lys Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Ala Val Val Arg Arg Tyr Gly
                485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Gly
                565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655
```

```
Phe Asp Glu Glu Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp His Met Leu Leu Thr
        675                 680                 685

Gly Lys Gly Lys Arg Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700

Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala Glu Asn Asn
705                 710                 715                 720

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
                725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765

Lys Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
                805                 810                 815

Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
        835                 840                 845
```

```
Ser Ala Lys Arg Leu Asp Glu Gly Val Ser Val Leu Arg Val Pro Leu
    850                 855                 860

Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Glu Arg
865                 870                 875                 880

Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
                885                 890                 895

Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910

Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Val Glu Gln Val
        915                 920                 925

Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940

Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Ala Gly Lys Tyr Tyr
945                 950                 955                 960

Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
                965                 970                 975

Arg Ala Val Val Ala Tyr Ala Asp Glu Glu Gly Trp Thr Val Ile Asp
            980                 985                 990

Glu Ser Phe Arg Phe Lys Phe Val  Leu Tyr Ser Asn Asp  Leu Ile Lys
        995                 1000                1005

Val Gln  Leu Lys Lys Asp Ser  Phe Leu Gly Tyr Phe  Ser Gly Leu
    1010                1015                1020

Asp Arg  Ala Thr Gly Ala Ile  Ser Leu Arg Glu His  Asp Leu Glu
    1025                1030                1035

Lys Ser  Lys Gly Lys Asp Gly  Met His Arg Ile Gly  Val Lys Thr
    1040                1045                1050
```

```
Ala Leu  Ser Phe Gln Lys Tyr  Gln Ile Asp Glu Met  Gly Lys Glu
    1055                1060                1065


Ile Arg  Leu Cys Arg Leu Lys  Lys Arg Pro Pro Val  Arg
    1070                1075                1080


<210>  562
<211>  1081
<212>  PRT
<213>  Neisseria meningitidis

<400>  562

Met Ala Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
1               5                   10                  15


Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Asp
            20                  25                  30


Glu Asn Pro Ile Cys Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
        35                  40                  45


Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Ala Ala Arg Arg Leu
    50                  55                  60


Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65                  70                  75                  80


Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
                85                  90                  95


Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100                 105                 110


Leu Arg Ser Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
        115                 120                 125


Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
```

```
    130                 135                 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160

Gly Val Ala Asn Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Ile Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Val Ser Gly Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335
```

```
Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Ile Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
                485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
```

```
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Gly
                565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655

Phe Asp Glu Asp Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp Arg Met Arg Leu Thr
        675                 680                 685

Gly Lys Gly Lys Lys Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700

Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala Glu Asn Asp
705                 710                 715                 720

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
                725                 730                 735
```

```
Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765

Lys Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
                805                 810                 815

Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
        835                 840                 845

Ser Ala Lys Arg Leu Asp Glu Gly Val Ser Val Leu Arg Val Pro Leu
    850                 855                 860

Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Glu Arg
865                 870                 875                 880

Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
                885                 890                 895

Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910

Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Val Glu Gln Val
        915                 920                 925

Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
```

```
    930                 935                 940

Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Ala Gly Lys Tyr Tyr
945                 950                 955                 960

Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
                965                 970                 975

Arg Ala Val Val Ala Tyr Ala Asp Glu Glu Gly Trp Thr Val Ile Asp
            980                 985                 990

Glu Ser Phe Arg Phe Lys Phe Val  Leu Tyr Ser Asn Asp  Leu Ile Lys
        995                 1000                1005

Val Gln  Leu Lys Lys Asp Ser  Phe Leu Gly Tyr Phe  Ser Gly Leu
    1010                1015                1020

Asp Arg  Ala Thr Gly Ala Ile  Ser Leu Arg Glu His  Asp Leu Glu
    1025                1030                1035

Lys Ser  Lys Gly Lys Asp Gly  Met His Arg Ile Gly  Val Lys Thr
    1040                1045                1050

Ala Leu  Ser Phe Gln Lys Tyr  Gln Ile Asp Glu Met  Gly Lys Glu
    1055                1060                1065

Ile Arg  Leu Cys Arg Leu Lys  Lys Arg Pro Pro Val  Arg
    1070                1075                1080
```

<210> 563
<211> 1082
<212> PRT
<213> Neisseria meningitidis

<400> 563

```
Met Ala Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
1               5                   10                  15
```

```
Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Asp
            20                  25                  30

Glu Asn Pro Ile Cys Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
        35                  40                  45

Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Met Ala Arg Arg Leu
    50                  55                  60

Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65                  70                  75                  80

Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
                85                  90                  95

Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100                 105                 110

Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
        115                 120                 125

Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160

Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Ile Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220
```

```
Pro His Val Ser Gly Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Ile Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415
```

```
Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
                485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Gly
                565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620
```

```
Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655

Phe Asp Glu Asp Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp Arg Met Arg Leu Thr
        675                 680                 685

Gly Lys Gly Lys Lys Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700

Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala Glu Asn Asp
705                 710                 715                 720

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
                725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765

Lys Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
                805                 810                 815
```

```
Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
        835                 840                 845

Ser Ala Lys Arg Leu Asp Glu Gly Val Ser Val Leu Arg Val Pro Leu
    850                 855                 860

Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Glu Arg
865                 870                 875                 880

Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
                885                 890                 895

Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910

Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Val Glu Gln Val
        915                 920                 925

Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940

Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Gly Asp Lys Tyr Tyr
945                 950                 955                 960

Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
                965                 970                 975

Arg Ala Val Val Gln Gly Lys Asp Glu Glu Asp Trp Gln Leu Ile Asp
            980                 985                 990

Asp Ser Phe Asn Phe Lys Phe Ser  Leu His Pro Asn Asp  Leu Val Glu
        995                 1000                1005

Val Ile  Thr Lys Lys Ala Arg  Met Phe Gly Tyr Phe  Ala Ser Cys
    1010                1015                1020
```

His Arg Gly Thr Gly Asn Ile Asn Ile Arg Ile His Asp Leu Asp
    1025   1030   1035

His Lys Ile Gly Lys Asn Gly Ile Leu Glu Gly Ile Gly Val Lys
    1040   1045   1050

Thr Ala Leu Ser Phe Gln Lys Tyr Gln Ile Asp Glu Leu Gly Glu
    1055   1060   1065

Glu Ile Arg Pro Cys Arg Leu Lys Lys Arg Pro Pro Val Arg
    1070   1075   1080

<210> 564
<211> 1082
<212> PRT
<213> Neisseria meningitidis

<400> 564

Met Ala Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
1   5   10   15

Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Asp
            20   25   30

Glu Asn Pro Ile Cys Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
        35   40   45

Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Met Ala Arg Arg Leu
    50   55   60

Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65   70   75   80

Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
                85   90   95

Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln

```
            100                 105                 110

Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
        115                 120                 125

Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160

Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Ile Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Val Ser Gly Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Ser Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300
```

```
Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Ile Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
                485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
```

```
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Gly
                565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655

Phe Asp Glu Asp Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp Arg Met Arg Leu Thr
        675                 680                 685

Gly Lys Gly Lys Lys Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700
```

```
Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala Glu Asn Asp
705                 710                 715                 720


Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
                725                 730                 735


Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750


Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765


Lys Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780


Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800


Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
                805                 810                 815


Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830


Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
        835                 840                 845


Ser Ala Lys Arg Leu Asp Glu Gly Val Ser Val Leu Arg Val Pro Leu
    850                 855                 860


Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Glu Arg
865                 870                 875                 880


Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
                885                 890                 895


Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
```

```
            900                 905                 910

Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Val Glu Gln Val
        915                 920                 925

Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940

Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Gly Asp Lys Tyr Tyr
945                 950                 955                 960

Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
                965                 970                 975

Arg Ala Val Val Gln Gly Lys Asp Glu Glu Asp Trp Gln Leu Ile Asp
            980                 985                 990

Asp Ser Phe Asn Phe Lys Phe Ser  Leu His Pro Asn Asp  Leu Val Glu
        995                 1000                1005

Val Ile  Thr Lys Lys Ala Arg  Met Phe Gly Tyr Phe  Ala Ser Cys
    1010                1015                1020

His Arg  Gly Thr Gly Asn Ile  Asn Ile Arg Ile His  Asp Leu Asp
    1025                1030                1035

His Lys  Ile Gly Lys Asn Gly  Ile Leu Glu Gly Ile  Gly Val Lys
    1040                1045                1050

Thr Ala  Leu Ser Phe Gln Lys  Tyr Gln Ile Asp Glu  Leu Gly Lys
    1055                1060                1065

Glu Ile  Arg Pro Cys Arg Leu  Lys Lys Arg Pro Pro  Val Arg
    1070                1075                1080

<210>  565
<211>  1082
<212>  PRT
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<213> Neisseria meningitidis

<400> 565

```
Met Ala Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
1               5                  10                  15


Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Asp
            20                  25                  30


Glu Asn Pro Ile Cys Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
        35                  40                  45


Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Met Ala Arg Arg Leu
    50                  55                  60


Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65                  70                  75                  80


Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
                85                  90                  95


Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100                 105                 110


Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
        115                 120                 125


Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140


Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160


Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175


Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190
```

```
Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Ile Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Val Ser Gly Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Ser Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380
```

```
Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Ile Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
                485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Gly
                565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590
```

```
Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655

Phe Asp Glu Asp Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Tyr Gln Phe Val Ala Asp Arg Met Arg Leu Thr
        675                 680                 685

Gly Lys Gly Lys Lys Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700

Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala Glu Asn Asp
705                 710                 715                 720

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
                725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765

Lys Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780
```

```
Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800


Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
                805                 810                 815


Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830


Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
        835                 840                 845


Ser Ala Lys Arg Leu Asp Glu Gly Val Ser Val Leu Arg Val Pro Leu
    850                 855                 860


Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Glu Arg
865                 870                 875                 880


Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
                885                 890                 895


Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910


Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Val Glu Gln Val
        915                 920                 925


Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940


Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Gly Asp Lys Tyr Tyr
945                 950                 955                 960


Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
                965                 970                 975


Arg Ala Val Val Gln Gly Lys Asp Glu Glu Asp Trp Gln Leu Ile Asp
            980                 985                 990
```

Asp Ser Phe Asn Phe Lys Phe Ser Leu His Pro Asn Asp Leu Val Glu
        995   1000   1005

Val Ile Thr Lys Lys Ala Arg Met Phe Gly Tyr Phe Ala Ser Cys
    1010   1015   1020

His Arg Gly Thr Gly Asn Ile Asn Ile Arg Ile His Asp Leu Asp
    1025   1030   1035

His Lys Ile Gly Lys Asn Gly Ile Leu Glu Gly Ile Gly Val Lys
    1040   1045   1050

Thr Ala Leu Ser Phe Gln Lys Tyr Gln Ile Asp Glu Leu Gly Lys
    1055   1060   1065

Glu Ile Arg Pro Cys Arg Leu Lys Lys Arg Pro Pro Val Arg
    1070   1075   1080

<210> 566
<211> 1081
<212> PRT
<213> Neisseria meningitidis

<400> 566

Met Ala Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
1   5   10   15

Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Asp
            20   25   30

Glu Asn Pro Ile Cys Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
        35   40   45

Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Met Ala Arg Arg Leu
    50   55   60

Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu

```
65                  70                  75                  80

Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
                85                  90                  95

Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100                 105                 110

Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
        115                 120                 125

Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160

Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Lys Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Asn Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Ile Ser Asp Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Thr Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270
```

```
Thr Ala Glu Arg Phe Val Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Gln Pro Leu Thr Asp Thr Gln Arg Ala Lys
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Val Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asn Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
```

```
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
                485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Gln Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Gly
                565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655

Phe Asp Glu Asp Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670
```

```
Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp Arg Met Arg Leu Thr
        675                 680                 685

Gly Lys Gly Lys Lys Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700

Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala Glu Asn Asp
705                 710                 715                 720

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
                725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765

Lys Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
                805                 810                 815

Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
        835                 840                 845

Ser Ala Lys Arg Leu Asp Glu Gly Val Ser Val Leu Arg Val Pro Leu
    850                 855                 860

Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Glu Arg
```

```
865                 870                 875                 880

Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
                885                 890                 895

Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910

Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Val Glu Gln Val
        915                 920                 925

Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940

Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Gly Asp Lys Tyr Tyr
945                 950                 955                 960

Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
                965                 970                 975

Arg Ala Val Val Ala Tyr Ala Asp Glu Glu Asp Trp Thr Val Ile Asp
            980                 985                 990

Glu Ser Phe Arg Phe Lys Phe Val  Leu Tyr Ser Asn Asp  Leu Ile Lys
        995                 1000                1005

Val Gln  Leu Lys Lys Asp Ser  Phe Leu Gly Tyr Phe  Ser Gly Leu
    1010                1015                1020

Asp Arg  Ala Thr Gly Ala Ile  Ser Leu Arg Glu His  Asp Leu Glu
    1025                1030                1035

Lys Ser  Lys Gly Lys Asp Gly  Met His Arg Ile Gly  Val Lys Thr
    1040                1045                1050

Ala Leu  Ser Phe Gln Lys Tyr  Gln Ile Asp Glu Met  Gly Lys Glu
    1055                1060                1065
```

```
Ile Arg  Pro Cys Arg Leu Lys  Lys Arg Pro Pro Val  Arg
    1070                1075                1080


<210>  567
<211>  1081
<212>  PRT
<213>  Neisseria meningitidis

<400>  567

Met Ala Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
1               5                   10                  15


Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Glu
            20                  25                  30


Glu Asn Pro Ile Arg Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
        35                  40                  45


Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Met Ala Arg Arg Leu
    50                  55                  60


Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65                  70                  75                  80


Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
                85                  90                  95


Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100                 105                 110


Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
        115                 120                 125


Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140


Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160
```

```
Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Cys Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Asn Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Val Ser Gly Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Ser Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350
```

```
Tyr His Thr Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Ile Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
                485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560
```

```
Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Gly
               565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
               645                 650                 655

Phe Asp Glu Asp Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp Arg Met Arg Leu Thr
        675                 680                 685

Gly Lys Gly Lys Lys Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700

Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala Glu Asn Asp
705                 710                 715                 720

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
               725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750
```

```
Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765

Lys Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
                805                 810                 815

Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
        835                 840                 845

Ser Ala Lys Arg Leu Asp Glu Gly Val Ser Val Leu Arg Val Pro Leu
    850                 855                 860

Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Glu Arg
865                 870                 875                 880

Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
                885                 890                 895

Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910

Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Val Glu Gln Val
        915                 920                 925

Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940

Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Gly Asp Lys Tyr Tyr
945                 950                 955                 960
```

```
Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
               965                 970                 975


Arg Ala Val Val Ala Tyr Ala Asp Glu Glu Asp Trp Thr Val Ile Asp
            980                 985                 990


Glu Ser Phe Arg Phe Lys Phe Val  Leu Tyr Ser Asn Asp  Leu Ile Lys
        995                 1000                1005


Val Gln  Leu Lys Lys Asp Ser  Phe Leu Gly Tyr Phe  Ser Gly Leu
    1010                1015                1020


Asp Arg  Ala Thr Gly Ala Ile  Ser Leu Arg Glu His  Asp Leu Glu
    1025                1030                1035


Lys Ser  Lys Gly Lys Asp Gly  Met His Arg Ile Gly  Val Lys Thr
    1040                1045                1050


Ala Leu  Ser Phe Gln Lys Tyr  Gln Ile Asp Glu Met  Gly Lys Glu
    1055                1060                1065


Ile Arg  Pro Cys Arg Leu Lys  Lys Arg Pro Pro Val  Arg
    1070                1075                1080


<210>  568
<211>  1082
<212>  PRT
<213>  Neisseria meningitidis

<400>  568

Met Ala Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
1               5                   10                  15


Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Glu
            20                  25                  30


Glu Asn Pro Ile Arg Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
```

```
        35                  40                  45

Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Met Ala Arg Arg Leu
    50                  55                  60

Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65                  70                  75                  80

Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
                85                  90                  95

Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100                 105                 110

Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
        115                 120                 125

Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160

Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Cys Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Asn Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Val Ser Gly Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240
```

```
Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Ile Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
```

```
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
                485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Val
                565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640
```

```
Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655

Phe Asp Glu Glu Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp His Ile Leu Leu Thr
        675                 680                 685

Gly Lys Gly Lys Arg Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700

Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala Glu Asn Asp
705                 710                 715                 720

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
                725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765

Lys Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
                805                 810                 815

Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
```

```
        835                 840                 845

Ser Ala Lys Arg Leu Asp Glu Gly Val Ser Val Leu Arg Val Pro Leu
    850                 855                 860

Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Glu Arg
865                 870                 875                 880

Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
                885                 890                 895

Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910

Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Val Glu Gln Val
        915                 920                 925

Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940

Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Gly Gly Lys Tyr Tyr
945                 950                 955                 960

Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
                965                 970                 975

Arg Ala Val Val Gln Gly Lys Asp Glu Glu Asp Trp Gln Leu Ile Asp
            980                 985                 990

Asp Ser Phe Asn Phe Lys Phe Ser  Leu His Pro Asn Asp  Leu Val Glu
        995                 1000                1005

Val Ile  Thr Lys Lys Ala Arg  Met Phe Gly Tyr Phe  Ala Ser Cys
    1010                1015                1020

His Arg  Gly Thr Gly Asn Ile  Asn Ile Arg Ile His  Asp Leu Asp
    1025                1030                1035
```

```
His Lys  Ile Gly Lys Asn Gly  Ile Leu Glu Gly Ile  Gly Val Lys
    1040                1045                1050


Thr Ala  Leu Ser Phe Gln Lys  Tyr Gln Ile Asp Glu  Leu Gly Lys
    1055                1060                1065


Glu Ile  Arg Pro Cys Arg Leu  Lys Lys Arg Pro Pro  Val Arg
    1070                1075                1080


<210>  569
<211>  1081
<212>  PRT
<213>  Neisseria meningitidis

<400>  569

Met Ala Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
1               5                   10                  15


Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Glu
            20                  25                  30


Glu Asn Pro Ile Arg Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
        35                  40                  45


Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Met Ala Arg Arg Leu
    50                  55                  60


Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65                  70                  75                  80


Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
                85                  90                  95


Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100                 105                 110


Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
        115                 120                 125
```

```
Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160

Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Ile Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Val Ser Gly Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320
```

```
Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Val Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Glu Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Thr Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Ala Val Val Arg Arg Tyr Gly
                485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525
```

```
Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Val
                565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Glu Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655

Phe Asp Glu Asp Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp Arg Met Arg Leu Thr
        675                 680                 685

Gly Lys Gly Lys Lys Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700

Leu Leu Arg Gly Phe Trp Gly Leu His Lys Val Arg Ala Glu Asn Asp
705                 710                 715                 720
```

```
Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Ile Ala
               725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765

Lys Ala His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
               805                 810                 815

Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
        835                 840                 845

Ser Ala Lys Arg Leu Asp Glu Gly Ile Ser Val Leu Arg Val Pro Leu
    850                 855                 860

Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Ala Arg
865                 870                 875                 880

Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
               885                 890                 895

Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910

Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Val Glu Gln Val
        915                 920                 925
```

```
Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940

Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Ala Gly Lys Tyr Tyr
945                 950                 955                 960

Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
                965                 970                 975

Arg Ala Val Val Ala Tyr Ala Asp Glu Glu Asp Trp Thr Val Ile Asp
            980                 985                 990

Glu Ser Phe Arg Phe Lys Phe Val  Leu Tyr Ser Asn Asp  Leu Ile Lys
        995                 1000                1005

Val Gln  Leu Lys Lys Asp Ser  Phe Leu Gly Tyr Phe  Ser Gly Leu
    1010                1015                1020

Asp Arg  Ala Thr Gly Ala Ile  Ser Leu Arg Glu His  Asp Leu Glu
    1025                1030                1035

Lys Ser  Lys Gly Lys Asp Gly  Met His Arg Ile Gly  Val Lys Thr
    1040                1045                1050

Ala Leu  Ser Phe Gln Lys Tyr  Gln Ile Asp Glu Met  Gly Lys Glu
    1055                1060                1065

Ile Arg  Pro Cys Arg Leu Lys  Lys Arg Pro Pro Val  Arg
    1070                1075                1080
```

<210> 570
<211> 1082
<212> PRT
<213> Neisseria meningitidis

<400> 570

```
Met Ala Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
```

```
1               5                   10                  15

Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Glu
            20                  25                  30

Glu Asn Pro Ile Arg Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
        35                  40                  45

Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Met Ala Arg Arg Leu
    50                  55                  60

Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65                  70                  75                  80

Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
                85                  90                  95

Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100                 105                 110

Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
        115                 120                 125

Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160

Gly Val Ala Asn Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205
```

```
Gln Ala Glu Leu Ile Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Val Ser Gly Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Asn Leu Ser Ser Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Val Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
```

```
               405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Lys Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
               485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Val
               565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605
```

```
Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655

Phe Asp Glu Asp Gly Phe Lys Glu Cys Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp His Ile Leu Leu Thr
        675                 680                 685

Gly Lys Gly Lys Arg Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700

Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala Glu Asn Asp
705                 710                 715                 720

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
                725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Lys Val Leu His Gln
        755                 760                 765

Lys Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
```

```
                805                 810                 815

Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Ala His Lys Asp Thr Leu Arg Ser
        835                 840                 845

Ala Lys Arg Phe Val Lys His Asn Glu Lys Ile Ser Val Lys Arg Val
    850                 855                 860

Trp Leu Thr Glu Ile Lys Leu Ala Asp Leu Glu Asn Met Val Asn Tyr
865                 870                 875                 880

Lys Asn Gly Arg Glu Ile Glu Leu Tyr Glu Ala Leu Lys Ala Arg Leu
                885                 890                 895

Glu Ala Tyr Gly Gly Asn Ala Lys Gln Ala Phe Asp Pro Lys Asp Asn
            900                 905                 910

Pro Phe Tyr Lys Lys Gly Gly Gln Leu Val Lys Ala Val Arg Val Glu
        915                 920                 925

Lys Thr Gln Glu Ser Gly Val Leu Leu Asn Lys Lys Asn Ala Tyr Thr
    930                 935                 940

Ile Ala Asp Asn Gly Asp Met Val Arg Val Asp Val Phe Cys Lys Val
945                 950                 955                 960

Asp Lys Lys Gly Lys Asn Gln Tyr Phe Ile Val Pro Ile Tyr Ala Trp
                965                 970                 975

Gln Val Ala Glu Asn Ile Leu Pro Asp Ile Asp Cys Lys Gly Tyr Arg
            980                 985                 990

Ile Asp Asp Ser Tyr Thr Phe Cys  Phe Ser Leu His Lys  Tyr Asp Leu
        995                 1000                1005
```

```
Ile Ala  Phe Gln Lys Asp Glu  Lys Ser Lys Val Glu  Phe Ala Tyr
    1010                1015                1020


Tyr Ile  Asn Cys Asp Ser Ser  Asn Gly Arg Phe Tyr  Leu Ala Trp
    1025                1030                1035


His Asp  Lys Gly Ser Lys Glu  Gln Gln Phe Arg Ile  Ser Thr Gln
    1040                1045                1050


Asn Leu  Val Leu Ile Gln Lys  Tyr Gln Val Asn Glu  Leu Gly Lys
    1055                1060                1065


Glu Ile  Arg Pro Cys Arg Leu  Lys Lys Arg Pro Pro  Val Arg
    1070                1075                1080
```

<210> 571
<211> 1082
<212> PRT
<213> Neisseria meningitidis

<400> 571

```
Met Ala Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
1               5                   10                  15


Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Glu
            20                  25                  30


Glu Asn Pro Ile Arg Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
        35                  40                  45


Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Met Ala Arg Arg Leu
    50                  55                  60


Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65                  70                  75                  80


Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
                85                  90                  95
```

```
Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100                 105                 110

Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
        115                 120                 125

Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160

Gly Val Ala Asn Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Ile Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Val Ser Gly Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285
```

```
Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Asn Leu Ser Ser Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Val Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
                485                 490                 495
```

```
Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Val
                565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655

Phe Asp Glu Asp Gly Phe Lys Glu Cys Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp His Ile Leu Leu Thr
        675                 680                 685
```

```
Gly Lys Gly Lys Arg Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700

Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala Glu Asn Asp
705                 710                 715                 720

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
                725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Lys Val Leu His Gln
        755                 760                 765

Lys Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
                805                 810                 815

Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Ala His Lys Asp Thr Leu Arg Ser
        835                 840                 845

Ala Lys Arg Phe Val Lys His Asn Glu Lys Ile Ser Val Lys Arg Val
    850                 855                 860

Trp Leu Thr Glu Ile Lys Leu Ala Asp Leu Glu Asn Met Val Asn Tyr
865                 870                 875                 880

Lys Asn Gly Arg Glu Ile Glu Leu Tyr Glu Ala Leu Lys Ala Arg Leu
                885                 890                 895
```

```
Glu Ala Tyr Gly Gly Asn Ala Lys Gln Ala Phe Asp Pro Lys Asp Asn
            900                 905                 910

Pro Phe Tyr Lys Lys Gly Gly Gln Leu Val Lys Ala Val Arg Val Glu
        915                 920                 925

Lys Thr Gln Glu Ser Gly Val Leu Leu Asn Lys Lys Asn Ala Tyr Thr
    930                 935                 940

Ile Ala Asp Asn Gly Asp Met Val Arg Val Asp Val Phe Cys Lys Val
945                 950                 955                 960

Asp Lys Lys Gly Lys Asn Gln Tyr Phe Ile Val Pro Ile Tyr Ala Trp
                965                 970                 975

Gln Val Ala Glu Asn Ile Leu Pro Asp Ile Asp Cys Lys Gly Tyr Arg
            980                 985                 990

Ile Asp Asp Ser Tyr Thr Phe Cys  Phe Ser Leu His Lys  Tyr Asp Leu
        995                 1000                1005

Ile Ala  Phe Gln Lys Asp Glu  Lys Ser Lys Val Glu  Phe Ala Tyr
    1010                1015                1020

Tyr Ile  Asn Cys Asp Ser Ser  Asn Gly Arg Phe Tyr  Leu Ala Trp
    1025                1030                1035

His Asp  Lys Gly Ser Lys Glu  Gln Gln Phe Arg Ile  Ser Thr Gln
    1040                1045                1050

Asn Leu  Val Leu Ile Gln Lys  Tyr Gln Val Asn Glu  Leu Gly Lys
    1055                1060                1065

Glu Ile  Arg Pro Cys Arg Leu  Lys Lys Arg Pro Pro  Val Arg
    1070                1075                1080
```

<210> 572
<211> 1082
<212> PRT
<213> Neisseria meningitidis

<400> 572

Met Ala Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
1 5 10 15

Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Glu
20 25 30

Glu Asn Pro Ile Arg Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
35 40 45

Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Met Ala Arg Arg Leu
50 55 60

Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65 70 75 80

Arg Thr Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asn
85 90 95

Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Leu Trp Gln
100 105 110

Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
115 120 125

Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
130 135 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145 150 155 160

Gly Val Ala Gly Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
165 170 175

```
Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Asn Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Ile Ser Asp Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Thr Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Thr Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Glu Leu Asp Asp Ile Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
```

```
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Ile Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Asn
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys Ile Asp Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile His Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
                485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Gly
                565                 570                 575
```

```
Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655

Phe Asp Glu Asp Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp Arg Met Arg Leu Thr
        675                 680                 685

Gly Lys Gly Lys Lys Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700

Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala Glu Asn Asp
705                 710                 715                 720

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
                725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765

Lys Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
```

```
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Thr Glu Lys Leu Ser Ser
                805                 810                 815

Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
        835                 840                 845

Ser Ala Lys Arg Leu Asp Glu Gly Ile Ser Val Leu Arg Val Pro Leu
    850                 855                 860

Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Glu Arg
865                 870                 875                 880

Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
                885                 890                 895

Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910

Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Met Arg Val Glu Gln Val
        915                 920                 925

Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940

Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Gly Asp Lys Tyr Tyr
945                 950                 955                 960

Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
                965                 970                 975
```

```
Arg Ala Val Val Gln Gly Lys Asp Glu Glu Asp Trp Gln Leu Ile Asp
            980                 985                 990


Asp Ser Phe Asn Phe Lys Phe Ser  Leu His Pro Asn Asp  Leu Val Glu
        995                 1000                1005


Val Ile  Thr Lys Lys Ala Arg  Met Phe Gly Tyr Phe  Ala Ser Cys
    1010                1015                1020


His Arg  Gly Thr Gly Asn Ile  Asn Ile Arg Ile His  Asp Leu Asp
    1025                1030                1035


His Lys  Ile Gly Lys Asn Gly  Ile Leu Glu Gly Ile  Gly Val Lys
    1040                1045                1050


Thr Ala  Leu Ser Phe Gln Lys  Tyr Gln Ile Asp Glu  Leu Gly Lys
    1055                1060                1065


Glu Ile  Arg Pro Cys Arg Leu  Lys Lys Arg Pro Pro  Val Arg
    1070                1075                1080


<210>  573
<211>  1082
<212>  PRT
<213>  Neisseria meningitidis

<400>  573

Met Ala Ala Phe Lys Pro Asn Pro Ile Asn Tyr Ile Leu Gly Leu Asp
1               5                   10                  15


Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Glu
            20                  25                  30


Glu Asn Pro Ile Arg Leu Ile Asp Leu Ser Val Arg Val Phe Glu Arg
        35                  40                  45


Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Met Ala Arg Arg Leu
    50                  55                  60
```

```
Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65                  70                  75                  80

Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asp
                85                  90                  95

Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100                 105                 110

Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
        115                 120                 125

Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140

Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160

Gly Val Ala Asp Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Ile Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Val Ser Gly Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255
```

```
His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Val Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
            340                 345                 350

Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Arg Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Val Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Ala Glu Glu Lys Ile Tyr Leu
    450                 455                 460
```

```
Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
                485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540

Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Gly
                565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655
```

```
Phe Asp Glu Asp Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp Arg Met Arg Leu Thr
        675                 680                 685

Gly Lys Gly Lys Lys Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700

Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala Glu Asn Asp
705                 710                 715                 720

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
                725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765

Lys Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Pro Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
                805                 810                 815

Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
        835                 840                 845

Ser Ala Lys Arg Leu Asp Glu Gly Val Ser Val Leu Arg Val Pro Leu
    850                 855                 860
```

```
Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Glu Arg
865                 870                 875                 880

Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
                885                 890                 895

Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910

Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Val Glu Gln Val
        915                 920                 925

Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940

Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Gly Asp Lys Tyr Tyr
945                 950                 955                 960

Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
                965                 970                 975

Arg Ala Val Val Gln Gly Lys Asp Glu Glu Asp Trp Gln Leu Ile Asp
            980                 985                 990

Asp Ser Phe Asn Phe Lys Phe Ser  Leu His Pro Asn Asp  Leu Val Glu
        995                 1000                1005

Val Ile  Thr Lys Lys Ala Arg  Met Phe Gly Tyr Phe  Ala Ser Cys
    1010                1015                1020

His Arg  Gly Thr Gly Asn Ile  Asn Ile Arg Ile His  Asp Leu Asp
    1025                1030                1035

His Lys  Ile Gly Lys Asn Gly  Ile Leu Glu Gly Ile  Gly Val Lys
    1040                1045                1050
```

```
Thr Ala  Leu Ser Phe Gln Lys  Tyr Gln Ile Asp Glu  Leu Gly Lys
    1055                1060                1065


Glu Ile  Arg Pro Cys Arg Leu  Lys Lys Arg Pro Pro  Val Arg
    1070                1075                1080
```

<210> 574
<211> 1082
<212> PRT
<213> Neisseria meningitidis

<400> 574

```
Met Ala Ala Phe Lys Pro Asn Ser Ile Asn Tyr Ile Leu Gly Leu Asp
1               5                   10                  15


Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Glu Glu
            20                  25                  30


Glu Asn Pro Ile Arg Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
        35                  40                  45


Ala Glu Val Pro Lys Thr Gly Asp Ser Leu Ala Met Ala Arg Arg Leu
    50                  55                  60


Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65                  70                  75                  80


Arg Thr Arg Arg Leu Leu Lys Arg Glu Gly Val Leu Gln Ala Ala Asn
                85                  90                  95


Phe Asp Glu Asn Gly Leu Ile Lys Ser Leu Pro Asn Thr Pro Trp Gln
            100                 105                 110


Leu Arg Ala Ala Ala Leu Asp Arg Lys Leu Thr Pro Leu Glu Trp Ser
        115                 120                 125


Ala Val Leu Leu His Leu Ile Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140
```

```
Lys Asn Glu Gly Glu Thr Ala Asp Lys Glu Leu Gly Ala Leu Leu Lys
145                 150                 155                 160

Gly Val Ala Gly Asn Ala His Ala Leu Gln Thr Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Leu Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Ser Asp Tyr Ser His Thr Phe Ser Arg Lys Asp Leu
        195                 200                 205

Gln Ala Glu Leu Ile Leu Leu Phe Glu Lys Gln Lys Glu Phe Gly Asn
    210                 215                 220

Pro His Val Ser Gly Gly Leu Lys Glu Gly Ile Glu Thr Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

His Cys Thr Phe Glu Pro Ala Glu Pro Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270

Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285

Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asp Thr Glu Arg Ala Thr
    290                 295                 300

Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala Gln Ala
305                 310                 315                 320

Arg Lys Leu Leu Gly Leu Glu Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335

Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met Lys Ala
```

```
            340                 345                 350

Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys Asp Lys
        355                 360                 365

Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile Gly Thr
    370                 375                 380

Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg Leu Lys
385                 390                 395                 400

Asp Arg Ile Gln Pro Glu Ile Leu Glu Ala Leu Leu Lys His Ile Ser
                405                 410                 415

Phe Asp Lys Phe Val Gln Ile Ser Leu Lys Ala Leu Arg Arg Ile Val
            420                 425                 430

Pro Leu Met Glu Gln Gly Lys Arg Tyr Asp Glu Ala Cys Ala Glu Ile
        435                 440                 445

Tyr Gly Asp His Tyr Gly Lys Lys Asn Thr Glu Glu Lys Ile Tyr Leu
    450                 455                 460

Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val Leu Arg Ala
465                 470                 475                 480

Leu Ser Gln Ala Arg Lys Val Ile Asn Gly Val Val Arg Arg Tyr Gly
                485                 490                 495

Ser Pro Ala Arg Ile His Ile Glu Thr Ala Arg Glu Val Gly Lys Ser
            500                 505                 510

Phe Lys Asp Arg Lys Glu Ile Glu Lys Arg Gln Glu Glu Asn Arg Lys
        515                 520                 525

Asp Arg Glu Lys Ala Ala Ala Lys Phe Arg Glu Tyr Phe Pro Asn Phe
    530                 535                 540
```

```
Val Gly Glu Pro Lys Ser Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Gly Lys Glu Ile Asn Leu Gly
                565                 570                 575

Arg Leu Asn Glu Lys Gly Tyr Val Glu Ile Asp His Ala Leu Pro Phe
            580                 585                 590

Ser Arg Thr Trp Asp Asp Ser Phe Asn Asn Lys Val Leu Val Leu Gly
        595                 600                 605

Ser Glu Asn Gln Asn Lys Gly Asn Gln Thr Pro Tyr Glu Tyr Phe Asn
    610                 615                 620

Gly Lys Asp Asn Ser Arg Glu Trp Gln Glu Phe Lys Ala Arg Val Glu
625                 630                 635                 640

Thr Ser Arg Phe Pro Arg Ser Lys Lys Gln Arg Ile Leu Leu Gln Lys
                645                 650                 655

Phe Asp Glu Asp Gly Phe Lys Glu Arg Asn Leu Asn Asp Thr Arg Tyr
            660                 665                 670

Val Asn Arg Phe Leu Cys Gln Phe Val Ala Asp Arg Met Arg Leu Thr
        675                 680                 685

Gly Lys Gly Lys Lys Arg Val Phe Ala Ser Asn Gly Gln Ile Thr Asn
    690                 695                 700

Leu Leu Arg Gly Phe Trp Gly Leu Arg Lys Val Arg Ala Glu Asn Asp
705                 710                 715                 720

Arg His His Ala Leu Asp Ala Val Val Val Ala Cys Ser Thr Val Ala
                725                 730                 735

Met Gln Gln Lys Ile Thr Arg Phe Val Arg Tyr Lys Glu Met Asn Ala
```

```
            740                 745                 750

Phe Asp Gly Lys Thr Ile Asp Lys Glu Thr Gly Glu Val Leu His Gln
        755                 760                 765

Lys Thr His Phe Pro Gln Pro Trp Glu Phe Phe Ala Gln Glu Val Met
    770                 775                 780

Ile Arg Val Phe Gly Lys Pro Asp Gly Lys Pro Glu Phe Glu Glu Ala
785                 790                 795                 800

Asp Thr Leu Glu Lys Leu Arg Thr Leu Leu Ala Glu Lys Leu Ser Ser
                805                 810                 815

Arg Pro Glu Ala Val His Glu Tyr Val Thr Pro Leu Phe Val Ser Arg
            820                 825                 830

Ala Pro Asn Arg Lys Met Ser Gly Gln Gly His Met Glu Thr Val Lys
        835                 840                 845

Ser Ala Lys Arg Leu Asp Glu Gly Val Ser Val Leu Arg Val Pro Leu
    850                 855                 860

Thr Gln Leu Lys Leu Lys Asp Leu Glu Lys Met Val Asn Arg Glu Arg
865                 870                 875                 880

Glu Pro Lys Leu Tyr Glu Ala Leu Lys Ala Arg Leu Glu Ala His Lys
                885                 890                 895

Asp Asp Pro Ala Lys Ala Phe Ala Glu Pro Phe Tyr Lys Tyr Asp Lys
            900                 905                 910

Ala Gly Asn Arg Thr Gln Gln Val Lys Ala Val Arg Val Glu Gln Val
        915                 920                 925

Gln Lys Thr Gly Val Trp Val Arg Asn His Asn Gly Ile Ala Asp Asn
    930                 935                 940
```

```
Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Gly Asp Lys Tyr Tyr
945                 950                 955                 960


Leu Val Pro Ile Tyr Ser Trp Gln Val Ala Lys Gly Ile Leu Pro Asp
                965                 970                 975


Arg Ala Val Val Gln Gly Lys Asp Glu Glu Asp Trp Gln Leu Ile Asp
            980                 985                 990


Asp Ser Phe Asn Phe Lys Phe Ser  Leu His Pro Asn Asp  Leu Val Glu
        995                 1000                1005


Val Ile  Thr Lys Lys Ala Arg  Met Phe Gly Tyr Phe  Ala Ser Cys
    1010                1015                1020


His Arg  Gly Thr Gly Asn Ile  Asn Ile Arg Ile His  Asp Leu Asp
    1025                1030                1035


His Lys  Ile Gly Lys Asn Gly  Ile Leu Glu Gly Ile  Gly Val Lys
    1040                1045                1050


Thr Ala  Leu Ser Phe Gln Lys  Tyr Gln Ile Asp Glu  Leu Gly Lys
    1055                1060                1065


Glu Ile  Arg Pro Cys Arg Leu  Lys Lys Arg Pro Pro  Val Arg
    1070                1075                1080


<210>  575
<211>  67
<212>  PRT
<213>  Neisseria meningitidis

<400>  575

Met Phe Gly Tyr Phe Ala Ser Cys His Arg Gly Thr Gly Asn Ile Asn
1               5                   10                  15


Ile Arg Ile His Asp Leu Asp His Lys Ile Gly Lys Asn Gly Ile Leu
            20                  25                  30
```

```
Glu Gly Ile Gly Val Lys Thr Ala Leu Ser Phe Gln Lys Tyr Gln Ile
        35                  40                  45


Asp Glu Leu Gly Lys Glu Ile Arg Pro Cys Arg Leu Lys Lys Arg Pro
    50                  55                  60


Pro Val Arg
65
```

<210> 576
<211> 220
<212> PRT
<213> Neisseria mucosa

<400> 576

```
Met Arg His Ile Phe Ser Asp Gly Leu Lys Glu Gly Ile Glu Thr Leu
1               5                   10                  15


Leu Met Thr Gln Arg Pro Ala Leu Ser Gly Asp Ala Val Gln Lys Met
            20                  25                  30


Leu Gly His Cys Thr Phe Glu Pro Thr Glu Pro Lys Ala Ala Lys Asn
        35                  40                  45


Thr Tyr Thr Ala Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu
    50                  55                  60


Arg Ile Leu Glu Gln Gly Ser Glu Arg Pro Leu Thr Asn Thr Glu Arg
65                  70                  75                  80


Ala Thr Leu Met Asp Glu Pro Tyr Arg Lys Ser Lys Leu Thr Tyr Ala
                85                  90                  95


Gln Ala Arg Lys Leu Leu Gly Leu Lys Asp Thr Ala Phe Phe Lys Gly
            100                 105                 110


Leu Arg Tyr Gly Lys Asp Asn Ala Glu Ala Ser Thr Leu Met Glu Met
```

```
        115                 120                 125

Lys Ala Tyr His Ala Ile Ser Arg Ala Leu Glu Lys Glu Gly Leu Lys
    130                 135                 140

Asp Lys Lys Ser Pro Leu Asn Leu Ser Pro Glu Leu Gln Asp Glu Ile
145                 150                 155                 160

Gly Thr Ala Phe Ser Leu Phe Lys Thr Asp Glu Asp Ile Thr Gly Arg
                165                 170                 175

Leu Lys Thr Glu Leu Thr Pro Ala Ser Asn Lys Thr Leu Ser Arg Pro
            180                 185                 190

Phe Thr Val Lys Ser Ala Ser Asn Gly Ser Thr Ser Ala Pro Trp Leu
        195                 200                 205

Pro Ser Thr Lys Trp Phe Leu His Phe Lys Pro Ala
    210                 215                 220
```

<210> 577
<211> 392
<212> PRT
<213> Neisseria sp.

<400> 577

```
Met Ala Pro Phe Thr Leu Lys Pro Leu Asn Tyr Ile Leu Gly Leu Asp
1               5                   10                  15

Ile Gly Ile Ala Ser Val Gly Trp Ala Val Val Glu Thr Asp Ser Asp
            20                  25                  30

Val Leu Pro Tyr Arg Leu Ile Asp Val Gly Val Arg Thr Phe Asp Arg
        35                  40                  45

Ala Glu Val Pro Lys Thr Gly Glu Ser Pro Ala Ala Ala Arg Arg Leu
    50                  55                  60
```

```
Ala Arg Ser Val Arg Arg Met Ile Arg Arg Arg Ala His Arg Met Leu
65                  70                  75                  80

Arg Ala Arg Arg Leu Leu Lys Arg Glu Gly Met Leu Gln Ala Ala Asp
                85                  90                  95

Phe Asp Ala His Gly Leu Val Glu Asn Leu Pro Val Asn Pro Trp Gln
            100                 105                 110

Leu Arg Val Asp Ala Leu Ser Arg Lys Leu Met Pro Leu Glu Trp Ala
        115                 120                 125

Ala Val Leu Leu His Met Val Lys His Arg Gly Tyr Leu Ser Gln Arg
    130                 135                 140

Lys Asn Glu Arg Asn Ser Ser Asp Lys Glu Leu Gly Ala Leu Leu Ser
145                 150                 155                 160

Gly Val Ala Ala Asn Ser Glu Ala Leu Gln Gly Gly Asp Phe Arg Thr
                165                 170                 175

Pro Ala Glu Leu Ala Val Asn Lys Phe Glu Lys Glu Ser Gly His Ile
            180                 185                 190

Arg Asn Gln Arg Gly Asp Tyr Ser His Thr Phe Asn Arg Lys Asp Val
        195                 200                 205

Gln Ala Glu Leu Val Leu Leu Phe Glu Lys Gln Lys Glu Tyr Gly Asn
    210                 215                 220

Pro Tyr Ile Ser Asp Gly Leu Leu Thr Gly Val Glu Asp Leu Leu Met
225                 230                 235                 240

Thr Gln Arg Ala Ala Leu Ser Gly Asp Ala Val Gln Lys Met Leu Gly
                245                 250                 255

Arg Cys Thr Phe Glu Pro Glu Glu Tyr Lys Ala Ala Lys Asn Thr Tyr
            260                 265                 270
```

```
Ser Ala Glu Arg Phe Val Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile
        275                 280                 285


Leu Asp Gln Gly Ser Glu Arg Pro Leu Thr Asp Ser Glu Arg Ala Lys
    290                 295                 300


Leu Met Asp Glu Pro Tyr Lys Lys Thr Lys Leu Thr Tyr Ala Gln Val
305                 310                 315                 320


Arg Arg Leu Leu Glu Leu Asp Asp Thr Ala Phe Phe Lys Gly Leu Arg
                325                 330                 335


Tyr Ser Lys Asp Asn Ala Glu Ser Ala Thr Leu Met Glu Met Lys Ala
            340                 345                 350


Tyr His Ser Ile Ser Gly Ala Leu Glu Lys Ala Gly Leu Lys Asn Lys
        355                 360                 365


Lys Ile Ala Ala Gly Leu Ile Ala Arg Ile Ala Gly Arg Asn Arg Arg
    370                 375                 380


Gly Val Phe Ala Ile Gln Asn Arg
385                 390
```

<210> 578
<211> 701
<212> PRT
<213> Neisseria sp.

<400> 578

```
Met Gln Asp Glu Ile Gly Glu Ala Phe Ser Leu Phe Lys Thr Asp Glu
1               5                   10                  15


Asp Ile Arg Gly Arg Leu Lys Gly Lys Leu Pro Asp Glu Gln Leu Asp
            20                  25                  30


Ala Leu Leu Glu Tyr Val Ser Phe Asp Lys Phe Val Gln Leu Ser Leu
```

```
        35                  40                  45

Lys Ala Leu Arg Lys Ile Leu Pro Leu Met Glu Gln Gly Lys Arg Tyr
    50                  55                  60

Asp Glu Ala Cys Ala Glu Ile Tyr Gly Asp His Tyr Gly Ile Lys Asp
65                  70                  75                  80

Asp Lys Gln Ala Gln Phe Leu Pro Pro Val Ser Ala Asp Glu Ile Arg
                85                  90                  95

Asn Pro Val Val Leu Arg Ala Leu Ser Gln Ala Arg Lys Val Val Asn
            100                 105                 110

Ala Val Val Arg Arg Tyr Gly Ser Pro Ala Arg Val His Ile Glu Thr
        115                 120                 125

Ala Arg Glu Val Gly Lys Ser Phe Leu Asp Arg Lys Lys Ile Glu Lys
    130                 135                 140

Arg Gln Glu Glu Asn Arg Lys Asp Arg Glu Arg Ser Ile Ala Lys Phe
145                 150                 155                 160

Arg Glu Tyr Phe Pro Asn Phe Val Gly Glu Pro Lys Ala Lys Asp Ile
                165                 170                 175

Leu Lys Met Arg Leu Tyr Glu Gln Gln Gln Gly Gln Cys Leu Tyr Ser
            180                 185                 190

Gly Lys Ala Ile Asp Leu Arg Arg Leu Asn Glu Lys Gly Tyr Val Glu
        195                 200                 205

Ile Asp His Ala Leu Pro Phe Ser Arg Thr Trp Asp Asp Ser Phe Asn
    210                 215                 220

Asn Lys Val Leu Val Leu Ala Gly Glu Asn Gln Asn Lys Arg Asn Gln
225                 230                 235                 240
```

```
Thr Pro Phe Glu Trp Leu Gly Gly Asp Glu Lys Arg Trp Arg Glu Phe
                245                 250                 255

Thr Ala Arg Val Glu His Cys Arg Phe Pro Arg Ser Lys Lys Gln Arg
            260                 265                 270

Ile Leu Met Gln Lys Leu Asp Glu Lys Asp Phe Lys Glu Arg Asn Leu
        275                 280                 285

Asn Asp Thr Arg Tyr Val Asn Arg Phe Leu Cys Asn Phe Ile Ala Gln
    290                 295                 300

Asn Met Leu Leu Thr Gly Glu Asp Lys Asn Arg Val Phe Ala Ser Asn
305                 310                 315                 320

Gly Gln Ile Thr Asn Leu Leu Arg Gly Met Trp Gly Leu Lys Lys Val
                325                 330                 335

Arg Glu Ser Asn Asp Arg His His Ala Leu Asp Ala Val Val Val Ala
            340                 345                 350

Cys Ser Thr Val Ala Met Gln Gln Lys Ile Thr Asn Tyr Val Arg Gln
        355                 360                 365

Lys Glu Met Asn Val Phe Asp Gly Glu Met Val Asp Lys Thr Thr Gly
    370                 375                 380

Glu Val Ser Arg Leu His Phe Pro Gln Pro Trp Asp Phe Phe Arg Gln
385                 390                 395                 400

Glu Val Met Met Arg Val Phe Gly Lys Pro Asp Thr Pro Ser Glu Asn
                405                 410                 415

Asn Glu Glu Ala Asp Thr Pro Glu Lys Leu Arg Ala Leu Leu Ala Asp
            420                 425                 430

Lys Leu Ser Ser Arg Pro Glu Ala Val His Glu Ala Val Thr Pro Leu
```

```
        435                 440                 445

Phe Val Ser Arg Ala Pro Ser Arg Lys Met Ser Gly Gln Gly His Met
    450                 455                 460

Glu Thr Ile Lys Ser Ala Lys Arg Leu Ser Glu Gly Lys Ser Val Leu
465                 470                 475                 480

Arg Val Pro Leu Thr Gln Leu Thr Pro Lys Leu Leu Glu Asn Met Val
                485                 490                 495

Asn Arg Glu Arg Glu Pro Gln Leu Tyr Glu Asp Leu Leu Gly Arg Leu
            500                 505                 510

Asn Ala His Gly Gly Asp Pro Ala Lys Ala Phe Ala Ala Pro Phe Phe
        515                 520                 525

Lys Arg Asp Lys Ala Gly Asn Pro Thr Gln Gln Val Lys Ala Val Arg
    530                 535                 540

Val Glu Asp Val Gln Lys Ser Gly Val Ile Val Arg Glu Gly Asn Gly
545                 550                 555                 560

Val Ala Asp Asn Ala Thr Met Val Arg Val Asp Val Phe Glu Lys Gly
                565                 570                 575

Gly Lys Tyr Tyr Leu Met Pro Ile Tyr Thr Trp Gln Ala Ala Lys Gly
            580                 585                 590

Ile Leu Pro Asn Lys Ala Val Ile Ala His Thr Asp Glu Ala Asn Trp
        595                 600                 605

Gln Glu Met Asp Thr Ser Phe Thr Phe Lys Phe Ala Leu Tyr Pro Asn
    610                 615                 620

Asp Leu Val Leu Ala Ser Leu Lys Lys Glu Thr Tyr Phe Gly Tyr Phe
625                 630                 635                 640
```

```
Ala Gly Leu Asp Arg Ser Thr Gly Asn Ile Ser Leu Arg Val His Asp
                645                 650                 655

Leu Glu Lys Ser Lys Gly Lys Asp Gly Val Tyr Arg Ile Gly Val Lys
            660                 665                 670

Thr Ala Leu Ser Phe Gln Lys Tyr Gln Val Asp Glu Leu Gly Lys Thr
        675                 680                 685

Ile Arg Pro Cys Arg Leu Lys Lys Arg Pro Pro Val Arg
    690                 695                 700
```

<210> 579
<211> 1089
<212> PRT
<213> Neisseria sp.

<400> 579

```
Met Thr Ala Phe Lys Pro Asn Pro Leu Asn Tyr Ile Leu Gly Leu Asp
1               5                   10                  15

Ile Gly Ile Ala Ser Val Gly Trp Ala Met Val Glu Ile Asp Asp Lys
            20                  25                  30

Glu Asn Pro Val Arg Leu Ile Asp Leu Gly Val Arg Val Phe Glu Arg
        35                  40                  45

Ala Glu Met Pro Lys Thr Gly Asp Ser Leu Ala Ala Ala Arg Arg Leu
    50                  55                  60

Ala Arg Ser Val Arg Arg Leu Thr Arg Arg Arg Ala His Arg Leu Leu
65                  70                  75                  80

Arg Ala Arg Arg Leu Leu Lys His Glu Gly Val Leu Lys Pro Glu Asp
                85                  90                  95

Phe Asp Glu Asn Gly Leu Val Lys Pro Leu Pro Tyr Ile Pro Lys Gln
            100                 105                 110
```

```
Pro Arg Asn Thr Pro Trp Gln Leu Arg Ala Ala Ala Leu Asp Arg Lys
        115                 120                 125

Leu Thr Pro Leu Glu Trp Ala Ala Val Leu Leu His Leu Val Lys His
    130                 135                 140

Arg Gly Tyr Leu Ser Gln Arg Lys Asn Glu Gly Glu Thr Asp Asp Lys
145                 150                 155                 160

Glu Leu Gly Ala Leu Leu Lys Gly Val Ala Asp Asn Thr His Ala Leu
                165                 170                 175

Gln Ala Gly Asn Phe Arg Thr Pro Ala Glu Leu Ala Leu Asn Lys Phe
            180                 185                 190

Glu Lys Glu Ser Gly His Ile Arg Asn Gln Arg Gly Asp Tyr Ser His
        195                 200                 205

Thr Phe Ser Arg Lys Asp Leu Gln Ala Glu Leu Val Leu Leu Phe Glu
    210                 215                 220

Lys Gln Lys Glu Phe Gly Asn Pro Tyr Val Ser Asp Asp Leu Lys Asn
225                 230                 235                 240

Gly Ile Glu Asn Leu Leu Met Thr Gln Arg Pro Ala Leu Ser Gly Asp
                245                 250                 255

Ala Ile Gln Lys Met Leu Gly His Cys Thr Phe Glu Pro Ala Glu Pro
            260                 265                 270

Lys Ala Ala Lys Asn Thr Tyr Thr Ala Glu Arg Phe Ile Trp Leu Thr
        275                 280                 285

Lys Leu Asn Asn Leu Arg Ile Leu Asn Gln Gly Asn Glu Arg Pro Leu
    290                 295                 300
```

```
Thr Asp Ala Glu Arg Thr Thr Leu Met Asp Glu Pro Tyr Lys Lys Ser
305                 310                 315                 320

Lys Leu Thr Tyr Ala Gln Ala Arg Lys Leu Leu Asp Leu Asp Asp Thr
                325                 330                 335

Ala Phe Phe Lys Gly Leu Arg Tyr Gly Lys Asp Asn Ala Glu Ser Ala
            340                 345                 350

Thr Leu Met Glu Met Lys Ala Tyr His Ala Ile Ser Arg Ala Leu Glu
        355                 360                 365

Lys Glu Gly Leu Lys Asp Lys Lys Ser Pro Leu Ser Leu Ser Pro Glu
    370                 375                 380

Leu Gln Asp Glu Ile Gly Thr Ala Phe Ser Leu Phe Lys Thr Asp Glu
385                 390                 395                 400

Glu Ile Thr Gly Arg Leu Lys Gly Cys Leu Gln Pro Glu Ile Leu Asp
                405                 410                 415

Ala Leu Leu Lys His Ile Ser Phe Asp Lys Phe Val Gln Ile Ser Leu
            420                 425                 430

Lys Ala Leu Arg Arg Ile Val Pro Leu Met Glu Gln Gly Lys Arg Tyr
        435                 440                 445

Asp Glu Ala Cys Ala Glu Ile Tyr Gly Asp His His Gly Arg Arg Asn
    450                 455                 460

Ser Glu Glu Thr Leu Tyr Leu Pro Pro Ile Pro Ala Asp Glu Ile Arg
465                 470                 475                 480

Asn Pro Val Val Leu Arg Ala Leu Ser Gln Ala Arg Lys Val Ile Asn
                485                 490                 495

Gly Val Gly Arg Arg Tyr Gly Ser Pro Ala Arg Ile His Ile Glu Thr
            500                 505                 510
```

```
Ala Arg Glu Val Gly Lys Ser Phe Lys Asp Arg Lys Glu Ile Glu Lys
        515                 520                 525

Arg Gln Glu Glu Asn Arg Lys Asp Arg Glu Lys Ala Ala Ala Glu Phe
    530                 535                 540

Gln Glu Tyr Phe Pro Asn Phe Val Gly Glu Pro Lys Ser Lys Asp Ile
545                 550                 555                 560

Leu Lys Leu Arg Leu Tyr Arg Gln Gln Asn Cys Lys Cys Leu Tyr Ser
                565                 570                 575

Gly Lys Glu Ile Asn Leu Gly Arg Leu Asn Glu Lys Gly Tyr Val Glu
            580                 585                 590

Ile Asp His Ala Leu Pro Phe Ser Arg Thr Trp Asp Asp Ser Phe Asn
        595                 600                 605

Asn Lys Val Leu Val Leu Gly Ser Glu Asn Gln Asn Lys Gly Asn Arg
    610                 615                 620

Thr Pro Tyr Glu Tyr Leu Asn Gly Lys Asp Asn Ser Arg Glu Trp Gln
625                 630                 635                 640

Glu Phe Lys Ala Arg Val Glu Thr Ser Arg Phe Pro His Ser Lys Lys
                645                 650                 655

Gln Arg Ile Leu Leu Gln Lys Phe Asp Glu Glu Gly Phe Lys Glu Arg
            660                 665                 670

Asn Leu Asn Asp Thr Arg Tyr Val Asn Arg Phe Leu Cys Lys Phe Val
        675                 680                 685

Ala Asp His Met Gln Leu Thr Gly Lys Gly Lys Arg Arg Val Phe Ala
    690                 695                 700
```

```
Ser Asn Gly Gln Ile Thr Asn Leu Leu Arg Gly Phe Trp Gly Leu Arg
705                 710                 715                 720

Lys Val Arg Ala Glu Asn Asp Arg His His Ala Leu Asp Ala Val Val
                725                 730                 735

Val Ala Cys Ser Thr Val Ala Met Gln Gln Arg Ile Thr Arg Phe Val
            740                 745                 750

Arg Tyr Lys Glu Met Asn Ala Phe Asp Gly Lys Thr Val Asp Lys Glu
        755                 760                 765

Thr Gly Glu Val Leu His Gln Lys Thr His Phe Pro Gln Pro Trp Glu
    770                 775                 780

Phe Phe Ala Gln Glu Val Met Ile Arg Val Phe Gly Lys Pro Asp Gly
785                 790                 795                 800

Lys Pro Glu Leu Glu Glu Ala Asp Thr Pro Glu Lys Leu Arg Ala Leu
                805                 810                 815

Leu Ala Glu Lys Leu Ser Ser Arg Pro Glu Ala Val His Glu Tyr Val
            820                 825                 830

Ala Pro Leu Phe Val Ser Arg Ala Pro Asn Arg Lys Met Ser Gly Gln
        835                 840                 845

Gly His Met Glu Thr Ile Lys Ser Pro Lys Arg Leu Asp Glu Gly Ile
    850                 855                 860

Ser Val Val Arg Val Pro Leu Thr Gln Leu Lys Leu Lys Asp Leu Glu
865                 870                 875                 880

Lys Met Val Asn Arg Glu Arg Glu Pro Lys Leu Tyr Glu Ala Leu Lys
                885                 890                 895

Ala Arg Leu Glu Ala His Lys Asp Asp Pro Ala Lys Ala Phe Ala Glu
            900                 905                 910
```

```
Pro Phe Tyr Lys Gln Asp Lys Ala Gly Asn Arg Thr Gln Gln Val Lys
        915                 920                 925

Ala Val Arg Ile Glu Gln Val Gln Lys Thr Gly Val Trp Val Arg Asn
    930                 935                 940

Gln Asn Gly Ile Ala Asp Asn Ala Thr Met Val Arg Val Asp Val Phe
945                 950                 955                 960

Glu Lys Gly Gly Lys Tyr Tyr Leu Val Pro Ile Tyr Ser Trp Gln Val
                965                 970                 975

Ala Lys Gly Ile Leu Pro Asp Lys Ala Ile Ile Ala Phe Lys Asp Glu
            980                 985                 990

Glu Glu Trp Gln Leu Ile Asp Asp  Ser Phe Asn Phe Lys  Phe Pro Leu
        995                 1000                1005

His Pro  Asn Asp Leu Val Glu  Val Ile Thr Lys Lys  Ala Arg Ile
    1010                1015                1020

Phe Gly  Tyr Phe Ala Ser Cys  His Arg Gly Thr Gly  Asn Ile Asn
    1025                1030                1035

Ile Arg  Ile His Asp Leu Asp  Asn Lys Val Gly Lys  Asn Gly Ile
    1040                1045                1050

Leu Glu  Gly Ile Gly Val Lys  Thr Ala Leu Ser Phe  Gln Lys Tyr
    1055                1060                1065

Gln Ile  Asp Glu Leu Gly Lys  Glu Ile Arg Pro Cys  Arg Leu Lys
    1070                1075                1080

Lys Arg  Pro Pro Val Arg
    1085
```

<210> 580
<211> 1097
<212> PRT
<213> Neisseria wadsworthii

<400> 580

Met Lys Lys Gln Pro Gln Arg Tyr Ile Leu Gly Leu Asp Leu Gly Ile
1 5 10 15

Ala Ser Val Gly Trp Ala Leu Ile Leu Val Asp Gly Ala Glu Asn Pro
20 25 30

Val Gly Leu Leu Asp Cys Gly Val Arg Thr Phe Glu Arg Ala Glu Val
35 40 45

Pro Lys Thr Gly Asp Ser Leu Ala Leu Ala Arg Arg Gln Ala Arg Ser
50 55 60

Val Arg Arg Leu Ile Arg Arg Arg Ala His Arg Leu Leu Arg Leu Arg
65 70 75 80

Arg Leu Leu Lys Arg Glu Gly Ile Leu Ser Ala Ala Asp Phe Asn Ser
85 90 95

Asp Gly Leu Pro Asn Leu Pro Ile Asp Ala Trp Gln Leu Arg Val Ala
100 105 110

Gly Leu Glu Arg Lys Leu Thr Asn Gln Glu Trp Ala Ala Val Leu Leu
115 120 125

His Leu Val Lys His Arg Gly Tyr Leu Ser Gln Arg Lys Ser Glu Thr
130 135 140

Gln Thr Glu Asn Lys Glu Leu Gly Arg Leu Leu Ala Gly Val Ala Glu
145 150 155 160

Asn Ser Lys Leu Leu Ser Glu Ser Ser Glu Gln Tyr Arg Thr Pro Ala
165 170 175

```
Glu Leu Ala Val Lys Leu Phe Ala Glu Gln Ser Gly His Leu Arg Asn
            180                 185                 190

Lys Gly Gly Glu Tyr Thr His Thr Phe Asn Arg Leu Asp Leu Gln Lys
        195                 200                 205

Glu Leu His Leu Leu Phe Glu Arg Gln Tyr Ala Leu Gly Asn Pro Phe
    210                 215                 220

Ala Ser Ala Glu Leu Gln Ser Lys Val Asp Glu Leu Leu Met Thr Gln
225                 230                 235                 240

Arg Ser Ala Leu Gln Gly Glu Ala Val Leu Lys Met Leu Gly Lys Cys
                245                 250                 255

Thr Phe Glu Pro Ser Glu Tyr Lys Ala Ala Lys Asn Thr Tyr Ser Ala
            260                 265                 270

Glu Arg Phe Ile Trp Leu Thr Lys Leu Asn Asn Leu Arg Ile Leu Tyr
        275                 280                 285

Asn Gly Glu Glu Arg Ala Leu Asp Glu Gly Asp Arg Lys Lys Leu Leu
    290                 295                 300

Asp Glu Pro Tyr Lys Lys Ala Lys Leu Thr Tyr Lys Gln Val Arg Ser
305                 310                 315                 320

Ile Leu Asn Leu Pro Glu Ser Ala Val Phe Lys Gly Leu Arg Tyr Gly
                325                 330                 335

Lys Asp Ser Asp Gly Leu Lys Ala Glu Asn Gly Thr Leu Met Glu Met
            340                 345                 350

Lys Ala Tyr His Lys Ile Arg Thr Ile Leu Asp Lys Ala Gly Leu Lys
        355                 360                 365

Gly Glu Trp Glu Asn Arg Ile Arg Asn Pro Glu Ile Leu Asp Lys Ile
```

```
    370                 375                 380

Gly Thr Ala Phe Ser Leu Tyr Lys Thr Asp Glu Asp Ile Gln Ala Ala
385                 390                 395                 400

Leu Ala Asp Leu Arg Leu Pro Glu Asn Val Leu Asp Ala Leu Leu Ala
                405                 410                 415

Gly Leu Asn Phe Asp Lys Phe Ile Gln Leu Ser Leu Lys Ala Leu Arg
            420                 425                 430

Asn Ile Leu Pro Leu Met Glu Arg Gly Ile Arg Tyr Asp Glu Ala Cys
        435                 440                 445

Lys Glu Val Tyr Gly Asp His Arg Ala Leu Ala Glu Ser Lys Asn Gln
    450                 455                 460

Val Leu Leu Pro Pro Ile Pro Ala Asp Glu Ile Arg Asn Pro Val Val
465                 470                 475                 480

Leu Arg Thr Leu Thr Gln Ala Arg Lys Val Ile Asn Ala Ile Ile Arg
                485                 490                 495

Arg Tyr Gly Ser Pro Gln Arg Val His Ile Glu Thr Ala Arg Glu Leu
            500                 505                 510

Gly Lys Ser Lys Gln Glu Arg Asp Lys Ile Asp Arg Lys Asn Lys Glu
        515                 520                 525

Asn Gln Asn Asp Arg Asn Arg Leu Ala Ser Asp Ile Arg Lys His Phe
    530                 535                 540

Asn Phe Glu Pro Thr Pro Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu
545                 550                 555                 560

Gln Gln His Gly Lys Cys Leu Tyr Ser Asp Leu Arg Glu Glu Lys Gly
                565                 570                 575
```

```
Glu Cys Leu Tyr Thr Gly Asn Val Ile Glu Leu His Arg Leu Phe Glu
            580                 585                 590

Asp Gly Tyr Val Glu Ile Asp His Ala Leu Pro Leu Ser Arg Thr Trp
        595                 600                 605

Asp Asn Ser Leu Asn Asn Lys Val Leu Val Leu Lys Ser Ser Asn Gln
    610                 615                 620

Asn Lys Gly Asn Lys Thr Pro Tyr Glu Trp Leu Asp Gly Ala Asn Asn
625                 630                 635                 640

Ser Arg Arg Trp Arg Glu Phe Gln Ala Arg Val Gln Gly Cys His Phe
                645                 650                 655

Pro Tyr Val Lys Lys Gln Arg Ile Gln Thr Ala Lys Leu Asp Ser Lys
            660                 665                 670

Ala Glu Gln Gly Phe Leu Glu Arg Asn Leu Asn Asp Thr Arg Tyr Ile
        675                 680                 685

Ser Lys Phe Met Cys Gln Phe Ile Thr Ala Asn Leu Arg Leu Ala Glu
    690                 695                 700

Thr Ser Asn Ala Leu Met Glu Glu Val Ala Gly Glu Asn Pro Tyr Trp
705                 710                 715                 720

Lys Glu Arg Lys Arg Gln Arg Val Phe Ala Pro Ser Gly Ser Ile Ile
                725                 730                 735

Ala Leu Leu Arg Gly Leu Trp Gly Leu Lys Lys Val Arg Glu Asp Asn
            740                 745                 750

Asp Arg His His Ala Leu Asp Ala Ile Val Val Ala Cys Ser Thr Val
        755                 760                 765

Ser Met Gln Gln Lys Ile Thr Lys Ala Met Gln Arg Arg Glu Thr Leu
```

```
    770                 775                 780

Glu Thr Val Asp Ser Glu Thr Gly Glu Val Lys Thr Arg Ile Pro Gln
785                 790                 795                 800

Pro Trp Asp Phe Phe Arg Gln Glu Val Met Ile Arg Val Phe Ser Asp
                805                 810                 815

Ser Pro Arg Glu Glu Leu Ala Glu Lys Leu Asn Ser Arg Pro Glu Ala
            820                 825                 830

Leu His Asp Phe Val Ser Pro Leu Phe Val Ser Arg Ala Pro Asn Arg
        835                 840                 845

Lys Met Thr Gly Gln Gly His Leu Glu Thr Val Lys Ser Ala Lys Arg
    850                 855                 860

Leu Ser Glu Asn Ile Ser Val Val Arg Lys Pro Leu Thr Ala Leu Lys
865                 870                 875                 880

Leu Lys Asp Ile Glu Asn Ile Val Gly Tyr Pro Asp Arg Glu Pro Ala
                885                 890                 895

Leu Tyr Gln Ala Leu Arg Glu Arg Leu Leu Ala His Lys Asp Asp Pro
            900                 905                 910

Val Lys Ala Phe Ala Asp Lys Pro Phe Tyr Lys Pro Ala Lys Asp Gly
        915                 920                 925

Gly Gln Gly Ser Leu Val Lys Ala Val Arg Ile Ile Glu Asn Thr Lys
    930                 935                 940

His Gly Leu Lys Ile Arg Asn Gly Ile Thr Asp Thr Asn Gly Asp Met
945                 950                 955                 960

Val Arg Thr Asp Val Tyr Gln Lys Thr Asp Lys Lys Gly Lys Arg Gln
                965                 970                 975
```

```
Tyr Phe Ile Val Pro Val Tyr Ala Trp Gln Val Glu Lys Asn Glu Leu
            980                 985                 990


Pro Thr Val Asp Cys Lys Gly Tyr  Glu Ile Asp Asp Asn  Tyr Glu Phe
        995                 1000                1005


Cys Phe  Ser Leu Tyr Lys Tyr  Asp Leu Ile Glu Ile  Gln Asn Pro
    1010                1015                1020


Asn Asp  Ile Asn Gln Glu Leu  Arg Ala Tyr Tyr Ile  Asn Cys Asp
    1025                1030                1035


Ser Ser  Asp Gly Arg Phe Trp  Leu Ala Tyr His Asp  Lys Ser Ala
    1040                1045                1050


Lys Glu  Gln Gln Phe Arg Ile  Ser Thr Gln Asn Gln  Pro Ile Ile
    1055                1060                1065


Lys Lys  Tyr Gln Val Asp Thr  Leu Gly Lys Glu Ile  Arg Leu Cys
    1070                1075                1080


Lys Ala  Glu Lys Arg Thr Ala  Leu Asn Gly Lys Lys  Lys Lys
    1085                1090                1095


<210>  581
<211>  1426
<212>  PRT
<213>  Niabella soli

<400>  581

Met Pro Arg Lys Asn Ile Leu Gly Leu Asp Leu Gly Thr Thr Ser Ile
1               5                   10                  15


Gly Phe Ala Lys Ile Ile Glu Asp Asp Asp Tyr Gln Cys Ser Ser Val
            20                  25                  30


Glu Leu Ile Gly Val Arg Val Asn Pro Leu Thr Thr Asp Glu Gln Thr
        35                  40                  45
```

```
Asn Phe Glu Lys Gly Lys Pro Val Ser Val Asn Ala Asp Arg Thr Leu
    50                  55                  60

Lys Arg Gly Met Arg Arg Asn Leu Asp Arg Tyr Gln Leu Arg Arg Asp
65                  70                  75                  80

Tyr Leu Ile Glu Ile Leu Arg Thr His His Ile Ile Thr Ala Asp Thr
                85                  90                  95

Lys Leu Ala Glu Asp Gly Lys Asn Thr Thr His Thr Thr Tyr Ala Leu
            100                 105                 110

Arg Ala Leu Ala Ala Thr Ala Glu Ile Pro Leu Glu Ala Phe Val Arg
        115                 120                 125

Val Leu Leu Ala Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys
    130                 135                 140

Ala Lys Asn Glu Asp Glu Gly Gln Leu Ile Asp Gly Met Ala Ile Ala
145                 150                 155                 160

Arg Arg Leu Tyr Glu Glu Ser Leu Thr Pro Gly Gln Phe Ser Tyr Gln
                165                 170                 175

Leu Leu Lys Glu Gly Lys Lys Tyr Leu Pro Asp Phe Tyr Arg Ser Asp
            180                 185                 190

Leu Asn Thr Glu Leu Asn Lys Val Trp Asn Phe Gln Lys Gln Phe Tyr
        195                 200                 205

Pro Glu Ile Leu Thr Asp Glu Phe Lys Arg His Leu Glu Gly Lys Gly
    210                 215                 220

Gln Arg Ala Thr Ala Val Ala Phe Trp Gly Gln His Gly Phe Ser Met
225                 230                 235                 240
```

```
Ala Glu Asn Lys Gly Ser Arg Glu Glu Lys Lys Leu His Ala Tyr Lys
                245                 250                 255

Trp Arg Ser Glu Ala Ala His Lys Gln Leu Thr Lys Glu Glu Val Ala
            260                 265                 270

Phe Val Ile Thr Glu Ile Asn Asn Asp Leu Asn Lys Ser Ser Gly Tyr
        275                 280                 285

Leu Gly Ala Ile Ser Asp Arg Ser Lys Glu Leu Phe Phe Asn Lys Gln
    290                 295                 300

Thr Val Gly Gln Tyr Leu His Gln Gln Leu Lys Glu Asn Pro His Thr
305                 310                 315                 320

Arg Leu Lys Gly Gln Val Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe
                325                 330                 335

Glu Thr Ile Trp Glu Met Gln Ala Lys Phe Tyr Ser Ala Leu Thr Leu
            340                 345                 350

Glu Leu Lys Glu Glu Val Arg Asp Val Val Ile Phe Tyr Gln Arg Lys
        355                 360                 365

Leu Lys Ser Gln Met Gly Leu Ile Ser Leu Cys Glu Phe Glu Ser Lys
    370                 375                 380

Glu Ile Glu Ile Glu Lys Asn Gly Glu Lys Ala Lys Lys Arg Ile Gly
385                 390                 395                 400

Leu Arg Val Ala Pro Lys Ser Ser Pro Leu Phe Gln Glu Phe Lys Ile
                405                 410                 415

Trp Gln Val Leu Asn Asn Leu Glu Phe Arg Asn Lys Lys Thr Lys Glu
            420                 425                 430

Val Phe Val Pro Glu Met Ala Ala Lys Gln Gln Leu Phe Asp Glu Leu
        435                 440                 445
```

```
Asn Ile Lys Gly Asn Leu Leu Ala Ser Glu Ala Ile Lys Ile Leu Gly
    450                 455                 460

Tyr Lys Thr Lys Asp Trp Glu Ala Asn Tyr His Thr Leu Glu Gly Asn
465                 470                 475                 480

Arg Thr Asn Lys Ser Leu Tyr Asp Ala Trp Leu Lys Ile Leu Glu Leu
                485                 490                 495

Glu Gly Tyr Asp Glu Asn Leu Leu Lys Leu Ser Gly Ser Asp Asp Ile
            500                 505                 510

Asp Val Ser Lys Ile Glu Lys Pro Ala Leu Glu Ile Arg Gln Met Val
        515                 520                 525

Leu Ala Val Phe Glu Val Leu Gly Ile Ser Gly Ala Ile Leu Asp Phe
    530                 535                 540

Asp Ala Glu Ala Asp Gly Lys Ala Phe Glu Gln Gln Pro Ala Tyr Gln
545                 550                 555                 560

Leu Trp His Leu Leu Tyr Ser Ala Glu Asp Asp Gly Lys Lys Tyr Ser
                565                 570                 575

Gln Glu Asp Ile Phe Thr Tyr Gly His Asp Asn Ile Gly Leu Lys Lys
            580                 585                 590

Lys Leu Cys Glu Lys Phe Gly Phe Arg Pro Glu His Thr Lys Ile Leu
        595                 600                 605

Val Asn Val Val Phe Ser Asp Asp Tyr Gly Asn Leu Ser Ser Lys Ala
    610                 615                 620

Met Arg Arg Ile Tyr Pro Phe Ile Lys Glu Leu Thr Tyr Asp Lys Ala
625                 630                 635                 640
```

```
Cys Ala Glu Ala Gly Tyr Arg His Ser Ala Ala Ser Leu Thr Lys Glu
                645                 650                 655

Glu Ile Ala Ala Arg Pro Leu Gln Asn Arg Leu Asp Leu Leu Lys Lys
            660                 665                 670

Asn Glu Leu Arg Ser Pro Val Val Glu Lys Ile Leu Asn Gln Met Val
        675                 680                 685

Asn Val Val Asn Thr Leu Val Asp Asp Glu Asn Gln Asn Arg Lys Ala
    690                 695                 700

Arg Gly Leu Ser Glu Asp Phe His Phe Asp Glu Ile Arg Ile Glu Leu
705                 710                 715                 720

Ala Arg Glu Leu Lys Lys Asn Ala Lys Glu Arg Ala Glu Met Thr Thr
                725                 730                 735

Asn Ile Asn Thr Ala Lys Gln Ser His Glu Lys Ile Ile Arg Ile Leu
            740                 745                 750

Gln Thr Glu Phe Gly Val Pro Asn Pro Ser Arg Asn Asp Ile Val Arg
        755                 760                 765

Tyr Lys Leu Tyr Glu Glu Leu Lys Asn Asn Gly Tyr Lys Asp Leu Tyr
    770                 775                 780

Thr Asn Thr Tyr Ile Ser Arg Asp Ile Leu Phe Ser Lys Gln Ile Asp
785                 790                 795                 800

Val Asp His Ile Ile Pro Gln Met Ser Leu Phe Asp Asp Ser Phe Ser
                805                 810                 815

Asn Lys Thr Val Val Phe Arg Lys Asp Asn Gln Asp Lys Gly Asn Lys
            820                 825                 830

Thr Ala Tyr Asp Tyr Ile Leu Gly Lys Tyr Gly Glu Gln Ala Leu Glu
        835                 840                 845
```

```
Glu Tyr Ile Ser Arg Ile Thr Ser Leu Phe Glu Leu Gly Lys Lys Asn
    850                 855                 860

Lys Glu Glu Gly Ile Gly Lys Ala Lys Phe Gln Lys Leu Gln Lys Arg
865                 870                 875                 880

Leu Val Asp Ile Gly Asp Gly Phe Ile Glu Arg Asp Leu Arg Glu Ser
                885                 890                 895

Gln Tyr Ile Ala Lys Lys Ala Asn Asn Met Leu Tyr Ala Ile Cys Arg
            900                 905                 910

Ser Val Val Ser Thr Ser Gly Glu Ile Thr Ala Arg Leu Arg Glu Asp
        915                 920                 925

Trp Asp Leu Val Asn Val Met Gln Glu Ile Asn Leu Pro Lys Phe Arg
    930                 935                 940

Ala Leu Gly Leu Thr Glu Met Val Glu Lys Lys Asp Gly Ala Gln Lys
945                 950                 955                 960

Glu Arg Ile Thr Asp Trp Thr Lys Arg Asn Asp His Arg His His Ala
                965                 970                 975

Met Asp Ala Leu Ala Ile Ala Phe Thr Arg His Ser His Ile Gln Tyr
            980                 985                 990

Leu Asn His Leu Asn Ala Arg Lys  Asp Glu Ala Asn Lys  Trp His Pro
        995                 1000                1005

Val Val  Ser Lys Ile Glu Glu  Lys Glu Thr Val Leu  Ile Tyr Asp
    1010                1015                1020

Asp Leu  Gly Asn Arg Lys Arg  Lys Phe Lys Ala Pro  Met Pro Asn
    1025                1030                1035
```

```
Phe Arg  Glu Val Val Lys Glu  His Leu Glu Asn Val  Leu Ile Ser
    1040                1045                1050

His Lys  Ala Lys Asn Lys Val  Val Thr Lys Asn Lys  Asn Lys Ile
    1055                1060                1065

Lys Thr  Val Arg Gly Glu Lys  Val Lys Thr Glu Leu  Thr Pro Arg
    1070                1075                1080

Gly Gln  Leu His Lys Glu Thr  Ile Tyr Gly Arg Tyr  Arg Tyr Tyr
    1085                1090                1095

Glu Ser  Lys Glu Glu Lys Ile  Gly Pro Lys Phe Asp  Ala Glu Met
    1100                1105                1110

Ile Gly  Met Val Thr Asn Pro  Gln Tyr Lys Lys Leu  Leu Leu Glu
    1115                1120                1125

Arg Leu  Ala Ala Asn Gly Asn  Asp Pro Lys Lys Ala  Phe Trp Gly
    1130                1135                1140

Lys Asn  Ala Leu Asn Lys Asn  Pro Leu Tyr Val Asp  Glu Ala Arg
    1145                1150                1155

Gln Glu  Leu Leu Pro Glu Lys  Ile Leu Leu Arg Trp  Leu Asn Asp
    1160                1165                1170

Asp Tyr  Ser Ile Arg Lys Asp  Val Thr Pro Glu Asn  Leu Lys Asp
    1175                1180                1185

Ile Lys  Thr Ile Glu Lys Ile  Leu Asp Lys Gly Val  Lys Lys Ile
    1190                1195                1200

Leu Leu  Lys Arg Leu Ala Asp  Phe Gly Asn Asp Pro  Lys Lys Ala
    1205                1210                1215

Phe Ser  Asp Leu Asp Lys Asn  Pro Ile Trp Gln Asn  Glu Ala Lys
    1220                1225                1230
```

```
Arg Ile  Ala Ile Lys Arg Val  Thr Ile Ser Gly Ile  Lys Asn Ala
    1235                1240                1245

Ala Pro  Leu His His Lys Lys  Asp His Leu Gly Asn  Asp Ile Leu
    1250                1255                1260

Asp Glu  Lys Gly Lys Gln Ile  Pro Ser Ser Phe Val  Ser Thr Gly
    1265                1270                1275

Asn Asn  His His Val Ala Ile  Tyr Arg Asp Ala Glu  Gly Asn Leu
    1280                1285                1290

Gln Glu  Arg Val Val Ser Leu  Phe Asp Ala Val Gln  Leu Val Asn
    1295                1300                1305

Gly Gly  Glu Pro Val Ile Asp  Lys Glu Tyr Asn Lys  Gly Ile Gly
    1310                1315                1320

Trp Gln  Phe Leu Phe Thr Met  Lys Gln Asn Glu Met  Phe Val Phe
    1325                1330                1335

Pro Asp  Glu Lys Thr Gly Phe  Asn Pro Arg Glu Val  Asp Leu Leu
    1340                1345                1350

Ser Ser  Gly Asn Arg Lys Leu  Ile Ser Pro Asn Leu  Phe Arg Val
    1355                1360                1365

Gln Lys  Leu Ala Ser Lys Asn  Tyr Phe Phe Arg His  His Leu Glu
    1370                1375                1380

Thr Ser  Val Glu Glu Lys Lys  Glu Leu Lys Asn Ile  Ala Tyr Lys
    1385                1390                1395

Pro Gln  Leu Gly Leu Asn Ala  Leu Ser Asn Ile Val  Lys Val Arg
    1400                1405                1410
```

Ile Asn His Ile Gly Glu Ile Val Ser Val Gly Glu Tyr
    1415   1420   1425

<210> 582
<211> 79
<212> PRT
<213> Nitritalea halalkaliphila

<400> 582

Met Pro Leu Arg Leu Pro Glu Arg Val Tyr Lys Met Ile Ser Ser Thr
1   5   10   15

Gly Ala Glu Cys His Phe Leu Pro Val Asn Val Ser Ser Leu Ile Lys
            20   25   30

Gly Tyr Asp Ala Lys Ser Lys Leu Gly Glu Phe Gly Ser Gln Asn Lys
        35   40   45

Gln Glu Val Thr Ser Asp Ser Phe Ile Arg Val Lys Glu Arg Cys Tyr
    50   55   60

Lys Leu Glu Ile Asn Arg Leu Gly Ile Pro Leu Asn Arg Leu Lys
65   70   75

<210> 583
<211> 1498
<212> PRT
<213> Odoribacter laneus

<400> 583

Met Glu Thr Thr Leu Gly Ile Asp Leu Gly Thr Asn Ser Ile Gly Leu
1   5   10   15

Ala Leu Val Asp Gln Glu Glu His Gln Ile Leu Tyr Ser Gly Val Arg
            20   25   30

Ile Phe Pro Glu Gly Ile Asn Lys Asp Thr Ile Gly Leu Gly Glu Lys
        35   40   45

```
Glu Glu Ser Arg Asn Ala Thr Arg Arg Ala Lys Arg Gln Met Arg Arg
    50                  55                  60

Gln Tyr Phe Arg Lys Lys Leu Arg Lys Ala Lys Leu Leu Glu Leu Leu
65                  70                  75                  80

Ile Ala Tyr Asp Met Cys Pro Leu Lys Pro Glu Asp Val Arg Arg Trp
                85                  90                  95

Lys Asn Trp Asp Lys Gln Gln Lys Ser Thr Val Arg Gln Phe Pro Asp
            100                 105                 110

Thr Pro Ala Phe Arg Glu Trp Leu Lys Gln Asn Pro Tyr Glu Leu Arg
        115                 120                 125

Lys Gln Ala Val Thr Glu Asp Val Thr Arg Pro Glu Leu Gly Arg Ile
    130                 135                 140

Leu Tyr Gln Met Ile Gln Arg Arg Gly Phe Leu Ser Ser Arg Lys Gly
145                 150                 155                 160

Lys Glu Glu Gly Lys Ile Phe Thr Gly Lys Asp Arg Met Val Gly Ile
                165                 170                 175

Asp Glu Thr Arg Lys Asn Leu Gln Lys Gln Thr Leu Gly Ala Tyr Leu
            180                 185                 190

Tyr Asp Ile Ala Pro Lys Asn Gly Glu Lys Tyr Arg Phe Arg Thr Glu
        195                 200                 205

Arg Val Arg Ala Arg Tyr Thr Leu Arg Asp Met Tyr Ile Arg Glu Phe
    210                 215                 220

Glu Ile Ile Trp Gln Arg Gln Ala Gly His Leu Gly Leu Ala His Glu
225                 230                 235                 240

Gln Ala Thr Arg Lys Lys Asn Ile Phe Leu Glu Gly Ser Ala Thr Asn
                245                 250                 255
```

```
Val Arg Asn Ser Lys Leu Ile Thr His Leu Gln Ala Lys Tyr Gly Arg
            260                 265                 270

Gly His Val Leu Ile Glu Asp Thr Arg Ile Thr Val Thr Phe Gln Leu
        275                 280                 285

Pro Leu Lys Glu Val Leu Gly Gly Lys Ile Glu Ile Glu Glu Glu Gln
    290                 295                 300

Leu Lys Phe Lys Ser Asn Glu Ser Val Leu Phe Trp Gln Arg Pro Leu
305                 310                 315                 320

Arg Ser Gln Lys Ser Leu Leu Ser Lys Cys Val Phe Glu Gly Arg Asn
                325                 330                 335

Phe Tyr Asp Pro Val His Gln Lys Trp Ile Ile Ala Gly Pro Thr Pro
            340                 345                 350

Ala Pro Leu Ser His Pro Glu Phe Glu Glu Phe Arg Ala Tyr Gln Phe
        355                 360                 365

Ile Asn Asn Ile Ile Tyr Gly Lys Asn Glu His Leu Thr Ala Ile Gln
    370                 375                 380

Arg Glu Ala Val Phe Glu Leu Met Cys Thr Glu Ser Lys Asp Phe Asn
385                 390                 395                 400

Phe Glu Lys Ile Pro Lys His Leu Lys Leu Phe Glu Lys Phe Asn Phe
                405                 410                 415

Asp Asp Thr Thr Lys Val Pro Ala Cys Thr Thr Ile Ser Gln Leu Arg
            420                 425                 430

Lys Leu Phe Pro His Pro Val Trp Glu Glu Lys Arg Glu Glu Ile Trp
        435                 440                 445
```

```
His Cys Phe Tyr Phe Tyr Asp Asp Asn Thr Leu Leu Phe Glu Lys Leu
    450                 455                 460

Gln Lys Asp Tyr Ala Leu Gln Thr Asn Asp Leu Glu Lys Ile Lys Lys
465                 470                 475                 480

Ile Arg Leu Ser Glu Ser Tyr Gly Asn Val Ser Leu Lys Ala Ile Arg
                485                 490                 495

Arg Ile Asn Pro Tyr Leu Lys Lys Gly Tyr Ala Tyr Ser Thr Ala Val
            500                 505                 510

Leu Leu Gly Gly Ile Arg Asn Ser Phe Gly Lys Arg Phe Glu Tyr Phe
        515                 520                 525

Lys Glu Tyr Glu Pro Glu Ile Glu Lys Ala Val Cys Arg Ile Leu Lys
    530                 535                 540

Glu Lys Asn Ala Glu Gly Glu Val Ile Arg Lys Ile Lys Asp Tyr Leu
545                 550                 555                 560

Val His Asn Arg Phe Gly Phe Ala Lys Asn Asp Arg Ala Phe Gln Lys
                565                 570                 575

Leu Tyr His His Ser Gln Ala Ile Thr Thr Gln Ala Gln Lys Glu Arg
            580                 585                 590

Leu Pro Glu Thr Gly Asn Leu Arg Asn Pro Ile Val Gln Gln Gly Leu
        595                 600                 605

Asn Glu Leu Arg Arg Thr Val Asn Lys Leu Leu Ala Thr Cys Arg Glu
    610                 615                 620

Lys Tyr Gly Pro Ser Phe Lys Phe Asp His Ile His Val Glu Met Gly
625                 630                 635                 640

Arg Glu Leu Arg Ser Ser Lys Thr Glu Arg Glu Lys Gln Ser Arg Gln
                645                 650                 655
```

```
Ile Arg Glu Asn Glu Lys Lys Asn Glu Ala Ala Lys Val Lys Leu Ala
            660                 665                 670

Glu Tyr Gly Leu Lys Ala Tyr Arg Asp Asn Ile Gln Lys Tyr Leu Leu
        675                 680                 685

Tyr Lys Glu Ile Glu Glu Lys Gly Gly Thr Val Cys Cys Pro Tyr Thr
    690                 695                 700

Gly Lys Thr Leu Asn Ile Ser His Thr Leu Gly Ser Asp Asn Ser Val
705                 710                 715                 720

Gln Ile Glu His Ile Ile Pro Tyr Ser Ile Ser Leu Asp Asp Ser Leu
                725                 730                 735

Ala Asn Lys Thr Leu Cys Asp Ala Thr Phe Asn Arg Glu Lys Gly Glu
            740                 745                 750

Leu Thr Pro Tyr Asp Phe Tyr Gln Lys Asp Pro Ser Pro Glu Lys Trp
        755                 760                 765

Gly Ala Ser Ser Trp Glu Glu Ile Glu Asp Arg Ala Phe Arg Leu Leu
    770                 775                 780

Pro Tyr Ala Lys Ala Gln Arg Phe Ile Arg Arg Lys Pro Gln Glu Ser
785                 790                 795                 800

Asn Glu Phe Ile Ser Arg Gln Leu Asn Asp Thr Arg Tyr Ile Ser Lys
                805                 810                 815

Lys Ala Val Glu Tyr Leu Ser Ala Ile Cys Ser Asp Val Lys Ala Phe
            820                 825                 830

Pro Gly Gln Leu Thr Ala Glu Leu Arg His Leu Trp Gly Leu Asn Asn
        835                 840                 845
```

```
Ile Leu Gln Ser Ala Pro Asp Ile Thr Phe Pro Leu Pro Val Ser Ala
    850                 855                 860

Thr Glu Asn His Arg Glu Tyr Tyr Val Ile Thr Asn Glu Gln Asn Glu
865                 870                 875                 880

Val Ile Arg Leu Phe Pro Lys Gln Gly Glu Thr Pro Arg Thr Glu Lys
                885                 890                 895

Gly Glu Leu Leu Leu Thr Gly Glu Val Glu Arg Lys Val Phe Arg Cys
            900                 905                 910

Lys Gly Met Gln Glu Phe Gln Thr Asp Val Ser Asp Gly Lys Tyr Trp
        915                 920                 925

Arg Arg Ile Lys Leu Ser Ser Ser Val Thr Trp Ser Pro Leu Phe Ala
    930                 935                 940

Pro Lys Pro Ile Ser Ala Asp Gly Gln Ile Val Leu Lys Gly Arg Ile
945                 950                 955                 960

Glu Lys Gly Val Phe Val Cys Asn Gln Leu Lys Gln Lys Leu Lys Thr
                965                 970                 975

Gly Leu Pro Asp Gly Ser Tyr Trp Ile Ser Leu Pro Val Ile Ser Gln
            980                 985                 990

Thr Phe Lys Glu Gly Glu Ser Val  Asn Asn Ser Lys Leu  Thr Ser Gln
        995                 1000                1005

Gln Val  Gln Leu Phe Gly Arg  Val Arg Glu Gly Ile  Phe Arg Cys
    1010                1015                1020

His Asn  Tyr Gln Cys Pro Ala  Ser Gly Ala Asp Gly  Asn Phe Trp
    1025                1030                1035

Cys Thr  Leu Asp Thr Asp Thr  Ala Gln Pro Ala Phe  Thr Pro Ile
    1040                1045                1050
```

```
Lys Asn  Ala Pro Pro Gly Val  Gly Gly Gly Gln Ile  Ile Leu Thr
    1055                1060                1065

Gly Asp  Val Asp Asp Lys Gly  Ile Phe His Ala Asp  Asp Asp Leu
    1070                1075                1080

His Tyr  Glu Leu Pro Ala Ser  Leu Pro Lys Gly Lys  Tyr Tyr Gly
    1085                1090                1095

Ile Phe  Thr Val Glu Ser Cys  Asp Pro Thr Leu Ile  Pro Ile Glu
    1100                1105                1110

Leu Ser  Ala Pro Lys Thr Ser  Lys Gly Glu Asn Leu  Ile Glu Gly
    1115                1120                1125

Asn Ile  Trp Val Asp Glu His  Thr Gly Glu Val Arg  Phe Asp Pro
    1130                1135                1140

Lys Lys  Asn Arg Glu Asp Gln  Arg His His Ala Ile  Asp Ala Ile
    1145                1150                1155

Val Ile  Ala Leu Ser Ser Gln  Ser Leu Phe Gln Arg  Leu Ser Thr
    1160                1165                1170

Tyr Asn  Ala Arg Arg Glu Asn  Lys Lys Arg Gly Leu  Asp Ser Thr
    1175                1180                1185

Glu His  Phe Pro Ser Pro Trp  Pro Gly Phe Ala Gln  Asp Val Arg
    1190                1195                1200

Gln Ser  Val Val Pro Leu Leu  Val Ser Tyr Lys Gln  Asn Pro Lys
    1205                1210                1215

Thr Leu  Cys Lys Ile Ser Lys  Thr Leu Tyr Lys Asp  Gly Lys Lys
    1220                1225                1230
```

```
Ile His  Ser Cys Gly Asn Ala  Val Arg Gly Gln Leu  His Lys Glu
    1235                1240                1245

Thr Val  Tyr Gly Gln Arg Thr  Ala Pro Gly Ala Thr  Glu Lys Ser
    1250                1255                1260

Tyr His  Ile Arg Lys Asp Ile  Arg Glu Leu Lys Thr  Ser Lys His
    1265                1270                1275

Ile Gly  Lys Val Val Asp Ile  Thr Ile Arg Gln Met  Leu Leu Lys
    1280                1285                1290

His Leu  Gln Glu Asn Tyr His  Ile Asp Ile Thr Gln  Glu Phe Asn
    1295                1300                1305

Ile Pro  Ser Asn Ala Phe Phe  Lys Glu Gly Val Tyr  Arg Ile Phe
    1310                1315                1320

Leu Pro  Asn Lys His Gly Glu  Pro Val Pro Ile Lys  Lys Ile Arg
    1325                1330                1335

Met Lys  Glu Glu Leu Gly Asn  Ala Glu Arg Leu Lys  Asp Asn Ile
    1340                1345                1350

Asn Gln  Tyr Val Asn Pro Arg  Asn Asn His His Val  Met Ile Tyr
    1355                1360                1365

Gln Asp  Ala Asp Gly Asn Leu  Lys Glu Glu Ile Val  Ser Phe Trp
    1370                1375                1380

Ser Val  Ile Glu Arg Gln Asn  Gln Gly Gln Pro Ile  Tyr Gln Leu
    1385                1390                1395

Pro Arg  Glu Gly Arg Asn Ile  Val Ser Ile Leu Gln  Ile Asn Asp
    1400                1405                1410

Thr Phe  Leu Ile Gly Leu Lys  Glu Glu Glu Pro Glu  Val Tyr Arg
    1415                1420                1425
```

Asn Asp Leu Ser Thr Leu Ser Lys His Leu Tyr Arg Val Gln Lys
    1430   1435   1440

Leu Ser Gly Met Tyr Tyr Thr Phe Arg His His Leu Ala Ser Thr
    1445   1450   1455

Leu Asn Asn Glu Arg Glu Glu Phe Arg Ile Gln Ser Leu Glu Ala
    1460   1465   1470

Trp Lys Arg Ala Asn Pro Val Lys Val Gln Ile Asp Glu Ile Gly
    1475   1480   1485

Arg Ile Thr Phe Leu Asn Gly Pro Leu Cys
    1490   1495

<210> 584
<211> 1389
<212> PRT
<213> Oenococcus kitaharae

<400> 584

Met Ala Arg Asp Tyr Ser Val Gly Leu Asp Ile Gly Thr Ser Ser Val
1   5   10   15

Gly Trp Ala Ala Ile Asp Asn Lys Tyr His Leu Ile Arg Ala Lys Ser
            20   25   30

Lys Asn Leu Ile Gly Val Arg Leu Phe Asp Ser Ala Val Thr Ala Glu
        35   40   45

Lys Arg Arg Gly Tyr Arg Thr Thr Arg Arg Arg Leu Ser Arg Arg His
    50   55   60

Trp Arg Leu Arg Leu Leu Asn Asp Ile Phe Ala Gly Pro Leu Thr Asp
65   70   75   80

Phe Gly Asp Glu Asn Phe Leu Ala Arg Leu Lys Tyr Ser Trp Val His

```
                85                  90                  95

Pro Gln Asp Gln Ser Asn Gln Ala His Phe Ala Ala Gly Leu Leu Phe
            100                 105                 110

Asp Ser Lys Glu Gln Asp Lys Asp Phe Tyr Arg Lys Tyr Pro Thr Ile
        115                 120                 125

Tyr His Leu Arg Leu Ala Leu Met Asn Asp Asp Gln Lys His Asp Leu
    130                 135                 140

Arg Glu Val Tyr Leu Ala Ile His His Leu Val Lys Tyr Arg Gly His
145                 150                 155                 160

Phe Leu Ile Glu Gly Asp Val Lys Ala Asp Ser Ala Phe Asp Val His
                165                 170                 175

Thr Phe Ala Asp Ala Ile Gln Arg Tyr Ala Glu Ser Asn Asn Ser Asp
            180                 185                 190

Glu Asn Leu Leu Gly Lys Ile Asp Glu Lys Lys Leu Ser Ala Ala Leu
        195                 200                 205

Thr Asp Lys His Gly Ser Lys Ser Gln Arg Ala Glu Thr Ala Glu Thr
    210                 215                 220

Ala Phe Asp Ile Leu Asp Leu Gln Ser Lys Lys Gln Ile Gln Ala Ile
225                 230                 235                 240

Leu Lys Ser Val Val Gly Asn Gln Ala Asn Leu Met Ala Ile Phe Gly
                245                 250                 255

Leu Asp Ser Ser Ala Ile Ser Lys Asp Glu Gln Lys Asn Tyr Lys Phe
            260                 265                 270

Ser Phe Asp Asp Ala Asp Ile Asp Glu Lys Ile Ala Asp Ser Glu Ala
        275                 280                 285
```

```
Leu Leu Ser Asp Thr Glu Phe Glu Phe Leu Cys Asp Leu Lys Ala Ala
    290                 295                 300

Phe Asp Gly Leu Thr Leu Lys Met Leu Leu Gly Asp Asp Lys Thr Val
305                 310                 315                 320

Ser Ala Ala Met Val Arg Arg Phe Asn Glu His Gln Lys Asp Trp Glu
                325                 330                 335

Tyr Ile Lys Ser His Ile Arg Asn Ala Lys Asn Ala Gly Asn Gly Leu
            340                 345                 350

Tyr Glu Lys Ser Lys Lys Phe Asp Gly Ile Asn Ala Ala Tyr Leu Ala
        355                 360                 365

Leu Gln Ser Asp Asn Glu Asp Asp Arg Lys Lys Ala Lys Lys Ile Phe
    370                 375                 380

Gln Asp Glu Ile Ser Ser Ala Asp Ile Pro Asp Asp Val Lys Ala Asp
385                 390                 395                 400

Phe Leu Lys Lys Ile Asp Asp Asp Gln Phe Leu Pro Ile Gln Arg Thr
                405                 410                 415

Lys Asn Asn Gly Thr Ile Pro His Gln Leu His Arg Asn Glu Leu Glu
            420                 425                 430

Gln Ile Ile Glu Lys Gln Gly Ile Tyr Tyr Pro Phe Leu Lys Asp Thr
        435                 440                 445

Tyr Gln Glu Asn Ser His Glu Leu Asn Lys Ile Thr Ala Leu Ile Asn
    450                 455                 460

Phe Arg Val Pro Tyr Tyr Val Gly Pro Leu Val Glu Glu Glu Gln Lys
465                 470                 475                 480

Ile Ala Asp Asp Gly Lys Asn Ile Pro Asp Pro Thr Asn His Trp Met
```

```
                485                 490                 495

Val Arg Lys Ser Asn Asp Thr Ile Thr Pro Trp Asn Leu Ser Gln Val
            500                 505                 510

Val Asp Leu Asp Lys Ser Gly Arg Arg Phe Ile Glu Arg Leu Thr Gly
        515                 520                 525

Thr Asp Thr Tyr Leu Ile Gly Glu Pro Thr Leu Pro Lys Asn Ser Leu
    530                 535                 540

Leu Tyr Gln Lys Phe Asp Val Leu Gln Glu Leu Asn Asn Ile Arg Val
545                 550                 555                 560

Ser Gly Arg Arg Leu Asp Ile Arg Ala Lys Gln Asp Ala Phe Glu His
                565                 570                 575

Leu Phe Lys Val Gln Lys Thr Val Ser Ala Thr Asn Leu Lys Asp Phe
            580                 585                 590

Leu Val Gln Ala Gly Tyr Ile Ser Glu Asp Thr Gln Ile Glu Gly Leu
        595                 600                 605

Ala Asp Val Asn Gly Lys Asn Phe Asn Asn Ala Leu Thr Thr Tyr Asn
    610                 615                 620

Tyr Leu Val Ser Val Leu Gly Arg Glu Phe Val Glu Asn Pro Ser Asn
625                 630                 635                 640

Glu Glu Leu Leu Glu Glu Ile Thr Glu Leu Gln Thr Val Phe Glu Asp
                645                 650                 655

Lys Lys Val Leu Arg Arg Gln Leu Asp Gln Leu Asp Gly Leu Ser Asp
            660                 665                 670

His Asn Arg Glu Lys Leu Ser Arg Lys His Tyr Thr Gly Trp Gly Arg
        675                 680                 685
```

```
Ile Ser Lys Lys Leu Leu Thr Thr Lys Ile Val Gln Asn Ala Asp Lys
    690                 695                 700

Ile Asp Asn Gln Thr Phe Asp Val Pro Arg Met Asn Gln Ser Ile Ile
705                 710                 715                 720

Asp Thr Leu Tyr Asn Thr Lys Met Asn Leu Met Glu Ile Ile Asn Asn
                725                 730                 735

Ala Glu Asp Asp Phe Gly Val Arg Ala Trp Ile Asp Lys Gln Asn Thr
            740                 745                 750

Thr Asp Gly Asp Glu Gln Asp Val Tyr Ser Leu Ile Asp Glu Leu Ala
        755                 760                 765

Gly Pro Lys Glu Ile Lys Arg Gly Ile Val Gln Ser Phe Arg Ile Leu
    770                 775                 780

Asp Asp Ile Thr Lys Ala Val Gly Tyr Ala Pro Lys Arg Val Tyr Leu
785                 790                 795                 800

Glu Phe Ala Arg Lys Thr Gln Glu Ser His Leu Thr Asn Ser Arg Lys
                805                 810                 815

Asn Gln Leu Ser Thr Leu Leu Lys Asn Ala Gly Leu Ser Glu Leu Val
            820                 825                 830

Thr Gln Val Ser Gln Tyr Asp Ala Ala Ala Leu Gln Asn Asp Arg Leu
        835                 840                 845

Tyr Leu Tyr Phe Leu Gln Gln Gly Lys Asp Met Tyr Ser Gly Glu Lys
    850                 855                 860

Leu Asn Leu Asp Asn Leu Ser Asn Tyr Asp Ile Asp His Ile Ile Pro
865                 870                 875                 880

Gln Ala Tyr Thr Lys Asp Asn Ser Leu Asp Asn Arg Val Leu Val Ser
```

```
               885                 890                 895

Asn Ile Thr Asn Arg Arg Lys Ser Asp Ser Ser Asn Tyr Leu Pro Ala
            900                 905                 910

Leu Ile Asp Lys Met Arg Pro Phe Trp Ser Val Leu Ser Lys Gln Gly
        915                 920                 925

Leu Leu Ser Lys His Lys Phe Ala Asn Leu Thr Arg Thr Arg Asp Phe
    930                 935                 940

Asp Asp Met Glu Lys Glu Arg Phe Ile Ala Arg Ser Leu Val Glu Thr
945                 950                 955                 960

Arg Gln Ile Ile Lys Asn Val Ala Ser Leu Ile Asp Ser His Phe Gly
                965                 970                 975

Gly Glu Thr Lys Ala Val Ala Ile Arg Ser Ser Leu Thr Ala Asp Met
            980                 985                 990

Arg Arg Tyr Val Asp Ile Pro Lys  Asn Arg Asp Ile Asn  Asp Tyr His
        995                 1000                1005

His Ala  Phe Asp Ala Leu Leu  Phe Ser Thr Val Gly  Gln Tyr Thr
    1010                1015                1020

Glu Asn  Ser Gly Leu Met Lys  Lys Gly Gln Leu Ser  Asp Ser Ala
    1025                1030                1035

Gly Asn  Gln Tyr Asn Arg Tyr  Ile Lys Glu Trp Ile  His Ala Ala
    1040                1045                1050

Arg Leu  Asn Ala Gln Ser Gln  Arg Val Asn Pro Phe  Gly Phe Val
    1055                1060                1065

Val Gly  Ser Met Arg Asn Ala  Ala Pro Gly Lys Leu  Asn Pro Glu
    1070                1075                1080
```

```
Thr Gly  Glu Ile Thr Pro Glu  Glu Asn Ala Asp Trp  Ser Ile Ala
    1085                1090                1095

Asp Leu  Asp Tyr Leu His Lys  Val Met Asn Phe Arg  Lys Ile Thr
    1100                1105                1110

Val Thr  Arg Arg Leu Lys Asp  Gln Lys Gly Gln Leu  Tyr Asp Glu
    1115                1120                1125

Ser Arg  Tyr Pro Ser Val Leu  His Asp Ala Lys Ser  Lys Ala Ser
    1130                1135                1140

Ile Asn  Phe Asp Lys His Lys  Pro Val Asp Leu Tyr  Gly Gly Phe
    1145                1150                1155

Ser Ser  Ala Lys Pro Ala Tyr  Ala Ala Leu Ile Lys  Phe Lys Asn
    1160                1165                1170

Lys Phe  Arg Leu Val Asn Val  Leu Arg Gln Trp Thr  Tyr Ser Asp
    1175                1180                1185

Lys Asn  Ser Glu Asp Tyr Ile  Leu Glu Gln Ile Arg  Gly Lys Tyr
    1190                1195                1200

Pro Lys  Ala Glu Met Val Leu  Ser His Ile Pro Tyr  Gly Gln Leu
    1205                1210                1215

Val Lys  Lys Asp Gly Ala Leu  Val Thr Ile Ser Ser  Ala Thr Glu
    1220                1225                1230

Leu His  Asn Phe Glu Gln Leu  Trp Leu Pro Leu Ala  Asp Tyr Lys
    1235                1240                1245

Leu Ile  Asn Thr Leu Leu Lys  Thr Lys Glu Asp Asn  Leu Val Asp
    1250                1255                1260

Ile Leu  His Asn Arg Leu Asp  Leu Pro Glu Met Thr  Ile Glu Ser
```

```
    1265                1270                1275

Ala Phe  Tyr Lys Ala Phe Asp  Ser Ile Leu Ser Phe  Ala Phe Asn
    1280                1285                1290

Arg Tyr  Ala Leu His Gln Asn  Ala Leu Val Lys Leu  Gln Ala His
    1295                1300                1305

Arg Asp  Asp Phe Asn Ala Leu  Asn Tyr Glu Asp Lys  Gln Gln Thr
    1310                1315                1320

Leu Glu  Arg Ile Leu Asp Ala  Leu His Ala Ser Pro  Ala Ser Ser
    1325                1330                1335

Asp Leu  Lys Lys Ile Asn Leu  Ser Ser Gly Phe Gly  Arg Leu Phe
    1340                1345                1350

Ser Pro  Ser His Phe Thr Leu  Ala Asp Thr Asp Glu  Phe Ile Phe
    1355                1360                1365

Gln Ser  Val Thr Gly Leu Phe  Ser Thr Gln Lys Thr  Val Ala Gln
    1370                1375                1380

Leu Tyr  Gln Glu Thr Lys
    1385


<210>  585
<211>  1535
<212>  PRT
<213>  Ornithobacterium rhinotracheale

<400>  585

Met Asn Thr Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                  10                  15

Ala Leu Ile Lys Val Leu Asn Asp Lys Thr Arg Leu Pro Leu Glu Ile
            20                  25                  30
```

```
Ile Asp Leu Gly Val Val Val Ile Pro Thr Asp Gln Arg Thr Leu Asp
        35                  40                  45

Lys Phe Ser Lys Gly Glu Ser Ile Ser Lys Thr Ala Glu Arg Thr Lys
    50                  55                  60

Gln Lys Gly Val Arg Lys Leu Tyr Glu Arg Lys Lys Leu Arg Arg Glu
65                  70                  75                  80

Arg Leu His Arg Val Leu Asn Ile Leu Gly Phe Leu Pro Glu His Tyr
                85                  90                  95

Ser Lys Lys Ile Asp Phe Lys Lys His Leu Gly Gln Phe Phe Gly Asn
            100                 105                 110

Ser Gln Pro Lys Ile Ser Tyr Val Glu Asn Asp His Gly Lys His Glu
        115                 120                 125

Phe Ile Phe Met Asp Ser Tyr Arg Glu Met Leu Lys Glu Phe Ser Lys
    130                 135                 140

His Asn Ile Lys Asn Val Pro Tyr Asp Trp Thr Ile Tyr Tyr Leu Arg
145                 150                 155                 160

Lys Lys Ala Leu Ser Gln Lys Ile Ser Lys Glu Glu Leu Ala Trp Val
                165                 170                 175

Ile Leu Asn Phe Asn Lys Lys Arg Gly Tyr Tyr Gln Phe Arg Asp Asp
            180                 185                 190

Asn Ala Asp Glu Asn Lys Glu Asn Lys Ile Glu Lys Tyr Tyr Ala Leu
        195                 200                 205

Lys Val Thr Asn Val Lys Lys Glu Asp Ala Gln Asn Tyr Thr Ile Thr
    210                 215                 220

Leu Glu Asn Gly Trp Ile Tyr Lys Asn Lys Ser Lys Ile Ser Leu Leu
225                 230                 235                 240
```

```
Asp Trp Val Gly Ser Thr Lys Glu Phe Ile Ser Thr Glu Lys Phe Asp
                245                 250                 255

Asn Lys Gly Asn Ile Ile Lys Lys Lys Asn Gly Glu Asp Asp Arg Thr
            260                 265                 270

Leu Lys Leu Val Asp Ser Glu Lys Asp Trp Ile Ala Ile Lys Lys Ser
        275                 280                 285

Thr Glu Asp Arg Ile Glu Asn Tyr Gly Lys Thr Val Gly Thr Tyr Leu
    290                 295                 300

Tyr Glu His Leu Leu Lys Asp Pro Asn Gln Lys Leu Asn Gly Glu Leu
305                 310                 315                 320

Ile Asn Ile Ile Asp Arg Lys Phe Tyr Lys Asn Glu Leu Lys Gln Ile
                325                 330                 335

Leu Glu Lys Gln Lys Glu Phe His Pro Glu Leu Leu Asn Glu Asp Leu
            340                 345                 350

Phe Gln Lys Ser Ile Ile Glu Leu Tyr Pro Lys Asn Ser Thr Arg Gln
        355                 360                 365

Lys Glu Leu Lys Asn Lys Asp Leu Cys Tyr Leu Leu Ile Asp Asp Val
    370                 375                 380

Ile Tyr Tyr Gln Arg Asp Leu Lys Lys Lys Asn Ser Thr Ile Asn Lys
385                 390                 395                 400

Cys Ser Phe Glu Ser Arg Glu Tyr Tyr Leu Asn Gly Glu Lys Gln Ile
                405                 410                 415

Gln Lys Ile Asn Cys Ile Ala Lys Ser Lys Pro Leu Tyr Gln Glu Phe
            420                 425                 430
```

```
Arg Thr Leu Gln Phe Ile Lys Asn Leu Lys Val Tyr Glu Ile Ile Asp
        435                 440                 445

Gly Leu Glu Lys Asp Ile Thr Ser Lys Leu Leu Pro Asp Phe Glu Thr
    450                 455                 460

Lys Glu His Phe Phe Glu Trp Leu Asn Asp Lys Glu Lys Ile Asp Gln
465                 470                 475                 480

Leu Gln Leu Leu Ser Tyr Lys Cys Phe Asp Leu His Asp Asn Val Lys
                485                 490                 495

Asn Asp Leu Ile Ala Lys Gly Ile Lys Arg Pro Thr Glu Lys Ala Ile
            500                 505                 510

Arg Thr Glu Leu Leu Glu Lys Tyr Arg Trp Asn Tyr Ser Lys Asp Asn
        515                 520                 525

Asp Arg Asn Phe Leu Leu Asn Glu Thr Arg Phe Lys Ile Leu Lys Tyr
    530                 535                 540

Leu Lys Lys Val Asp Lys Lys Leu Thr Leu Thr Asn Glu Gln Ile Glu
545                 550                 555                 560

Ser Leu Trp Leu Leu Leu Tyr Ser Ala Lys Asp Glu Arg Glu Leu Lys
                565                 570                 575

Asn Gly Leu Gln Lys Phe Ser Glu Lys Asn Lys Leu Pro Lys Lys Phe
            580                 585                 590

Ser Asp Ile Phe Ile Ser Phe Pro Pro Phe Lys Lys Glu Tyr Gly Ala
        595                 600                 605

Tyr Ser Glu Lys Ala Leu Lys Lys Leu Leu Ser Leu Val Arg Phe Gly
    610                 615                 620

Lys Tyr Trp Ser Phe Asn Lys Ile Asp Asn Asn Ile Gln Asn Lys Ile
625                 630                 635                 640
```

```
Met Asn Ile Leu Asn Gly Glu Val Asp Asp Ser Ile Ser Asp Arg Val
                645                 650                 655

Arg Glu Lys Thr Ile Leu Leu Gln Asp Lys Asn Asp Phe Gln Asp Leu
            660                 665                 670

Pro Leu Trp Leu Ala Ser Tyr Val Ala Tyr Asn Arg Phe Ser Glu Val
        675                 680                 685

Ser Glu Ile Lys Tyr Trp Asp Ser Pro Asp Lys Ile Glu Phe Leu Lys
    690                 695                 700

Gln His Ser Ile Gly Asn Pro Ile Val Glu Lys Ile Ile Asn Glu Thr
705                 710                 715                 720

Leu Lys Leu Ile Lys Asp Ile Trp Val Ile His Gly Lys Ser Cys Lys
                725                 730                 735

Asn Phe Phe Ser Glu Ile His Ile Glu Leu Ser Arg Glu Ile Lys Ser
            740                 745                 750

Ser Ser Lys Lys Arg Ala Gln Ile Thr Asn Asn Asn Thr Lys Asn Gln
        755                 760                 765

Lys Leu Asn Asn Leu Ile Lys Ser Leu Leu Ile Glu Met Ala Ser Asp
    770                 775                 780

Thr Lys Tyr Glu Asn Val Thr Pro Tyr Ser Pro Ser Gln Gln Glu Ile
785                 790                 795                 800

Leu Lys Ile Tyr Asp Glu Gly Ile Tyr Ser Lys Glu Glu Asn Ser Glu
                805                 810                 815

Lys Ile Lys Glu Ile Asn Lys Ile Arg Asn Asn Asn Lys Ile Ser Lys
            820                 825                 830
```

```
Ser Asp Ile Thr Lys Tyr Lys Leu Trp Leu Glu Gln Gly Tyr Ile Ser
        835                 840                 845

Pro Tyr Thr Gly Lys Ile Ile Pro Leu Thr Lys Leu Phe Thr Ala Lys
    850                 855                 860

Tyr Gln Lys Glu His Ile Ile Pro Gln Thr Lys Phe Phe Asp Asp Ser
865                 870                 875                 880

Phe Asn Asn Lys Val Ile Cys Glu Ala Glu Val Asn Lys Leu Lys Asp
                885                 890                 895

Asn Ser Leu Ala Met Asn Phe Ile Lys Ala Lys Gly Gly Lys Ala Val
            900                 905                 910

Lys Leu Ser Asp Gly Glu Thr Val Thr Ile Leu Asn Gln Glu Glu Tyr
        915                 920                 925

Lys Gln Leu Val Arg Thr Ser Phe Lys Lys Asn Ser Ile Lys Leu Arg
    930                 935                 940

Asn Leu Leu Leu Glu Glu Ile Pro Asp Thr Phe Thr Lys Arg Gln Leu
945                 950                 955                 960

Asn Asp Thr Lys Tyr Ile Ser Lys Leu Val Leu Ser Leu Leu Ser Asn
                965                 970                 975

Ile Val Arg Glu Lys Gly Glu Leu Glu Ser Thr Ala Lys Arg Ile Val
            980                 985                 990

Ser Thr Asn Gly Gln Ile Thr Ser  Ile Leu Arg Asn Asp  Trp Gly Leu
        995                 1000                1005

Asn Asn  Ile Trp Asn Lys Leu  Ile Thr Pro Arg Phe  Glu Arg Leu
    1010                1015                1020

Asn Asn  Ile Asn Lys Asn Lys  Ile Tyr Gly Asn Trp  Glu Asn Lys
    1025                1030                1035
```

```
Lys Gly  Lys Asn Val Phe Gln  Ile Asn Tyr Leu Asn  Asp Asn Leu
    1040                1045                1050

Ser Thr  Leu Asn Thr Lys Arg  Ile Asp His Arg His  His Ala Leu
    1055                1060                1065

Asp Ala  Leu Ile Val Ala Cys  Thr Thr Arg Asn His  Ile Asn Phe
    1070                1075                1080

Leu Asn  Asn Gln Tyr Ala Lys  Ser Arg Asn Gln Arg  His Asp Leu
    1085                1090                1095

Arg Ala  Lys Leu Lys Arg Arg  Glu Thr Ile Thr Thr  Glu Gly Ser
    1100                1105                1110

Lys Lys  Gln Val Phe Lys Asp  Phe Ile Lys Pro Trp  Glu Ser Phe
    1115                1120                1125

Thr Gln  Asp Ala Leu Lys Lys  Leu Glu Thr Thr Ile  Val Asn Phe
    1130                1135                1140

Lys Val  Asn Lys Arg Ile Ile  Asn Lys Thr Ile Asn  Trp Tyr Lys
    1145                1150                1155

Lys Trp  Glu Lys Gln Lys Asp  Gly Thr Tyr Lys Lys  Ile Gln Lys
    1160                1165                1170

Lys Gln  Thr Lys Gly Asp Ala  Trp Ala Ile Arg Lys  Pro Leu His
    1175                1180                1185

Ile Asp  Thr Ile Tyr Gly Ile  Val Cys Lys Lys Leu  Pro Leu Lys
    1190                1195                1200

Ser Ala  Leu Glu Asn Tyr Lys  Asn Ile Ile Asp Glu  Asn Leu Lys
    1205                1210                1215
```

```
His Lys  Ile Lys Glu Leu Lys  Glu Val Asn Lys Phe  Asp Asn Asn
    1220                1225                1230

Gln Ile  Ile Asn Phe Phe Lys  Glu Cys Asn Phe Ile  Phe Glu Asp
    1235                1240                1245

Asn Asn  Ile Gln Lys Val Glu  Val Tyr Asp Phe Lys  Asp Asn Arg
    1250                1255                1260

Asp Lys  Thr Ile Leu Ser Ser  Ser Arg Gln Leu Ile  Asp Glu Ser
    1265                1270                1275

Phe Thr  Pro Lys Lys Ile Gly  Lys Val Leu Asp Pro  Thr Ile Arg
    1280                1285                1290

Asn Ile  Leu Leu Lys His Leu  Asn Ser Thr Lys Tyr  Asn Asn Lys
    1295                1300                1305

Phe Asp  Ser Asp Gly Asn Pro  Ile Lys Pro Glu Lys  Leu Ala Phe
    1310                1315                1320

Ser Pro  Glu Gly Leu Lys Asp  Leu Asn Lys Asn Ile  Lys His Leu
    1325                1330                1335

Asn Asn  Asn Lys Glu His Gln  Pro Ile Lys Arg Val  Lys Leu Phe
    1340                1345                1350

Glu Thr  Leu Gly Asn Lys Ile  Lys Val Gly Tyr Thr  Gln Gln Lys
    1355                1360                1365

Asn Lys  Lys Phe Ala Glu Thr  Ala Thr Gly Thr Asn  Leu Phe Leu
    1370                1375                1380

Gly Ile  Tyr Ser Asp Asn Asn  Lys Arg Asp Phe Lys  Thr Ile Pro
    1385                1390                1395

Leu Ile  Leu Ala Ile Gln Arg  Glu Lys Glu Gly Leu  Asn Pro Cys
    1400                1405                1410
```

```
Pro Asp  Thr Asp Glu Lys Gly  Asn Gln Leu Leu Phe  Ser Leu Ser
    1415                1420                1425


Pro Asn  Glu Leu Val Phe Val  Pro Asn Asn Glu Glu  Arg Lys Asn
    1430                1435                1440


Pro Asn  Leu Val Asp Phe Glu  Asn Leu Ser Lys Asp  Gln Ile Asp
    1445                1450                1455


Arg Ile  Tyr Lys Phe Val Ser  Cys Thr Gly Ser Glu  Ala Tyr Phe
    1460                1465                1470


Val Pro  Ser Arg Thr Ala Lys  Pro Ile Ile Glu Asn  Glu Asn Gly
    1475                1480                1485


Thr Asn  Asn Lys Ser Gln Arg  Ile Ile Glu Phe Asn  Glu Lys Thr
    1490                1495                1500


Ser Ile  Lys Asn Glu Lys Asn  Glu Pro Val Leu Ile  Lys Thr Ile
    1505                1510                1515


Cys Trp  Lys Ile Glu Val Asn  Arg Leu Gly Lys Ile  Ile Lys Val
    1520                1525                1530


Ile Lys
    1535
```

<210> 586
<211> 103
<212> PRT
<213> Parabacteroides merdae

<400> 586

```
Met Ile Val Tyr Arg Leu Phe Tyr Arg Phe Leu Phe Lys Ala Thr Lys
1               5                   10                  15


Leu Val Asn Phe Val Ile His Lys Glu Leu Lys Arg Gln Ile Ala Arg
```

```
            20                  25                  30

Thr Gly Lys Ile Lys Phe His Ser Gly Gly Cys Gly Cys Gln Ser Gly
        35                  40                  45

Asn Tyr Lys Met Gln Asn Phe Glu Lys Gly Lys Ser Ile Thr Thr Asn
    50                  55                  60

Ala Asp Arg Thr Leu Lys Arg Ser Met Arg Arg Asn Leu Tyr Arg Cys
65                  70                  75                  80

Lys Leu Arg Arg Asp Val Leu Ile Glu Leu Leu Lys Lys Val Gly Phe
                85                  90                  95

Ile Pro Glu Lys Gln Trp Lys
            100
```

<210> 587
<211> 82
<212> PRT
<213> Parabacteroides merdae

<400> 587

```
Met Ser Ile Trp Lys Leu Gln Tyr Pro Pro Leu Asp Leu Lys Ile Tyr
1               5                   10                  15

Asn Lys Phe Leu Val Tyr Ser Arg Val Asn Pro Leu Thr Val Asp Glu
            20                  25                  30

Met Gln Asn Phe Glu Lys Gly Lys Ser Ile Thr Thr Asn Ala Asp Arg
        35                  40                  45

Thr Leu Lys Arg Ser Met Arg Arg Asn Leu Gln Arg Tyr Lys Leu Arg
    50                  55                  60

Arg Asp Val Leu Ile Glu Leu Leu Lys Lys Val Gly Phe Met Ser Glu
65                  70                  75                  80
```

Lys Gln

<210> 588
<211> 84
<212> PRT
<213> Parabacteroides merdae

<400> 588

Met Ser Ile Trp Lys Leu Gln Tyr Pro Pro Leu Asp Leu Lys Ile Tyr
1   5   10   15

Asn Lys Phe Leu Val Tyr Ser Arg Val Asn Pro Leu Thr Val Asp Glu
            20   25   30

Met Gln Asn Phe Glu Lys Gly Lys Ser Ile Thr Thr Asn Ala Asp Arg
        35   40   45

Thr Leu Lys Arg Ser Met Arg Arg Asn Leu Tyr Arg Cys Lys Leu Arg
    50   55   60

Arg Asp Val Leu Ile Glu Leu Leu Lys Lys Val Gly Phe Ile Pro Glu
65   70   75   80

Lys Gln Trp Lys

<210> 589
<211> 398
<212> PRT
<213> Pasteurella bettyae

<400> 589

Met Leu Ala Asn Glu Asn Gln Asn Lys Gly Asn Leu Thr Pro Tyr Glu
1   5   10   15

Trp Leu Asp Gly Lys Asn Asn Ser Lys Arg Trp Gln Asp Phe Val Ala
            20   25   30

```
Arg Val Gln Thr Cys Cys Phe Ser His Arg Lys Lys Gln His Ile Leu
        35                  40                  45

Ser His Lys Leu Asp Glu Lys Ser Phe Ile Glu Arg Asn Leu Asn Asp
    50                  55                  60

Thr Arg Tyr Val Ala Arg Phe Leu Cys Asn Phe Ile Ala Asp Asn Met
65                  70                  75                  80

Leu Leu Thr Gly Lys Gly Lys Arg Lys Val Phe Ala Ser Asn Gly Gln
                85                  90                  95

Ile Thr Ala Leu Leu Arg Gly Arg Trp Gly Leu Gln Lys Val Arg Asp
            100                 105                 110

Asp Asn Asp Arg His His Ala Leu Asp Ala Val Val Ile Ala Cys Ser
        115                 120                 125

Thr Val Ala Met Gln Gln Lys Ile Thr Arg Phe Val Lys Tyr Glu Glu
    130                 135                 140

Gly Asn Val Phe Ser Gly Glu Arg Ile Asp Arg Glu Thr Gly Glu Ile
145                 150                 155                 160

Ile Pro Leu Tyr Phe Pro Thr Pro Trp Lys Phe Phe Lys Glu Asn Val
                165                 170                 175

Glu Ile Arg Ile Phe Ser Glu Asn Pro Lys Leu Glu Leu Glu Asn Arg
            180                 185                 190

Leu Pro Asp Tyr Pro Gln Tyr Asn His Glu Phe Val Gln Pro Leu Phe
        195                 200                 205

Val Ser Arg Met Pro Thr Arg Lys Met Thr Gly Gln Gly His Met Glu
    210                 215                 220

Thr Ile Lys Ser Ala Lys Arg Leu Asp Glu Gly Ile Ser Val Leu Lys
225                 230                 235                 240
```

```
Val Pro Leu Thr Gln Leu Lys Leu Ala Asp Leu Glu Asn Met Val Asn
                245                 250                 255

Arg Glu Arg Glu Leu Ala Leu Tyr Glu Ala Leu Lys Glu Arg Leu Glu
            260                 265                 270

Leu Phe Gly Asn Asp Pro Ala Lys Ala Phe Ile Glu Pro Phe Tyr Lys
        275                 280                 285

Lys Gly Gly Ala Leu Val Lys Ala Val Arg Val Lys Lys Val Gln Lys
    290                 295                 300

Ser Gly Val Leu Val Arg Asp Gly Asn Gly Val Ala Asp Asn Ala Leu
305                 310                 315                 320

Met Val Arg Val Asp Val Phe Thr Lys Gly Gly Lys Tyr Phe Leu Val
                325                 330                 335

Pro Ile Tyr Thr Trp Gln Val Ala Lys Gly Ile Leu Pro Asn Lys Ala
            340                 345                 350

Val Thr Ala Asn Ile Asp Glu Ile Asp Trp Leu Glu Met Asp Glu Ser
        355                 360                 365

Tyr Gln Phe Ile Phe Thr Met Tyr Pro Asn Asp Leu Val Lys Val Lys
    370                 375                 380

Leu Lys Lys Glu Glu Phe Phe Gly Tyr Tyr Gly Gly Leu Asp
385                 390                 395
```

<210> 590
<211> 610
<212> PRT
<213> Pasteurella bettyae

<400> 590

```
Met Asn Met Leu Lys Pro Leu Asn Tyr Ile Leu Gly Leu Asp Leu Gly
```

```
1               5                   10                  15

Ile Gly Ser Val Gly Trp Ala Val Val Glu Ile Asp Glu Gln Gly Asn
            20                  25                  30

Pro Leu Arg Leu Ile Asp Val Gly Val Arg Thr Phe Glu Arg Ala Glu
        35                  40                  45

Val Ala Lys Thr Gly Glu Ser Leu Ala Leu Ala Arg Arg Leu Ala Arg
    50                  55                  60

Ser Ser Arg Arg Leu Val Lys Arg Arg Ala Ala Arg Ile Lys Lys Ala
65                  70                  75                  80

Lys Arg Leu Leu Lys Ala Glu Asn Ile Leu Leu Ser Val Asp Glu Ile
                85                  90                  95

Leu Pro Asn Asp Val Trp Gln Leu Arg Val Lys Gly Leu Asp His Lys
            100                 105                 110

Leu Glu Arg Gln Glu Trp Ala Ala Val Leu Leu His Leu Leu Lys Arg
        115                 120                 125

Arg Gly Tyr Leu Ser Gln Arg Lys Asn Glu Ser Lys Ser Glu Asn Lys
    130                 135                 140

Glu Leu Gly Ala Leu Leu Ser Gly Val Val Thr Asn His Gln Ile Leu
145                 150                 155                 160

Gln Thr Asp Glu Tyr Arg Thr Pro Ala Glu Ile Ala Val His Lys Phe
                165                 170                 175

Gln Ala Glu Asp Gly His Ile Arg Asn Gln Arg Gly Asp Tyr Thr His
            180                 185                 190

Thr Phe Ser Arg Leu Asp Leu Leu Ala Glu Met Glu Leu Leu Phe Gln
        195                 200                 205
```

```
Arg Gln Thr Glu Leu Gly Asn Leu His Thr Ser Ser Lys Leu Leu Glu
    210                 215                 220

Asn Leu Thr Ala Leu Leu Met Trp Gln Lys Pro Ala Leu Ala Gly Glu
225                 230                 235                 240

Ala Ile Leu Lys Met Leu Gly Lys Cys Thr Phe Glu Pro Thr Glu Tyr
                245                 250                 255

Lys Ala Ala Lys Asn Ser Tyr Ser Ala Glu Arg Phe Val Trp Leu Thr
            260                 265                 270

Lys Leu Asn Asn Leu Arg Ile Leu Glu Gln Gly Ala Glu Arg Ala Leu
        275                 280                 285

Thr Asp Ser Glu Arg Phe Val Leu Leu Asp Gln Pro Tyr Glu Lys Ala
    290                 295                 300

Lys Leu Thr Tyr Ala Gln Val Arg Thr Leu Leu Lys Leu Ser Asp Glu
305                 310                 315                 320

Ala Ile Phe Lys Gly Val Arg Tyr Gln Gly Glu Asp Lys Lys Thr Val
                325                 330                 335

Glu Ser Lys Thr Thr Leu Met Glu Met Lys Ala Tyr His Gln Ile Arg
            340                 345                 350

Lys Ala Leu Asp Gly Ala Asp Leu Lys Asp Glu Trp Asn Thr Leu Lys
        355                 360                 365

Asn Asp Ser Ala Leu Leu Asp Glu Ile Gly Thr Ala Phe Ser Leu Tyr
    370                 375                 380

Lys Thr Asp Asp Asp Ile Ser His Tyr Leu Gly Gly Lys Leu Ser Glu
385                 390                 395                 400

Lys Val Leu Asn Val Leu Leu Glu Asn Leu Asn Phe Asp Lys Phe Ile
```

```
                405                 410                 415

Gln Leu Ser Leu Lys Ala Leu Gln Lys Ile Leu Pro Leu Met Leu Gln
            420                 425                 430

Gly Gln Arg Tyr Asp Glu Ala Val Ser Ala Val Tyr Gly Asp His Tyr
        435                 440                 445

Gly Lys Lys Ser Ala Glu Ser Cys Arg Leu Leu Pro Ala Ile Pro Ala
    450                 455                 460

Asn Glu Ile His Asn Pro Val Val Leu Arg Thr Leu Thr Gln Ala Arg
465                 470                 475                 480

Lys Val Ile Asn Ala Val Val Arg Leu Tyr Gly Ser Pro Ala Arg Ile
                485                 490                 495

His Ile Glu Thr Gly Arg Lys Val Gly Lys Ser Tyr Gln Asp Arg Lys
            500                 505                 510

Lys Leu Glu Lys Gln Gln Glu Glu Asn Arg Glu Gln Arg Glu Ser Ala
        515                 520                 525

Val Lys Lys Phe Lys Glu Tyr Phe Pro Asn Phe Val Gly Glu Pro Lys
    530                 535                 540

Gly Lys Asp Ile Leu Lys Leu Arg Leu Tyr Glu Leu Gln Gln Ser Lys
545                 550                 555                 560

Cys Leu Tyr Ser Gly Lys Ser Phe Asp Pro Asn Arg Leu Leu Glu Lys
                565                 570                 575

Gly Tyr Val Glu Val Asp His Ala Leu Pro Phe Ser Arg Thr Trp Asp
            580                 585                 590

Asp Ser Phe Asn Asn Lys Val Cys Leu Pro Met Lys Thr Arg Ile Lys
        595                 600                 605
```

Ala Ile
    610

<210> 591
<211> 199
<212> PRT
<213> Pasteurella multocida

<400> 591

Met Ala Cys Ala Thr Pro Ser Met Gln Gln Lys Ile Thr Arg Phe Ile
1   5   10   15

Arg Phe Lys Glu Val His Pro Tyr Lys Ile Glu Asn Arg Tyr Glu Met
            20   25   30

Val Asp Gln Glu Ser Gly Glu Ile Ile Ser Pro His Phe Pro Glu Pro
        35   40   45

Trp Ala Tyr Phe Arg Gln Glu Val Asn Ile Arg Val Phe Asp Asn His
    50   55   60

Pro Asp Thr Val Leu Lys Glu Met Leu Pro Asp Arg Pro Gln Ala Asn
65   70   75   80

His Gln Phe Val Gln Pro Leu Phe Val Ser Arg Ala Pro Thr Arg Lys
                85   90   95

Met Ser Gly Gln Gly His Met Glu Thr Ile Lys Ser Ala Lys Arg Leu
            100   105   110

Ala Glu Gly Ile Ser Val Leu Arg Ile Pro Leu Thr Gln Leu Lys Pro
        115   120   125

Asn Leu Leu Glu Asn Met Val Asn Lys Glu Arg Glu Pro Ala Leu Tyr
    130   135   140

Ala Gly Leu Lys Ala Arg Leu Ala Glu Phe Asn Gln Asp Pro Ala Lys
145   150   155   160

```
Ala Phe Thr Thr Pro Phe Tyr Lys Gln Gly Gly Gln Gln Val Lys Ala
                165                 170                 175


Ile Arg Val Glu Gln Val Gln Lys Ser Gly Val Leu Val Arg Glu Asn
            180                 185                 190


Asn Gly Val Ala Asp Asn Ala
        195
```

<210> 592
<211> 63
<212> PRT
<213> Pasteurella multocida

<400> 592

```
Met Gln Thr Thr Asn Leu Ser Tyr Ile Leu Gly Leu Asp Leu Gly Ile
1               5                   10                  15


Ala Ser Val Gly Trp Ala Val Val Glu Ile Asn Glu Asn Glu Asp Pro
            20                  25                  30


Ile Gly Leu Ile Asp Val Gly Val Arg Ile Phe Glu Arg Ala Glu Val
        35                  40                  45


Pro Lys Thr Gly Glu Ser Leu Ala Leu Ser Arg Arg Leu Ala Arg
    50                  55                  60
```

<210> 593
<211> 1058
<212> PRT
<213> Pasteurella multocida

<400> 593

```
Met Gln Thr Thr Asn Leu Ser Tyr Ile Leu Gly Leu Asp Leu Gly Ile
1               5                   10                  15


Ala Ser Val Gly Trp Ala Val Val Glu Ile Asn Glu Asn Glu Asp Pro
            20                  25                  30
```

```
Ile Gly Leu Ile Asp Val Gly Val Arg Ile Phe Glu Arg Ala Glu Val
        35                  40                  45

Pro Lys Thr Gly Glu Ser Leu Ala Leu Ser Arg Arg Leu Ala Arg Ser
    50                  55                  60

Thr Arg Arg Leu Ile Arg Arg Arg Ala His Arg Leu Leu Leu Ala Lys
65                  70                  75                  80

Arg Phe Leu Lys Arg Glu Gly Ile Leu Ser Thr Thr Asp Leu Glu Lys
                85                  90                  95

Gly Leu Pro Asn Gln Ala Trp Glu Leu Arg Val Ala Gly Leu Glu Arg
            100                 105                 110

Arg Leu Ser Ala Ile Glu Trp Gly Ala Val Leu Leu His Leu Ile Lys
        115                 120                 125

His Arg Gly Tyr Leu Ser Lys Arg Lys Asn Glu Ser Gln Thr Asn Asn
    130                 135                 140

Lys Glu Leu Gly Ala Leu Leu Ser Gly Val Ala Gln Asn His Gln Leu
145                 150                 155                 160

Leu Gln Ser Asp Asp Tyr Arg Thr Pro Ala Glu Leu Ala Leu Lys Lys
                165                 170                 175

Phe Ala Lys Glu Glu Gly His Ile Arg Asn Gln Arg Gly Ala Tyr Thr
            180                 185                 190

His Thr Phe Asn Arg Leu Asp Leu Leu Ala Glu Leu Asn Leu Leu Phe
        195                 200                 205

Ala Gln Gln His Gln Phe Gly Asn Pro His Cys Lys Glu His Ile Gln
    210                 215                 220
```

```
Gln Tyr Met Thr Glu Leu Leu Met Trp Gln Lys Pro Ala Leu Ser Gly
225                 230                 235                 240

Glu Ala Ile Leu Lys Met Leu Gly Lys Cys Thr His Glu Lys Asn Glu
                245                 250                 255

Phe Lys Ala Ala Lys His Thr Tyr Ser Ala Glu Arg Phe Val Trp Leu
            260                 265                 270

Thr Lys Leu Asn Asn Leu Arg Ile Leu Glu Asp Gly Ala Glu Arg Ala
        275                 280                 285

Leu Asn Glu Glu Glu Arg Gln Leu Leu Ile Asn His Pro Tyr Glu Lys
    290                 295                 300

Ser Lys Leu Thr Tyr Ala Gln Val Arg Lys Leu Leu Gly Leu Ser Glu
305                 310                 315                 320

Gln Ala Ile Phe Lys His Leu Arg Tyr Ser Lys Glu Ser Ala Glu Ser
                325                 330                 335

Ala Thr Phe Met Glu Leu Lys Ala Trp His Ala Ile Arg Lys Ala Leu
            340                 345                 350

Glu Asn Gln Gly Leu Lys Asp Thr Trp Gln Asp Leu Ala Lys Lys Pro
        355                 360                 365

Asp Leu Leu Asp Glu Ile Gly Thr Ala Phe Ser Leu Tyr Lys Thr Asp
    370                 375                 380

Glu Asp Ile Gln Gln Tyr Leu Glu Gly Lys Leu Pro Asp Ser Val Ile
385                 390                 395                 400

Asn Ala Leu Leu Val Ser Leu Asn Phe Asp Lys Phe Ile Glu Leu Ser
                405                 410                 415

Leu Lys Ser Leu Arg Lys Ile Leu Pro Leu Met Glu Gln Gly Lys Arg
            420                 425                 430
```

```
Tyr Asp Gln Ala Cys His Glu Ile Tyr Gly His His Tyr Gly Glu Lys
        435                 440                 445

Asn Gln Gln Ile Ser Gln Leu Leu Pro Val Ile Pro Thr Gln Glu Ile
    450                 455                 460

Arg Asn Pro Val Val Leu Arg Thr Leu Ser Gln Ala Arg Lys Val Ile
465                 470                 475                 480

Asn Ala Ile Ile Arg Gln Tyr Gly Ser Pro Ala Arg Val His Ile Glu
                485                 490                 495

Thr Gly Arg Glu Leu Gly Lys Ser Phe Lys Glu Arg Arg Glu Ile Gln
            500                 505                 510

Lys Gln Gln Glu Asp Asn Arg Thr Lys Arg Glu Ser Ala Val Gln Lys
        515                 520                 525

Phe Lys Glu Leu Phe Ser Asp Phe Ser Ser Glu Pro Lys Ser Lys Asp
    530                 535                 540

Ile Leu Lys Phe Arg Leu Tyr Glu Gln Gln His Gly Lys Cys Leu Tyr
545                 550                 555                 560

Ser Gly Lys Glu Ile Asn Ile His Arg Leu Asn Glu Lys Gly Tyr Val
                565                 570                 575

Glu Ile Asp His Ala Leu Pro Phe Ser Arg Thr Trp Asp Asp Ser Phe
            580                 585                 590

Asn Asn Lys Val Leu Val Leu Ala Ser Glu Asn Gln Asn Lys Gly Asn
        595                 600                 605

Gln Thr Pro Tyr Glu Trp Leu Gln Gly Lys Ile Asn Ser Glu Arg Trp
    610                 615                 620
```

```
Lys Asn Phe Val Ala Leu Val Leu Gly Ser Gln Cys Ser Ala Ala Lys
625                 630                 635                 640

Lys Gln Arg Leu Leu Thr Gln Val Ile Asp Asp Asn Lys Phe Ile Asp
                645                 650                 655

Arg Asn Leu Asn Asp Thr Arg Tyr Ile Ala Arg Phe Leu Ser Asn Tyr
            660                 665                 670

Ile Gln Glu Asn Leu Leu Leu Val Gly Lys Asn Lys Lys Asn Val Phe
        675                 680                 685

Thr Pro Asn Gly Gln Ile Thr Ala Leu Leu Arg Ser Arg Trp Gly Leu
    690                 695                 700

Ile Lys Val Arg Glu Asn Asn Asp Arg His His Ala Leu Asp Ala Ile
705                 710                 715                 720

Val Val Ala Cys Ala Thr Pro Ser Met Gln Gln Lys Ile Thr Arg Phe
                725                 730                 735

Ile Arg Phe Lys Glu Val His Pro Tyr Lys Ile Glu Asn Arg Tyr Glu
            740                 745                 750

Met Val Asp Gln Glu Ser Gly Glu Ile Ile Ser Pro His Phe Pro Glu
        755                 760                 765

Pro Trp Ala Tyr Phe Arg Gln Glu Val Asn Ile Arg Val Phe Asp Asn
    770                 775                 780

His Pro Asp Thr Val Leu Lys Glu Met Leu Pro Asp Arg Pro Gln Ala
785                 790                 795                 800

Asn His Gln Phe Val Gln Pro Leu Phe Val Ser Arg Ala Pro Thr Arg
                805                 810                 815

Lys Met Ser Gly Gln Gly His Met Glu Thr Ile Lys Ser Ala Lys Arg
            820                 825                 830
```

```
Leu Ala Glu Gly Ile Ser Val Leu Arg Ile Pro Leu Thr Gln Leu Lys
        835                 840                 845

Pro Asn Leu Leu Glu Asn Met Val Asn Lys Glu Arg Glu Pro Ala Leu
    850                 855                 860

Tyr Val Gly Leu Lys Ala Arg Leu Ala Glu Phe Asn Gln Asp Pro Ala
865                 870                 875                 880

Lys Ala Phe Ala Thr Pro Phe Tyr Lys Gln Gly Gly Gln Gln Val Lys
                885                 890                 895

Ala Ile Arg Val Glu Leu Val Gln Lys Ser Gly Val Leu Val Arg Gln
            900                 905                 910

Gly Asn Gly Val Ala Asp Asn Ala Pro Gly Ser Ile Val Arg Thr Asp
        915                 920                 925

Val Phe Ile Lys Asn Asn Lys Phe Phe Leu Val Pro Ile Tyr Thr Trp
    930                 935                 940

Gln Val Ala Lys Gly Ile Leu Pro Asn Lys Ala Ile Val Ala His Lys
945                 950                 955                 960

Asn Glu Asp Glu Trp Glu Glu Met Asp Glu Gly Ala Lys Phe Lys Phe
                965                 970                 975

Ser Ile Phe Pro Asn Asp Leu Ile Glu Leu Arg Thr Lys Thr Glu Cys
            980                 985                 990

Phe Leu Gly Tyr Tyr Ile Gly Pro  Asp Arg His Asn Gly  Ser Ile Ser
        995                 1000                1005

Leu Arg  Glu His Asp Ser Glu  Ile Ser Lys Gly Asn  Ala Gly Val
    1010                1015                1020
```

Tyr Arg Val Gly Val Lys Leu Ala Leu Ser Leu Glu Lys Tyr His
    1025   1030   1035

Ile Asp Glu Leu Gly Lys Asn Arg Arg Ile Cys Arg Pro His Gln
    1040   1045   1050

Arg Arg Pro Val Arg
    1055

<210> 594
<211> 1056
<212> PRT
<213> Pasteurella multocida

<400> 594

Met Gln Thr Thr Asn Leu Ser Tyr Ile Leu Gly Leu Asp Leu Gly Ile
1   5   10   15

Ala Ser Val Gly Trp Ala Val Val Glu Ile Asn Glu Asn Glu Asp Pro
            20   25   30

Ile Gly Leu Ile Asp Val Gly Val Arg Ile Phe Glu Arg Ala Glu Val
        35   40   45

Pro Lys Thr Gly Glu Ser Leu Ala Leu Ser Arg Arg Leu Ala Arg Ser
    50   55   60

Thr Arg Arg Leu Ile Arg Arg Arg Ala Arg Arg Leu Leu Leu Ala Lys
65   70   75   80

Arg Phe Leu Lys Arg Glu Gly Ile Leu Ser Thr Thr Asp Leu Glu Lys
                85   90   95

Gly Leu Pro Asn Gln Ala Trp Glu Leu Arg Val Ala Gly Leu Glu Arg
            100   105   110

Arg Leu Ser Ala Ile Glu Trp Gly Ala Val Leu Leu His Leu Ile Lys
        115   120   125

```
His Arg Gly Tyr Leu Ser Lys Arg Lys Asn Glu Ser Gln Thr Asn Asn
    130                 135                 140

Lys Glu Leu Gly Ala Leu Leu Ser Gly Val Ala Gln Asn His Gln Leu
145                 150                 155                 160

Leu Gln Ser Asp Asp Tyr Arg Thr Pro Ala Glu Leu Ala Leu Lys Lys
                165                 170                 175

Phe Ala Lys Glu Glu Gly His Ile Arg Asn Gln Arg Gly Ala Tyr Thr
            180                 185                 190

His Thr Phe Asn Arg Leu Asp Leu Leu Ala Glu Leu Asn Leu Leu Phe
        195                 200                 205

Ala Gln Gln His Gln Phe Gly Asn Pro His Cys Lys Glu His Ile Gln
    210                 215                 220

Gln Tyr Met Thr Glu Leu Leu Met Trp Gln Lys Pro Ala Leu Ser Gly
225                 230                 235                 240

Glu Ala Ile Leu Lys Met Leu Gly Lys Cys Thr His Glu Lys Asn Glu
                245                 250                 255

Phe Lys Ala Ala Lys His Thr Tyr Ser Ala Glu Arg Phe Val Trp Leu
            260                 265                 270

Thr Lys Leu Asn Asn Leu Arg Ile Leu Glu Asp Gly Ala Glu Arg Ala
        275                 280                 285

Leu Asn Glu Glu Glu Arg Gln Leu Leu Ile Asn His Pro Tyr Glu Lys
    290                 295                 300

Ser Lys Leu Thr Tyr Ala Gln Val Arg Lys Leu Leu Gly Leu Ser Glu
305                 310                 315                 320

Gln Ala Ile Phe Lys His Leu Arg Tyr Ser Lys Glu Asn Ala Glu Ser
```

```
                325                 330                 335

Ala Thr Phe Met Glu Leu Lys Ala Trp His Ala Ile Arg Lys Ala Leu
            340                 345                 350

Glu Asn Gln Gly Leu Lys Asp Thr Trp Gln Asp Leu Ala Lys Lys Pro
        355                 360                 365

Asp Leu Leu Asp Glu Ile Gly Thr Ala Phe Ser Leu Tyr Lys Thr Asp
    370                 375                 380

Glu Asp Ile Gln Gln Tyr Leu Thr Asn Lys Val Pro Asn Ser Val Ile
385                 390                 395                 400

Asn Ala Leu Leu Val Phe Leu Asn Phe Asp Lys Phe Ile Glu Leu Ala
                405                 410                 415

Leu Lys Ser Leu Arg Lys Ile Leu Pro Leu Met Glu Gln Gly Lys Arg
            420                 425                 430

Tyr Asp Gln Ala Cys Arg Glu Ile Tyr Gly His His Tyr Gly Glu Ala
        435                 440                 445

Asn Gln Lys Thr Ser Gln Leu Leu Pro Ala Ile Pro Ala Gln Glu Ile
    450                 455                 460

Arg Asn Pro Val Val Leu Arg Thr Leu Ser Gln Ala Arg Lys Val Ile
465                 470                 475                 480

Asn Ala Ile Ile Arg Gln Tyr Gly Ser Pro Ala Arg Val His Ile Glu
                485                 490                 495

Thr Gly Arg Glu Leu Gly Lys Ser Phe Lys Glu Arg Arg Glu Ile Gln
            500                 505                 510

Lys Gln Gln Glu Asp Asn Arg Thr Lys Arg Glu Ser Ala Val Gln Lys
        515                 520                 525
```

```
Phe Lys Glu Leu Phe Ser Asp Phe Ser Ser Glu Pro Lys Ser Lys Asp
    530                 535                 540

Ile Leu Lys Phe Arg Leu Tyr Glu Gln Gln His Gly Lys Cys Leu Tyr
545                 550                 555                 560

Ser Gly Lys Glu Ile Asn Ile His Arg Leu Asn Glu Lys Gly Tyr Val
                565                 570                 575

Glu Ile Asp His Ala Leu Pro Phe Ser Arg Thr Trp Asp Asp Ser Phe
            580                 585                 590

Asn Asn Lys Val Leu Val Leu Ala Ser Glu Asn Gln Asn Lys Gly Asn
        595                 600                 605

Gln Thr Pro Tyr Glu Trp Leu Gln Gly Lys Ile Asn Ser Glu Arg Trp
    610                 615                 620

Lys Asn Phe Val Ala Leu Val Leu Gly Ser Gln Cys Ser Ala Ala Lys
625                 630                 635                 640

Lys Gln Arg Leu Leu Thr Gln Val Ile Asp Asp Asn Lys Phe Ile Asp
                645                 650                 655

Arg Asn Leu Asn Asp Thr Arg Tyr Ile Ala Arg Phe Leu Ser Asn Tyr
            660                 665                 670

Ile Gln Glu Asn Leu Leu Leu Val Gly Lys Asn Lys Lys Asn Val Phe
        675                 680                 685

Thr Pro Asn Gly Gln Ile Thr Ala Leu Leu Arg Ser Arg Trp Gly Leu
    690                 695                 700

Ile Lys Ile Arg Glu Asn Asn Asp Arg His His Ala Leu Asp Ala Ile
705                 710                 715                 720

Val Val Ala Cys Ala Thr Pro Ser Met Gln Gln Lys Ile Thr Arg Phe
```

```
                725                 730                 735

Ile Arg Phe Lys Glu Val His Pro Tyr Lys Ile Glu Asn Arg Tyr Glu
            740                 745                 750

Met Val Asp Gln Glu Ser Gly Glu Ile Ile Ser Pro His Phe Pro Glu
        755                 760                 765

Pro Trp Ala Tyr Phe Arg Gln Glu Val Asn Ile Arg Val Phe Asp Asn
    770                 775                 780

His Pro Asp Thr Val Leu Lys Glu Met Leu Pro Asp Arg Pro Gln Ala
785                 790                 795                 800

Asn His Gln Phe Val Gln Pro Leu Phe Val Ser Arg Ala Pro Thr Arg
                805                 810                 815

Lys Met Ser Gly Gln Gly His Met Glu Thr Ile Lys Ser Ala Lys Arg
            820                 825                 830

Leu Ala Glu Gly Ile Ser Val Leu Arg Ile Pro Leu Thr Gln Leu Lys
        835                 840                 845

Pro Asn Leu Leu Glu Asn Met Val Asn Lys Glu Arg Glu Pro Ala Leu
    850                 855                 860

Tyr Ala Gly Leu Lys Ala Arg Leu Ala Glu Phe Asn Gln Asp Pro Ala
865                 870                 875                 880

Lys Ala Phe Thr Thr Pro Phe Tyr Lys Gln Gly Gly Gln Gln Val Lys
                885                 890                 895

Ala Ile Arg Val Glu Gln Val Gln Lys Ser Gly Val Leu Val Arg Glu
            900                 905                 910

Asn Asn Gly Val Ala Asp Asn Ala Ser Ile Val Arg Thr Asp Val Phe
        915                 920                 925
```

```
Ile Lys Asn Asn Lys Phe Phe Leu Val Pro Ile Tyr Thr Trp Gln Val
    930                 935                 940

Ala Lys Gly Ile Leu Pro Asn Lys Ala Ile Val Ala His Lys Asn Glu
945                 950                 955                 960

Asp Glu Trp Glu Glu Met Asp Glu Gly Ala Lys Phe Lys Phe Ser Leu
                965                 970                 975

Phe Pro Asn Asp Leu Val Glu Leu Lys Thr Lys Lys Glu Tyr Phe Phe
            980                 985                 990

Gly Tyr Tyr Ile Gly Leu Asp Arg  Ala Thr Gly Asn Ile  Ser Leu Lys
        995                 1000                1005

Glu His  Asp Gly Glu Ile Ser  Lys Gly Lys Asp Gly  Val Tyr Arg
    1010                1015                1020

Val Gly  Val Lys Leu Ala Leu  Ser Phe Glu Lys Tyr  Gln Val Asp
    1025                1030                1035

Glu Leu  Gly Lys Asn Arg Gln  Ile Cys Arg Pro Gln  Gln Arg Gln
    1040                1045                1050

Pro Val  Arg
    1055
```

<210> 595
<211> 134
<212> PRT
<213> Pasteurella multocida

<400> 595

```
Met Val Asn Lys Glu Arg Glu Pro Ala Leu Tyr Ala Gly Leu Lys Ala
1               5                   10                  15

Arg Leu Ala Glu Phe Asn Gln Asp Pro Ala Lys Ala Phe Thr Thr Pro
            20                  25                  30
```

```
Phe Tyr Lys Gln Gly Gly Gln Gln Val Lys Ala Ile Arg Val Glu Gln
        35                  40                  45

Val Gln Lys Ser Gly Val Leu Val Arg Glu Asn Asn Gly Val Ala Asp
    50                  55                  60

Asn Ala Ser Ile Val Arg Thr Asp Val Phe Ile Lys Asn Asn Lys Phe
65                  70                  75                  80

Phe Leu Val Pro Ile Tyr Thr Trp Gln Val Ala Lys Gly Ile Leu Pro
                85                  90                  95

Asn Lys Ala Ile Val Ala His Lys Asn Glu Asp Glu Trp Glu Glu Met
            100                 105                 110

Asp Glu Gly Ala Lys Phe Lys Phe Ser Leu Phe Pro Asn Asp Leu Val
        115                 120                 125

Glu Leu Lys Thr Lys Lys
    130
```

<210> 596
<211> 53
<212> PRT
<213> Pasteurella multocida

<400> 596

```
Tyr Ser Lys Glu Asn Ala Glu Ser Ala Thr Phe Met Glu Leu Lys Ala
1               5                   10                  15

Trp His Ala Ile Arg Lys Ala Leu Glu Asn Gln Gly Leu Lys Asp Thr
            20                  25                  30

Trp Gln Asp Leu Ala Lys Lys Pro Asp Leu Leu Asp Glu Ile Gly Thr
        35                  40                  45

Ala Phe Ser Leu Leu
```

50

<210> 597
<211> 1366
<212> PRT
<213> Pediococcus acidilactici

<400> 597

Met Gly Asp Arg Lys Tyr Asn Leu Gly Leu Asp Ile Gly Thr Ser Ser
1 5 10 15

Ile Gly Phe Ala Ala Val Asp Glu Asn Asn Gln Pro Ile Arg Val Lys
20 25 30

Gly Lys Thr Ala Ile Gly Val Arg Leu Phe Glu Glu Gly Lys Thr Ala
35 40 45

Ala Asp Arg Arg Gly Phe Arg Thr Thr Arg Arg Arg Leu Ser Arg Arg
50 55 60

Arg Trp Arg Ile Asn Leu Leu Asn Glu Ile Phe Asp Ala His Leu Ala
65 70 75 80

Glu Val Asp Pro Thr Phe Leu Ala Arg Leu Lys Glu Ser Asn Arg Ser
85 90 95

Asn Leu Asp Pro Lys Lys Ser Phe Gln Gly Ser Leu Leu Phe Pro Glu
100 105 110

Arg Lys Asp Tyr Gln Phe Tyr Glu Glu Tyr Pro Thr Ile Tyr His Leu
115 120 125

Arg Lys Ala Leu Met Glu Glu Asp Arg Lys Phe Asp Ile Arg Glu Ile
130 135 140

Tyr Leu Ala Val His His Ile Ile Lys Tyr Arg Gly Asn Phe Leu Asn
145 150 155 160

```
Gly Thr Pro Met Arg Ser Phe Lys Val Glu Asn Ile Glu Leu Asp Thr
                165                 170                 175

Leu Phe Asp Gln Leu Asn Gln Leu Tyr Ala Glu Ile Val Pro Asp Asn
            180                 185                 190

Glu Leu Ala Phe Asp Leu Ala Gln Val Ala Asp Val Lys Asp Val Leu
        195                 200                 205

Ser Ser Thr Thr Ile Tyr Lys Met Asp Lys Lys Lys Gln Leu Val Lys
    210                 215                 220

Met Met Leu Leu Pro Ala Ser Asn Lys Ala Leu Gln Ser Glu Asn Lys
225                 230                 235                 240

Lys Ile Val Thr Gln Phe Val Asn Ala Ile Leu Asn Tyr Lys Phe Lys
                245                 250                 255

Leu Asp Val Leu Leu Gln Val Glu Thr Asp Ala Asp Trp Ser Leu Lys
            260                 265                 270

Leu Asn Asp Glu Gly Ala Asp Asp Lys Leu Glu Glu Phe Thr Gly Asp
        275                 280                 285

Leu Asp Glu Asn Arg Leu Glu Ile Ile Asp Leu Leu Gln Arg Leu His
    290                 295                 300

Asn Trp Phe Ser Leu Asn Glu Ile Thr Lys Asp Gly Asn Ser Leu Ser
305                 310                 315                 320

Ala Ala Met Val Glu Lys Tyr Glu Asn His His His His Leu Gly Leu
                325                 330                 335

Leu Lys Lys Val Ile Glu Asn His Pro Asp Ala Lys Lys Ala Lys Ala
            340                 345                 350

Leu Lys Glu Thr Tyr Thr Ala Tyr Val Gly Lys Thr Asp Asp Lys Thr
        355                 360                 365
```

```
Gln Asn Gln Asp Asp Phe Tyr Lys Ala Val Glu Lys Asn Leu Asp Asp
    370                 375                 380

Ser Pro Asp Ala Lys Glu Ile Lys Arg Leu Ile Gln Leu Asp Gln Phe
385                 390                 395                 400

Met Pro Lys Gln Arg Thr Gly Gln Asn Gly Ala Ile Pro His Gln Leu
                405                 410                 415

His Gln Gln Glu Leu Asp Gln Ile Ile Glu Lys Gln Ser Lys Tyr Tyr
            420                 425                 430

Pro Phe Leu Ala Glu Pro Asn Pro Asn Val Lys Arg Arg Lys Asp Ala
        435                 440                 445

Pro Tyr Lys Leu Asp Glu Leu Ile Ala Phe Lys Ile Pro Tyr Tyr Val
    450                 455                 460

Gly Pro Leu Val Thr Pro Glu Glu Gln Ala Gln Asn Lys Glu Asn Val
465                 470                 475                 480

Phe Ala Trp Met Lys Arg Lys Ala Ala Gly Pro Ile Thr Pro Trp Asn
                485                 490                 495

Phe Asp Glu Lys Val Asp Arg Met Glu Ser Ala Asn Arg Phe Ile Arg
            500                 505                 510

Arg Met Thr Thr Lys Asp Thr Tyr Leu Phe Gly Glu Asp Val Leu Pro
        515                 520                 525

Ala Glu Ser Met Ile Tyr Gln Lys Phe Val Val Leu Asn Glu Leu Asn
    530                 535                 540

Asn Leu Lys Ile Asn Gly Arg His Leu Ser Leu Lys Asp Lys Gln Asp
545                 550                 555                 560
```

```
Val Tyr Asn Asp Leu Phe Lys Gln Gln Lys Thr Val Ser Ile Lys Ala
                565                 570                 575

Leu Gln Asn Tyr Tyr Val Thr Lys Lys Lys Ala Ala Thr Ala Pro Thr
            580                 585                 590

Val Gly Gly Leu Ala Asp Pro Lys Lys Phe Leu Ser Ser Leu Ser Thr
        595                 600                 605

Tyr Ile Asp Phe Lys Asn Met Phe Gly Glu Arg Val Asn Asp Pro Gln
    610                 615                 620

Phe Gln Glu Asp Leu Glu Gln Ile Val Glu Trp Ser Thr Ile Phe Glu
625                 630                 635                 640

Asp Arg Gly Ile Phe Lys Ala Lys Leu Gln Ala Leu Gly Trp Leu Ser
                645                 650                 655

Glu Lys Gln Ile Gln Gln Leu Val Ala Lys Arg Tyr Lys Gly Trp Gly
            660                 665                 670

Arg Leu Ser Lys Lys Leu Leu Thr Gly Leu Lys Asn Ala Glu Gly Tyr
        675                 680                 685

Ser Ile Leu Asp Glu Met Trp Arg Ser Thr Glu Asn Phe Met Gln Ile
    690                 695                 700

Gln Thr Arg Pro Glu Phe Ala Ala Leu Ile Gln Gln Ala Asn Glu Lys
705                 710                 715                 720

Gln Phe Glu Gly Asn Asp Pro Asn Asn Val Trp Glu Asn Ile Glu Ser
                725                 730                 735

Ile Leu Gly Asp Ala Tyr Thr Ser Pro Gln Asn Lys Lys Ala Ile Arg
            740                 745                 750

Gln Val Val Lys Val Val Gln Asp Ile Glu Lys Ala Val Gly Asn Pro
        755                 760                 765
```

```
Pro Glu Lys Ile Ala Ile Glu Phe Thr Arg Glu Ala Ala Ala Asn Pro
    770                 775                 780

Gln Arg Thr Gln Ser Arg Leu Arg Thr Leu Glu Lys Leu Tyr Glu Ser
785                 790                 795                 800

Ala Glu Glu Val Val Asp Ala Gly Leu Thr Ala Glu Leu Ala Glu Phe
                805                 810                 815

Lys Glu Asn Lys His Val Leu Ser Asp Lys Tyr Tyr Leu Tyr Phe Thr
            820                 825                 830

Gln Leu Gly Arg Asp Val Tyr Thr Gly Asp Thr Ile Ser Leu Asp Lys
        835                 840                 845

Leu Asn Asp Tyr Asp Val Asp His Ile Leu Pro Gln Ser Phe Ile Lys
    850                 855                 860

Asp Asp Ser Leu Asp Asn Arg Val Leu Thr Ile Arg Ala Val Asn Asn
865                 870                 875                 880

Gly Lys Ser Asp Asn Val Pro Ala Lys Met Phe Gly Lys Lys Met Gly
                885                 890                 895

Ser Phe Trp Arg Tyr Leu Leu Asp Asn Gly Met Ile Ser Lys Arg Lys
            900                 905                 910

Tyr Asn Asn Leu Ile Thr Asp Pro Asp Asn Ile Ser Lys Tyr Ala Gln
        915                 920                 925

Lys Gly Phe Ile Asn Arg Gln Leu Val Glu Thr Ser Gln Val Ile Lys
    930                 935                 940

Leu Thr Ala Asn Ile Leu Asn Gly Ile Tyr Asp Lys Asp Thr Glu Ile
945                 950                 955                 960
```

```
Ile Glu Val Pro Ala Lys Met Asn Ser Gln Met Arg Lys Met Phe Asp
               965                 970                 975

Leu Val Lys Val Arg Glu Val Asn Asp Tyr His His Ala Phe Asp Ala
           980                 985                 990

Tyr Leu Thr Ile Phe Ile Gly Lys  Tyr Leu Tyr Lys Cys  Tyr Pro Lys
        995                1000                1005

Leu Arg  Pro Tyr Phe Val Tyr  Gly Lys Phe Lys Lys  Phe Gly Asp
    1010                1015                1020

Asn Glu  Asp Ile Glu Val Gly  Asp Gly Arg Phe Asn  Phe Leu Asn
    1025                1030                1035

Arg Ile  Glu Arg Leu Lys Asn  Val Thr Asp Pro Glu  Thr Gly Glu
    1040                1045                1050

Ile Leu  Trp Ser Asn Val Ala  Pro Asn Glu Thr Ile  Lys Gln Ile
    1055                1060                1065

Lys Lys  Val Tyr Asn Tyr Lys  Phe Met Leu Val Ser  Arg Glu Thr
    1070                1075                1080

Thr Thr  Arg Arg Ala Glu Leu  Phe Asn Gln Thr Val  Tyr Pro Lys
    1085                1090                1095

Asn Tyr  Arg Gly Lys Leu Ile  Pro Ile Lys Glu Asp  Arg Pro Thr
    1100                1105                1110

Asp Leu  Tyr Gly Gly Tyr Ser  Gly Asn Thr Asp Ala  Tyr Leu Ala
    1115                1120                1125

Ile Val  Ala Leu Glu Asp Lys  Lys Lys Gly Lys Tyr  Phe Lys Val
    1130                1135                1140

Val Gly  Ile Pro Thr Arg Ala  Ala Ala Lys Leu Glu  Lys Leu Lys
    1145                1150                1155
```

```
Gln Gln  Asp Ser Gln Gln Tyr  Leu Gln Ala Leu His  Lys Val Ile
    1160                1165                1170

Ala Pro  Gln Phe Thr Lys Ser  Thr Lys Lys Gly Ile  Lys Lys Thr
    1175                1180                1185

Glu Phe  Glu Ile Val Leu Asp  Lys Val His Tyr Arg  Gln Leu Val
    1190                1195                1200

Gln Asp  Gly Pro Val Lys Met  Met Leu Gly Ser Ser  Thr Tyr Lys
    1205                1210                1215

Tyr Asn  Ala Lys Gln Leu Val  Leu Ser Glu Lys Ala  Leu Gln Val
    1220                1225                1230

Ile Ala  Asp Asp Arg Lys Phe  Asp Glu Thr Gln Lys  Asp Asp Asn
    1235                1240                1245

Leu Ile  Ala Val Tyr Asp Glu  Ile Leu Ser Ile Val  Asn Gln Ser
    1250                1255                1260

Phe Asp  Leu Tyr Asp Ile Asn  Gly Phe Arg Lys Lys  Leu Asn Asp
    1265                1270                1275

Asn Arg  Asp Gln Phe Ile Asp  Leu Pro Ala Glu Thr  Lys Tyr Glu
    1280                1285                1290

Gly Arg  Lys Val Val Ala His  Gly Lys Arg Glu Met  Ile Leu Glu
    1295                1300                1305

Ile Leu  Lys Gly Leu His Ala  Asn Ala Ala Phe Gly  Asn Leu Lys
    1310                1315                1320

Pro Ile  Gly Phe Ser Thr Ala  Phe Gly Gln Leu Gln  Val Pro Asn
    1325                1330                1335
```

Gly Ile Ile Leu Ser Lys Asn Ala Ile Leu Ile His Gln Ser Pro
    1340   1345   1350

Ser Gly Leu Phe Glu Arg Lys Ile Lys Leu Ser Asp Leu
    1355   1360   1365

<210> 598
<211> 1229
<212> PRT
<213> Pediococcus acidilactici

<400> 598

Met Gly Asp Arg Lys Tyr Asn Leu Gly Leu Asp Ile Gly Thr Ser Ser
1   5   10   15

Ile Gly Phe Ala Ala Val Asp Glu Asn Asn Gln Pro Ile Arg Val Lys
            20   25   30

Gly Lys Thr Ala Ile Gly Val Arg Leu Phe Glu Glu Gly Lys Thr Ala
        35   40   45

Ala Asp Arg Arg Gly Phe Arg Thr Thr Arg Arg Arg Leu Ser Arg Arg
    50   55   60

Arg Trp Arg Ile Asn Leu Leu Asn Glu Ile Phe Asp Ala His Leu Ala
65   70   75   80

Glu Val Asp Pro Thr Phe Leu Ala Arg Leu Lys Glu Ser Asn Arg Ser
                85   90   95

Asn Leu Asp Pro Lys Lys Ser Phe Gln Gly Ser Leu Leu Phe Pro Glu
            100   105   110

Arg Lys Asp Tyr Gln Phe Tyr Glu Glu Tyr Pro Thr Ile Tyr His Leu
        115   120   125

Arg Lys Ala Leu Met Glu Lys Asp Arg Lys Phe Asp Ile Arg Glu Ile
    130   135   140

```
Tyr Leu Ala Val His His Ile Ile Lys Tyr Arg Gly Asn Phe Leu Asn
145                 150                 155                 160

Gly Thr Pro Met Arg Ser Phe Lys Val Glu Asn Ile Glu Leu Asn Thr
                165                 170                 175

Leu Phe Asp Gln Leu Asn Gln Leu Tyr Ala Glu Ile Val Pro Asp Asn
            180                 185                 190

Glu Leu Ala Phe Asp Leu Ala Gln Val Ala Asp Val Lys Asp Val Leu
        195                 200                 205

Ser Ser Thr Thr Ile Tyr Lys Met Asp Lys Lys Lys Gln Leu Val Lys
    210                 215                 220

Met Met Leu Leu Pro Ala Ser Asn Lys Ala Leu Gln Ser Glu Asn Lys
225                 230                 235                 240

Lys Ile Val Thr Gln Phe Val Asn Ala Ile Leu Asn Tyr Lys Phe Lys
                245                 250                 255

Leu Asp Val Leu Leu Gln Val Glu Thr Asp Ala Asp Trp Ser Leu Lys
            260                 265                 270

Leu Asn Asp Glu Gly Ala Asp Asp Lys Leu Glu Glu Phe Thr Gly Asp
        275                 280                 285

Leu Asp Glu Asn Arg Leu Glu Ile Ile Asp Leu Leu Gln Arg Leu His
    290                 295                 300

Asn Trp Phe Ser Leu Asn Glu Ile Thr Lys Asp Gly Asn Ser Leu Ser
305                 310                 315                 320

Ala Ala Met Val Glu Lys Tyr Glu Asn His His His His Leu Gly Leu
                325                 330                 335

Leu Lys Lys Val Ile Glu Asn His Pro Asp Ala Lys Lys Ala Lys Ala
```

```
            340                 345                 350

Leu Lys Glu Thr Tyr Thr Ala Tyr Val Gly Lys Thr Asp Asp Lys Thr
        355                 360                 365

Gln Asn Gln Asp Asp Phe Tyr Lys Ala Val Glu Lys Asn Leu Asp Asp
    370                 375                 380

Ser Pro Asp Ala Lys Gly Ile Lys Arg Leu Ile Gln Leu Asp Gln Phe
385                 390                 395                 400

Met Pro Lys Gln Arg Thr Gly Gln Asn Gly Ala Ile Pro His Gln Leu
                405                 410                 415

His Gln Gln Glu Leu Asp Gln Ile Ile Glu Lys Gln Ser Lys Tyr Tyr
            420                 425                 430

Pro Phe Leu Ala Glu Pro Asn Pro Asn Val Lys Arg Arg Lys Asp Ala
        435                 440                 445

Pro Tyr Lys Leu Asp Glu Leu Ile Ala Phe Lys Ile Pro Tyr Tyr Val
    450                 455                 460

Gly Pro Leu Val Thr Pro Glu Glu Gln Ala Gln Asn Lys Glu Asn Val
465                 470                 475                 480

Phe Ala Trp Met Lys Arg Lys Ala Ala Gly Pro Ile Thr Pro Trp Asn
                485                 490                 495

Phe Asp Glu Lys Val Asp Arg Met Glu Ser Ala Asn Arg Phe Ile Arg
            500                 505                 510

Arg Met Thr Thr Lys Asp Thr Tyr Leu Phe Gly Glu Asp Val Leu Pro
        515                 520                 525

Ala Glu Ser Met Ile Tyr Gln Lys Phe Val Val Leu Asn Glu Leu Asn
    530                 535                 540
```

```
Asn Leu Lys Ile Asn Gly Arg His Leu Ser Leu Lys Asp Lys Gln Asp
545                 550                 555                 560

Val Tyr Asn Asp Leu Phe Lys Gln Gln Lys Thr Val Ser Ile Lys Ala
                565                 570                 575

Leu Gln Asn Tyr Tyr Val Thr Lys Lys Lys Ala Ala Thr Ala Pro Thr
            580                 585                 590

Val Gly Gly Leu Ala Asp Pro Lys Lys Phe Leu Ser Ser Leu Ser Thr
        595                 600                 605

Tyr Ile Asp Phe Lys Asn Met Phe Gly Glu Arg Val Asn Asp Pro Gln
    610                 615                 620

Phe Gln Glu Asp Leu Glu Gln Ile Val Glu Trp Ser Thr Ile Phe Glu
625                 630                 635                 640

Asp Arg Gly Ile Phe Lys Ala Lys Leu Gln Ala Leu Gly Trp Leu Ser
                645                 650                 655

Glu Lys Gln Ile Gln Gln Leu Val Ala Lys Arg Tyr Lys Gly Trp Gly
            660                 665                 670

Arg Leu Ser Lys Lys Leu Leu Thr Gly Leu Lys Asn Ala Glu Gly Tyr
        675                 680                 685

Ser Ile Leu Asp Glu Met Trp Arg Ser Thr Glu Asn Phe Met Gln Ile
    690                 695                 700

Gln Ser Arg Pro Glu Phe Ala Ala Leu Ile Gln Gln Ala Asn Glu Lys
705                 710                 715                 720

Gln Phe Glu Gly Asn Asp Pro Asp Asn Val Trp Glu Asn Ile Glu Asn
                725                 730                 735

Ile Leu Gly Asp Ala Tyr Thr Ser Pro Gln Asn Lys Lys Ala Ile Arg
```

```
            740                 745                 750

Gln Val Val Lys Val Val Gln Asp Ile Glu Lys Ala Val Gly Asn Pro
        755                 760                 765

Pro Glu Lys Ile Ala Ile Glu Phe Thr Arg Glu Ala Ala Ala Asn Pro
    770                 775                 780

Gln Arg Thr Gln Ser Arg Leu Arg Thr Leu Glu Lys Leu Tyr Glu Ser
785                 790                 795                 800

Ala Glu Glu Val Val Asp Ala Gly Leu Thr Ala Glu Leu Ala Glu Phe
                805                 810                 815

Lys Glu Asn Lys His Val Leu Ser Asp Lys Tyr Tyr Leu Tyr Phe Thr
            820                 825                 830

Gln Leu Gly Arg Asp Val Tyr Thr Gly Asp Thr Ile Ser Leu Asp Lys
        835                 840                 845

Leu Asn Asp Tyr Asp Val Asp His Ile Leu Pro Gln Ser Phe Ile Lys
    850                 855                 860

Asp Asp Ser Leu Asp Asn Arg Val Leu Thr Ile Arg Ala Val Asn Asn
865                 870                 875                 880

Gly Lys Ser Asp Asn Val Pro Ala Lys Met Phe Gly Lys Lys Met Gly
                885                 890                 895

Ser Phe Trp Arg His Leu Leu Asp Asn Gly Met Ile Ser Lys Arg Lys
            900                 905                 910

Tyr Asn Asn Leu Ile Thr Asp Pro Asp Asn Ile Ser Lys Tyr Ala Gln
        915                 920                 925

Lys Gly Phe Ile Asn Arg Gln Leu Val Glu Thr Ser Gln Val Ile Lys
    930                 935                 940
```

```
Leu Thr Ala Asn Ile Leu Asn Gly Ile Tyr Asp Lys Asp Thr Glu Ile
945                 950                 955                 960


Ile Glu Val Pro Ala Lys Met Asn Ser Gln Met Arg Lys Met Phe Asp
                965                 970                 975


Leu Val Lys Val Arg Glu Val Asn Asp Tyr His His Ala Phe Asp Ala
            980                 985                 990


Tyr Leu Thr Ile Phe Ile Gly Asn  Tyr Leu Tyr Lys Cys  Tyr Pro Lys
        995                 1000                1005


Leu Arg  Pro Tyr Phe Val Tyr  Asp Asn Phe Lys Lys  Phe Gly Asn
    1010                1015                1020


Lys Glu  Asp Ile Gly His Lys  Arg Phe Asn Phe Leu  Gly Lys Ile
    1025                1030                1035


Glu Arg  Glu Lys Lys Val Val  Ala Pro Glu Thr Gly  Glu Ile Leu
    1040                1045                1050


Trp Ser  Asn Val Ala Pro Asn  Glu Thr Ile Lys Gln  Ile Lys Lys
    1055                1060                1065


Val Tyr  Asn Tyr Lys Phe Met  Ile Val Ser Arg Glu  Ile Thr Thr
    1070                1075                1080


Arg Arg  Ala Glu Leu Phe Asn  Gln Thr Val Tyr Pro  Lys Asn Tyr
    1085                1090                1095


Arg Gly  Lys Leu Ile Pro Ile  Lys Glu Asp Arg Pro  Thr Asp Leu
    1100                1105                1110


Tyr Gly  Gly Tyr Ser Gly Asn  Thr Asp Ala Tyr Leu  Ala Ile Val
    1115                1120                1125


Ala Leu  Glu Asp Lys Lys Lys  Gly Lys Tyr Phe Lys  Val Val Gly
```

```
    1130                1135                1140

Ile Pro  Thr Arg Ala Ala Ala  Lys Leu Glu Lys Leu  Lys Gln Gln
    1145                1150                1155

Asp Ser  Gln Gln Tyr Leu Gln  Ala Leu His Glu Val  Ile Ala Pro
    1160                1165                1170

Gln Phe  Thr Lys Ser Thr Lys  Lys Gly Ile Lys Lys  Thr Glu Phe
    1175                1180                1185

Glu Ile  Val Leu Asp Lys Val  His Tyr Arg Gln Leu  Val Gln Asp
    1190                1195                1200

Gly Pro  Val Lys Met Met Leu  Gly Ser Ser Thr Tyr  Lys Tyr Asn
    1205                1210                1215

Ala Lys  Gln Leu Val Leu Ser  Glu Lys Ala Leu
    1220                1225
```

<210> 599
<211> 270
<212> PRT
<213> Pediococcus lolii

<400> 599

```
Leu Phe Asn Gln Thr Ile Tyr Ser Ala Lys Ala Ser Lys Thr Met Ile
1               5                   10                  15

Pro Ile Lys Asn Asp Arg Pro Thr Lys Leu Tyr Gly Gly Tyr Ser Gly
            20                  25                  30

Asn Glu Asp Ala Tyr Met Ser Ile Ile Arg Leu Ser Asp Lys Lys Lys
        35                  40                  45

Thr Tyr Lys Val Val Gly Ile Ser Met Arg Asp Ala Ser Lys Leu Lys
    50                  55                  60
```

```
Ala Tyr Glu Asn Asn Ala His Glu Glu Tyr Leu Lys Lys Leu Lys Glu
65                  70                  75                  80

Val Ile Glu Gln Gln Phe Leu Asp Ser Gly Lys Lys Thr Lys Ala Asp
                85                  90                  95

Phe Glu Ile Val Ile Pro Lys Val Asn Tyr His Gln Arg Met Gln Asp
            100                 105                 110

Gly Thr Lys Gln Phe Arg Ile Gly Ser Ser Lys Tyr Val His Asn Thr
        115                 120                 125

Lys Gln Leu Val Leu Ser Glu Lys Thr Leu Lys Ala Ile Arg Asn Asn
    130                 135                 140

Lys Gln Tyr Asn Gly Asp Ala Glu Lys Asp Leu Ile Asn Ala Phe Asp
145                 150                 155                 160

Glu Ile Leu Thr Ile Val Asn Asp Ser Phe Ser Ile Phe Asp Ile Arg
                165                 170                 175

Ser Phe Arg Lys Lys Leu Asn Glu Ser Arg Asp Lys Phe Val Ser Leu
            180                 185                 190

Pro Val Glu Asp Thr Lys Glu Lys Ser Lys Val Ile Lys Gly Lys Arg
        195                 200                 205

Glu Thr Leu Lys Gln Ile Leu Ile Ala Leu His Ala Asn Gly Thr Ser
    210                 215                 220

Gln Asp Ile Pro Gln Leu Gly Leu Lys Ser Phe Gly Lys Met Val Lys
225                 230                 235                 240

Thr Gly Gly Leu Thr Leu Ser Glu Asn Thr Ala Leu Ile His Gln Ser
                245                 250                 255

Pro Ser Gly Leu Phe Glu His Lys Ile Lys Leu Ser Asp Leu
            260                 265                 270
```

<210> 600
<211> 1016
<212> PRT
<213> Pediococcus lolii

<400> 600

Met Asn Gly Ile Phe Asp Ala His Leu Ala Glu Val Asp Pro Thr Phe
1 5 10 15

Leu Ala Arg Leu Lys Glu Ser Asn Arg Ser Asn Leu Asp Pro Lys Lys
20 25 30

Ser Phe Gln Gly Ser Leu Leu Phe Pro Glu Arg Lys Asp Tyr Gln Phe
35 40 45

Tyr Lys Glu Tyr Pro Thr Ile Tyr His Leu Arg Lys Ala Leu Met Glu
50 55 60

Lys Asp Arg Lys Phe Asp Ile Arg Glu Ile Tyr Leu Ala Val His His
65 70 75 80

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Asn Gly Thr Pro Met Arg Ser
85 90 95

Phe Lys Val Glu Asn Ile Glu Leu Asp Thr Leu Phe Asp Arg Leu Asn
100 105 110

Gln Leu Tyr Glu Glu Ile Ile Pro Asp Asn Glu Leu Ala Phe Asp Leu
115 120 125

Glu Gln Val Ala Asp Val Lys Glu Val Leu Ser Ser Thr Thr Ile Tyr
130 135 140

Lys Met Asp Lys Lys Lys Gln Leu Val Lys Met Met Leu Leu Pro Ala
145 150 155 160

Ser Asn Lys Ala Leu Gln Ser Glu Asn Lys Lys Ile Val Thr Gln Phe

```
                165                 170                 175

Val Asn Ala Ile Leu Asn Tyr Lys Phe Lys Leu Asp Val Leu Leu Gln
            180                 185                 190

Val Glu Thr Asp Ala Asp Trp Ser Leu Lys Leu Asn Asp Glu Gly Ala
        195                 200                 205

Asp Asp Lys Leu Glu Glu Phe Thr Gly Asp Leu Asp Glu Asn Arg Leu
    210                 215                 220

Glu Ile Ile Asp Leu Leu Gln Arg Leu His Asn Trp Phe Ser Leu Asn
225                 230                 235                 240

Glu Ile Thr Lys Asp Gly Asn Ser Leu Ser Ala Ala Met Val Glu Lys
                245                 250                 255

Tyr Lys Asp His Arg His His Leu Glu Leu Leu Lys Lys Val Ile Glu
            260                 265                 270

Asp His Ser Asp Ala Lys Lys Ala Lys Ala Leu Lys Glu Thr Tyr Thr
        275                 280                 285

Ala Tyr Val Gly Lys Thr Asp Asp Lys Thr Gln Asn Lys Asp Asp Phe
    290                 295                 300

Tyr Lys Ala Val Glu Lys Asn Leu Asp Asp Ser Pro Glu Ala Lys Glu
305                 310                 315                 320

Ile Lys Arg Leu Ile Gln Leu Asp Gln Phe Met Pro Lys Gln Arg Thr
                325                 330                 335

Gly Gln Asn Gly Ala Ile Pro His Gln Leu His Gln Gln Glu Leu Asp
            340                 345                 350

Gln Ile Ile Glu Lys Gln Ser Lys Tyr Tyr Pro Phe Leu Ala Glu Pro
        355                 360                 365
```

```
Asn Pro Asn Val Lys Arg Arg Lys Asp Ala Pro Tyr Lys Leu Asp Glu
    370                 375                 380

Leu Ile Ala Phe Lys Ile Pro Tyr Tyr Val Gly Pro Leu Val Thr Pro
385                 390                 395                 400

Glu Glu Gln Ala Gln Asn Lys Glu Asn Val Phe Ala Trp Met Lys Arg
                405                 410                 415

Lys Ala Ala Gly Pro Ile Thr Pro Trp Asn Phe Asp Glu Lys Val Asp
            420                 425                 430

Arg Met Glu Ser Ala Asn Arg Phe Ile Arg Arg Met Thr Thr Lys Asp
        435                 440                 445

Thr Tyr Leu Phe Gly Glu Asp Val Leu Pro Ala Glu Ser Met Ile Tyr
    450                 455                 460

Glu Lys Phe Val Val Leu Asn Glu Leu Asn Asn Leu Lys Ile Asn Gly
465                 470                 475                 480

Arg His Leu Ser Leu Lys Asp Lys Gln Asp Ile Tyr Asn Asp Leu Phe
                485                 490                 495

Lys Gln Gln Lys Thr Val Ser Ile Lys Ala Leu Gln Asn Tyr Tyr Val
            500                 505                 510

Thr Lys Lys Lys Ala Ala Thr Ala Pro Thr Val Gly Gly Leu Ala Asp
        515                 520                 525

Pro Lys Lys Phe Leu Ser Ser Leu Ser Thr Tyr Ile Asp Phe Lys Asn
    530                 535                 540

Met Phe Gly Glu Arg Val Asn Asp Pro Gln Phe Gln Glu Asp Leu Glu
545                 550                 555                 560

Gln Ile Val Glu Trp Ser Thr Ile Phe Glu Asp Arg Gly Ile Phe Lys
```

```
                565                 570                 575

Ala Lys Leu Gln Ala Leu Gly Trp Leu Ser Glu Lys Gln Ile Gln Gln
            580                 585                 590

Leu Val Ala Lys Arg Tyr Lys Gly Trp Gly Arg Leu Ser Lys Lys Leu
        595                 600                 605

Leu Thr Gly Leu Lys Asn Ala Glu Gly Tyr Ser Ile Leu Asp Glu Met
    610                 615                 620

Trp His Ser Thr Glu Asn Phe Met Gln Ile Gln Thr Arg Pro Glu Phe
625                 630                 635                 640

Ala Ala Leu Ile Gln Gln Ala Asn Glu Lys Gln Phe Glu Gly Asn Asp
                645                 650                 655

Pro Asp Asn Val Trp Glu Asn Ile Glu Asn Ile Leu Gly Asp Ala Tyr
            660                 665                 670

Thr Ser Pro Gln Asn Lys Lys Ala Ile Arg Gln Val Val Lys Val Val
        675                 680                 685

Gln Asp Ile Glu Lys Ala Val Gly Asn Pro Pro Glu Lys Ile Ala Ile
    690                 695                 700

Glu Phe Thr Arg Glu Ala Ala Ala Asn Pro Gln Arg Thr Gln Ser Arg
705                 710                 715                 720

Leu Arg Thr Leu Glu Lys Leu Tyr Glu Ser Ala Glu Glu Val Val Asp
                725                 730                 735

Ala Gly Leu Thr Ala Glu Leu Ala Glu Phe Lys Glu Asn Lys His Val
            740                 745                 750

Leu Ser Asp Lys Tyr Tyr Leu Tyr Phe Thr Gln Leu Gly Arg Asp Val
        755                 760                 765
```

```
Tyr Thr Gly Asp Thr Ile Ser Leu Asp Arg Leu Asn Asp Tyr Asp Val
    770                 775                 780

Asp His Ile Leu Pro Gln Ser Phe Ile Lys Asp Asp Ser Leu Asp Asn
785                 790                 795                 800

Arg Val Leu Thr Ile Arg Ala Val Asn Asn Gly Lys Ser Asp Asn Val
                805                 810                 815

Pro Ala Lys Met Phe Gly Lys Lys Met Gly Ser Phe Trp Arg Tyr Leu
            820                 825                 830

Leu Asp Asn Gly Met Ile Ser Lys Arg Lys Tyr Asn Asn Leu Ile Thr
        835                 840                 845

Asp Pro Asp Asn Ile Ser Lys Tyr Ala Gln Lys Gly Phe Ile Asn Arg
    850                 855                 860

Gln Leu Val Glu Thr Ser Gln Val Ile Lys Leu Thr Ala Asn Ile Leu
865                 870                 875                 880

Asn Gly Ile Tyr Asp Lys Asp Thr Glu Ile Ile Glu Val Pro Ala Lys
                885                 890                 895

Met Asn Ser Gln Met Arg Lys Met Phe Asp Leu Val Lys Val Arg Glu
            900                 905                 910

Val Asn Asp Tyr His His Ala Phe Asp Ala Tyr Leu Thr Ile Phe Ile
        915                 920                 925

Gly Asn Tyr Leu Tyr Lys Cys Tyr Pro Lys Leu Arg Pro Tyr Phe Val
    930                 935                 940

Tyr Asp Asn Phe Lys Lys Phe Gly Asn Lys Glu Asp Ile Gly His Lys
945                 950                 955                 960

Arg Phe Asn Phe Leu Gly Lys Ile Glu Arg Asp Lys Lys Val Val Ala
```

```
               965                 970                 975

Pro Glu Thr Gly Glu Ile Leu Trp Ser Asn Val Ala Pro Asn Glu Thr
            980                 985                 990

Ile Lys Gln Ile Lys Lys Val Tyr  Asp Tyr Lys Phe Met  Leu Thr Ser
        995                 1000                1005

His Glu  Thr Tyr Thr Lys His  Gly
    1010                1015
```

<210> 601
<211> 1333
<212> PRT
<213> Planococcus antarcticus

<400> 601

```
Met Lys Asn Tyr Thr Ile Gly Leu Asp Ile Gly Val Ala Ser Val Gly
1               5                   10                  15

Trp Val Cys Ile Asp Glu Asn Tyr Lys Ile Leu Asn Tyr Asn Asn Arg
            20                  25                  30

His Ala Phe Gly Val His Glu Phe Glu Ser Ala Glu Ser Ala Ala Gly
        35                  40                  45

Arg Arg Leu Lys Arg Gly Met Arg Arg Arg Tyr Asn Arg Arg Lys Lys
    50                  55                  60

Arg Leu Gln Leu Leu Gln Ser Leu Phe Asp Ser Tyr Ile Thr Asp Ser
65                  70                  75                  80

Gly Phe Phe Ser Lys Thr Asp Ser Gln His Phe Trp Lys Asn Asn Asn
                85                  90                  95

Glu Phe Glu Asn Arg Ser Leu Thr Glu Val Leu Ser Ser Leu Arg Ile
            100                 105                 110
```

```
Ser Ser Arg Lys Tyr Pro Thr Ile Tyr His Leu Arg Ser Asp Leu Ile
        115                 120                 125

Glu Ser Asn Lys Lys Met Asp Leu Arg Leu Val Tyr Leu Ala Leu His
    130                 135                 140

Asn Leu Val Lys Tyr Arg Gly His Phe Leu Gln Glu Gly Asn Trp Ser
145                 150                 155                 160

Glu Ala Ala Ser Ala Glu Gly Met Asp Asp Gln Leu Leu Glu Leu Val
                165                 170                 175

Thr Arg Tyr Ala Glu Leu Glu Asn Leu Ser Pro Leu Asp Leu Ser Glu
            180                 185                 190

Ser Gln Trp Lys Ala Ala Glu Thr Leu Leu Leu Asn Arg Asn Leu Thr
        195                 200                 205

Lys Thr Asp Gln Ser Lys Glu Leu Thr Ala Met Phe Gly Lys Glu Tyr
    210                 215                 220

Glu Pro Phe Cys Lys Leu Val Ala Gly Leu Gly Val Ser Leu His Gln
225                 230                 235                 240

Leu Phe Pro Ser Ser Glu Gln Ala Leu Ala Tyr Lys Glu Thr Lys Thr
                245                 250                 255

Lys Val Gln Leu Ser Asn Glu Asn Val Glu Glu Val Met Glu Leu Leu
            260                 265                 270

Leu Glu Glu Glu Ser Ala Leu Leu Glu Ala Val Gln Pro Phe Tyr Gln
        275                 280                 285

Gln Val Val Leu Tyr Glu Leu Leu Lys Gly Glu Thr Tyr Val Ala Lys
    290                 295                 300

Ala Lys Val Ser Ala Phe Lys Gln Tyr Gln Lys Asp Met Ala Ser Leu
305                 310                 315                 320
```

```
Lys Asn Leu Leu Asp Lys Thr Phe Gly Glu Lys Val Tyr Arg Ser Tyr
               325                 330                 335

Phe Ile Ser Asp Lys Asn Ser Gln Arg Glu Tyr Gln Lys Ser His Lys
            340                 345                 350

Val Glu Val Leu Cys Lys Leu Asp Gln Phe Asn Lys Glu Ala Lys Phe
        355                 360                 365

Ala Glu Thr Phe Tyr Lys Asp Leu Lys Lys Leu Leu Glu Asp Lys Ser
    370                 375                 380

Lys Thr Ser Ile Gly Thr Thr Glu Lys Asp Glu Met Leu Arg Ile Ile
385                 390                 395                 400

Lys Ala Ile Asp Ser Asn Gln Phe Leu Gln Lys Gln Lys Gly Ile Gln
               405                 410                 415

Asn Ala Ala Ile Pro His Gln Asn Ser Leu Tyr Glu Ala Glu Lys Ile
            420                 425                 430

Leu Arg Asn Gln Gln Ala His Tyr Pro Phe Ile Thr Thr Glu Trp Ile
        435                 440                 445

Glu Lys Val Lys Gln Ile Leu Ala Phe Arg Ile Pro Tyr Tyr Ile Gly
    450                 455                 460

Pro Leu Val Lys Asp Thr Thr Gln Ser Pro Phe Ser Trp Val Glu Arg
465                 470                 475                 480

Lys Gly Asp Ala Pro Ile Thr Pro Trp Asn Phe Asp Glu Gln Ile Asp
               485                 490                 495

Lys Ala Ala Ser Ala Glu Ala Phe Ile Ser Arg Met Arg Lys Thr Cys
            500                 505                 510
```

```
Thr Tyr Leu Lys Gly Gln Glu Val Leu Pro Lys Ser Ser Leu Thr Tyr
        515                 520                 525

Glu Arg Phe Glu Val Leu Asn Glu Leu Asn Gly Ile Gln Leu Arg Thr
    530                 535                 540

Thr Gly Ala Glu Ser Asp Phe Arg His Arg Leu Ser Tyr Glu Met Lys
545                 550                 555                 560

Cys Trp Ile Ile Asp Asn Val Phe Lys Gln Tyr Lys Thr Val Ser Thr
                565                 570                 575

Lys Arg Leu Leu Gln Glu Leu Lys Lys Ser Pro Tyr Ala Asp Glu Leu
            580                 585                 590

Tyr Asp Glu His Thr Gly Glu Ile Lys Glu Val Phe Gly Thr Gln Lys
        595                 600                 605

Glu Asn Ala Phe Ala Thr Ser Leu Ser Gly Tyr Ile Ser Met Lys Ser
    610                 615                 620

Ile Leu Gly Ala Val Val Asp Asp Asn Pro Ala Met Thr Glu Glu Leu
625                 630                 635                 640

Ile Tyr Trp Ile Ala Val Phe Glu Asp Arg Glu Ile Leu His Leu Lys
                645                 650                 655

Ile Gln Glu Lys Tyr Pro Ser Ile Thr Asp Val Gln Arg Gln Lys Leu
            660                 665                 670

Ala Leu Val Lys Leu Pro Gly Trp Gly Arg Phe Ser Arg Leu Leu Ile
        675                 680                 685

Asp Gly Leu Pro Leu Asp Glu Gln Gly Gln Ser Val Leu Asp His Met
    690                 695                 700

Glu Gln Tyr Ser Ser Val Phe Met Glu Val Leu Lys Asn Lys Gly Phe
705                 710                 715                 720
```

```
Gly Leu Glu Lys Lys Ile Gln Lys Met Asn Gln His Gln Val Asp Gly
               725                 730                 735

Thr Lys Lys Ile Arg Tyr Glu Asp Ile Glu Glu Leu Ala Gly Ser Pro
            740                 745                 750

Ala Leu Lys Arg Gly Ile Trp Arg Ser Val Lys Ile Val Glu Glu Leu
        755                 760                 765

Val Ser Ile Phe Gly Glu Pro Ala Asn Ile Val Leu Glu Val Ala Arg
    770                 775                 780

Glu Asp Gly Glu Lys Lys Arg Thr Lys Ser Arg Lys Asp Gln Trp Glu
785                 790                 795                 800

Glu Leu Thr Lys Thr Thr Leu Lys Asn Asp Pro Asp Leu Lys Ser Phe
               805                 810                 815

Ile Gly Glu Ile Lys Ser Gln Gly Asp Gln Arg Phe Asn Glu Gln Arg
            820                 825                 830

Phe Trp Leu Tyr Val Thr Gln Gln Gly Lys Cys Leu Tyr Thr Gly Lys
        835                 840                 845

Ala Leu Asp Ile Gln Asn Leu Ser Met Tyr Glu Val Asp His Ile Leu
    850                 855                 860

Pro Gln Asn Phe Val Lys Asp Asp Ser Leu Asp Asn Leu Ala Leu Val
865                 870                 875                 880

Met Pro Glu Ala Asn Gln Arg Lys Asn Gln Val Gly Gln Asn Lys Met
               885                 890                 895

Pro Leu Glu Ile Ile Glu Ala Asn Gln Gln Tyr Ala Met Arg Thr Leu
            900                 905                 910
```

```
Trp Glu Arg Leu His Glu Leu Lys Leu Ile Ser Ser Gly Lys Leu Gly
        915                 920                 925


Arg Leu Lys Lys Pro Ser Phe Asp Glu Val Asp Lys Asp Lys Phe Ile
    930                 935                 940


Ala Arg Gln Leu Val Glu Thr Arg Gln Ile Ile Lys His Val Arg Asp
945                 950                 955                 960


Leu Leu Asp Glu Arg Phe Ser Lys Ser Asp Ile His Leu Val Lys Ala
                965                 970                 975


Gly Ile Val Ser Lys Phe Arg Arg Phe Ser Glu Ile Pro Lys Ile Arg
            980                 985                 990


Asp Tyr Asn Asn Lys His His Ala  Met Asp Ala Leu Phe  Ala Ala Ala
        995                 1000                1005


Leu Ile  Gln Ser Ile Leu Gly  Lys Tyr Gly Lys Asn  Phe Leu Ala
    1010                1015                1020


Phe Asp  Leu Ser Lys Lys Asp  Arg Gln Lys Gln Trp  Arg Ser Val
    1025                1030                1035


Lys Gly  Ser Asn Lys Glu Phe  Phe Leu Phe Lys Asn  Phe Gly Asn
    1040                1045                1050


Leu Arg  Leu Gln Ser Pro Val  Thr Gly Glu Glu Val  Ser Gly Val
    1055                1060                1065


Glu Tyr  Met Lys His Val Tyr  Phe Glu Leu Pro Trp  Gln Thr Thr
    1070                1075                1080


Lys Met  Thr Gln Thr Gly Asp  Gly Met Phe Tyr Lys  Glu Ser Ile
    1085                1090                1095


Phe Ser  Pro Lys Val Lys Gln  Ala Lys Tyr Val Ser  Pro Lys Thr
    1100                1105                1110
```

```
Glu Lys  Phe Val His Asp Glu  Val Lys Asn His Ser  Ile Cys Leu
    1115                1120                1125

Val Glu  Phe Thr Phe Met Lys  Lys Glu Lys Glu Val  Gln Glu Thr
    1130                1135                1140

Lys Phe  Ile Asp Leu Lys Val  Ile Glu His His Gln  Phe Leu Lys
    1145                1150                1155

Glu Pro  Glu Ser Gln Leu Ala  Lys Phe Leu Ala Glu  Lys Glu Thr
    1160                1165                1170

Asn Ser  Pro Ile Ile His Ala  Arg Ile Ile Arg Thr  Ile Pro Lys
    1175                1180                1185

Tyr Gln  Lys Ile Trp Ile Glu  His Phe Pro Tyr Tyr  Phe Ile Ser
    1190                1195                1200

Thr Arg  Glu Leu His Asn Ala  Arg Gln Phe Glu Ile  Ser Tyr Glu
    1205                1210                1215

Leu Met  Glu Lys Val Lys Gln  Leu Ser Glu Arg Ser  Ser Val Glu
    1220                1225                1230

Glu Leu  Lys Ile Val Phe Gly  Leu Leu Ile Asp Gln  Met Asn Asp
    1235                1240                1245

Asn Tyr  Pro Ile Tyr Thr Lys  Ser Ser Ile Gln Asp  Arg Val Gln
    1250                1255                1260

Lys Phe  Val Asp Thr Gln Leu  Tyr Asp Phe Lys Ser  Phe Glu Ile
    1265                1270                1275

Gly Phe  Glu Glu Leu Lys Lys  Ala Val Ala Ala Asn  Ala Gln Arg
    1280                1285                1290
```

```
Ser Asp  Thr Phe Gly Ser Arg  Ile Ser Lys Lys Pro  Lys Pro Glu
    1295                1300                1305


Glu Val  Ala Ile Gly Tyr Glu  Ser Ile Thr Gly Leu  Lys Tyr Arg
    1310                1315                1320


Lys Pro  Arg Ser Val Val Gly  Thr Lys Arg
    1325                1330
```

<210> 602
<211> 211
<212> PRT
<213> Porphyromonas catoniae

<400> 602

```
Met Gly Lys Lys Val Leu Gly Leu Asp Leu Gly Val Gly Ser Ile Gly
1               5                   10                  15


Trp Cys Leu Ile Thr Leu Asp Lys Asp Glu Lys Pro Gln Ser Ile Leu
            20                  25                  30


Gly Met Gly Ser Arg Ile Val Pro Leu Ser Ala Asp Asp Ala Thr Glu
        35                  40                  45


Phe Thr Gln Gly Lys Ala Ile Thr Lys Asn Lys Met Arg Thr Val Ala
    50                  55                  60


Arg Thr Ile Arg Lys Gly Met Asp Arg Tyr Gln Leu Arg Arg Glu Ala
65                  70                  75                  80


Leu Lys Lys Val Leu Arg Glu His Ala Met Leu Pro Asp Glu Ala Leu
                85                  90                  95


Ile Lys Leu Pro Leu Leu Glu Leu Trp Glu Leu Arg Ala Arg Ala Ala
            100                 105                 110


Thr Pro Gly Glu Gln Val Ser Leu Thr Glu Leu Gly Arg Val Leu Leu
        115                 120                 125
```

```
His Ile Asn Gln Lys Arg Gly Tyr Lys His Ala Lys Ala Asp Glu Ala
    130                 135                 140

Ala Glu Ala Glu Thr Lys Lys Gly Lys Glu Thr Gly Tyr Val Ala Gln
145                 150                 155                 160

Val Lys Gly Arg Tyr Gln Ile Leu Lys Glu Lys Gly Leu Thr Ile Gly
                165                 170                 175

Gln His Phe Ala Gly Glu Leu Arg Ala Asn Gln Gln Thr Ala Pro Arg
            180                 185                 190

Gly Thr Tyr Tyr Thr Tyr Arg Ile Lys Glu Gln Val Tyr Pro Arg Val
        195                 200                 205

Arg Gly Val
    210
```

<210> 603
<211> 1009
<212> PRT
<213> Porphyromonas catoniae

<400> 603

```
Met Arg Ile Ile Arg Glu Ala Tyr Ile Glu Glu Tyr Asp Arg Ile Met
1               5                   10                  15

Ala Val Gln Arg Val Phe Tyr Pro Glu Leu Leu Thr Asp Ala Leu Ile
            20                  25                  30

Gly Arg Ile Arg Asp Arg Ile Ile Phe Tyr Gln Arg Pro Leu Lys Ser
        35                  40                  45

Cys Lys Gln Leu Val Ser Phe Cys Glu Phe Glu Lys Lys Glu Lys Val
    50                  55                  60

Ile Arg Val Lys His Thr Asn Lys Glu Gly Val Gln Glu Leu Val Glu
65                  70                  75                  80
```

```
Lys Thr Ile Thr Ile Gly Pro Lys Val Ala Pro Lys Ser Ser Pro Ile
                85                  90                  95

Phe Gln Val Cys Lys Val Trp Glu Ser Ile His Asn Ile Arg Leu Tyr
            100                 105                 110

His Pro Asp Gly Thr Glu Arg Lys Leu Glu Gln Glu Glu Lys Gln Lys
        115                 120                 125

Leu Phe Asp Tyr Leu Gln Arg Asn Asp Lys Leu Ser Leu Thr Thr Leu
    130                 135                 140

Arg Lys Glu Leu Lys Ile Lys Pro Lys Asp Lys Leu Trp Cys Asp Lys
145                 150                 155                 160

Leu Leu Glu Lys Gly Ile Ala Gly Asn Thr Thr Ala Ala Ile Leu Arg
                165                 170                 175

Lys Ala Phe Lys Gly Tyr Glu His Tyr Glu Arg Leu Phe Arg Phe Asp
            180                 185                 190

Leu Val Arg Arg Asp Ser His Glu Ala Asp Glu Asp Gly Val Ile Arg
        195                 200                 205

Pro Ile Ile Asp Glu Ser Tyr Gln Asn Glu Pro Leu Tyr Lys Leu Trp
    210                 215                 220

His Ile Leu Tyr Ser Ile Glu Asp Arg Ala Glu Met Arg Ser Ala Leu
225                 230                 235                 240

Ile Gly Gln Leu Gly Ile Lys Ala Glu Asp Leu Asp Asn Gly Leu Met
                245                 250                 255

Asp Ala Leu Tyr Lys Ile Asp Phe Val Lys Gln Gly Tyr Gly Asn Lys
            260                 265                 270
```

```
Ser Ala Lys Phe Ile Cys Lys Leu Leu Pro His Leu Gln Glu Gly Lys
        275                 280                 285

Met Tyr Ser Glu Ala Ala Glu Ala Ala Gly Met Arg His Ser Asp Ser
    290                 295                 300

Met Thr Ala Gln Glu Arg Asp Glu Arg Asn Leu Leu Glu Glu Ile Pro
305                 310                 315                 320

Leu Leu Gln Lys Asn Ala Leu Arg Gln Pro Val Val Glu Lys Val Leu
                325                 330                 335

Asn Gln Met Ile Asn Leu Val Asn Ala Leu Lys Arg Glu His Gly Glu
            340                 345                 350

Ile Asp Glu Val Arg Val Glu Leu Ala Arg Glu Leu Lys Met Ser Arg
        355                 360                 365

Glu Glu Arg Glu Lys Ala Thr Lys Asn Asn Ser Ser Arg Glu Lys Glu
    370                 375                 380

Asn Lys Ala Ile Ala Glu Arg Ile Thr Glu Tyr Gly Leu Thr Pro Thr
385                 390                 395                 400

Lys Ser Arg Ile Gln Lys Tyr Arg Leu Trp Gln Glu Ser Ala Glu Ser
                405                 410                 415

Cys Ile Tyr Cys Gly Lys Arg Val Asp Val Val Gln Phe Leu Arg Gly
            420                 425                 430

Glu Glu Thr Glu Val Glu His Ile Ile Pro Lys Ser Ile Leu Phe Asp
        435                 440                 445

Asp Ser Leu Ser Asn Lys Ala Cys Ala Cys Arg Ser Cys Asn Gln Glu
    450                 455                 460

Lys Gly Asn Arg Phe Ala Met Glu Tyr Ile Gln Ala Lys Gly Trp Glu
465                 470                 475                 480
```

```
Gln Asp Tyr Ile Glu Arg Val Asp Ser Leu Phe His Asp Lys Lys Ile
               485                 490                 495

Ser Tyr Ser Lys Arg Gln His Leu Leu Met Leu Pro Lys Asp Leu Pro
            500                 505                 510

Glu Asp Phe Ile Glu Arg His Leu Arg Leu Ser Gln Tyr Ile Ser Arg
        515                 520                 525

Glu Ala Gln Gly Ile Leu Arg Lys Gly Ile Arg Leu Val Ser Ala Ser
    530                 535                 540

Glu Gly Gly Val Thr Ala Lys Leu Arg Gln Leu Trp Gly Tyr Asp Asn
545                 550                 555                 560

Ile Leu Arg Asp Leu Asn Leu Glu Arg Tyr Lys Ser Met Gly Glu Thr
               565                 570                 575

Glu Val Val Thr Val Glu His Arg Asp Gly Gln Arg Thr Asp Glu Arg
            580                 585                 590

Ile Lys Asp Trp Ser Lys Arg Lys Asp His Arg His His Ala Ile Asp
        595                 600                 605

Ala Leu Val Val Ala Cys Thr Arg Gln Ser Tyr Ile Gln Arg Leu Asn
    610                 615                 620

Arg Val Asn Ala Glu Ala Asp Arg Gln Glu Met Asp Ala Phe Ile Lys
625                 630                 635                 640

Glu Gln Gln Gln Glu His Lys Leu Ser Lys Lys Glu Lys Leu Ser Leu
               645                 650                 655

Leu Glu Asn Trp Leu Lys Glu Gln Pro His Phe Thr Thr Gly Glu Val
            660                 665                 670
```

```
Lys Glu His Ala Glu Gly Ile Leu Ile Ser Phe Arg Pro Gly Lys Arg
        675                 680                 685

Thr Val Ser Arg Gly Arg Asn Ile Tyr Lys Arg Ser Gly Lys Thr Asp
    690                 695                 700

Val Gln Arg Asn Val Leu Ile Pro Arg Gly Ala Leu Ser Glu Glu Thr
705                 710                 715                 720

Val Tyr Gly Val Ile Ser Val Asp Gly Glu Asn Lys Val Val Cys Lys
                725                 730                 735

Tyr Pro Leu Gln Lys Phe Leu Asp Thr Lys Glu Thr Asn Val Asp Lys
            740                 745                 750

Ile Ala Asp Gln Ala Ala Glu Lys Ile Val Asp Lys Val Leu Arg Glu
        755                 760                 765

Lys Ile Arg Glu Arg Ile Lys Arg Tyr Gly Lys Lys Glu Ala Phe Ala
    770                 775                 780

Glu Pro Leu Tyr Leu Asp Glu Ala Gln Thr Gln Val Val Arg Ser Val
785                 790                 795                 800

Arg Cys Phe Ile Ser Lys Asp Gln Ala Lys Leu Ile Pro Leu Arg Tyr
                805                 810                 815

Asn Asp Glu Ser Glu Ala Val Gly Phe Val Ala Pro Gly Asn Asn His
            820                 825                 830

His Leu Ala Leu Tyr Arg Asp Ala Ser Gly Lys Met Arg Ala Ser Val
        835                 840                 845

Val Ser Phe Phe Ala Ala Val Glu Arg Ala Arg Tyr Gly Ile Pro Met
    850                 855                 860

Ile Val Leu Asn Pro Arg Glu Thr Arg Glu Lys Ala Arg Ile Ile Pro
865                 870                 875                 880
```

```
Asp Leu Pro Glu Ser Ile Phe Ser Lys Leu Pro Glu Glu Asp Trp Val
                885                 890                 895


Leu Glu Glu Thr Leu Gln Glu Gly Glu Met Val Leu Leu Gly Met Glu
            900                 905                 910


Asn Asp Ala Ile Glu Glu Ala Ile Lys Lys Lys Asp Tyr Ser Lys Leu
        915                 920                 925


Ser Arg Tyr Leu Tyr Arg Val Gln Ser Leu Ser Tyr Asn Asp Tyr Lys
    930                 935                 940


Phe Cys Phe His Leu Glu Thr Glu Ser Glu Lys Lys Glu Lys Lys Lys
945                 950                 955                 960


Gly Glu Asp Lys Lys Arg Gly Glu Lys Ala Lys Asn Thr Ala Val Met
                965                 970                 975


Pro Pro Lys Arg Tyr Arg Ile Arg Cys Leu Ala Thr Tyr Gln Glu Asp
            980                 985                 990


Leu Asn Pro Arg Lys Val Lys Ile  Asp Leu Leu Gly Arg  Ile Ser Leu
        995                 1000                1005


Ala
```

<210> 604
<211> 1197
<212> PRT
<213> Porphyromonas sp.

<400> 604

```
Met Leu Met Ser Lys His Val Leu Gly Leu Asp Leu Gly Val Gly Ser
1               5                   10                  15


Ile Gly Trp Cys Leu Ile Ala Leu Asp Ala Gln Gly Asp Pro Ala Glu
```

```
            20                  25                  30

Ile Leu Gly Met Gly Ser Arg Val Val Pro Leu Asn Asn Ala Thr Lys
        35                  40                  45

Ala Ile Glu Ala Phe Asn Ala Gly Ala Ala Phe Thr Ala Ser Gln Glu
    50                  55                  60

Arg Thr Ala Arg Arg Thr Met Arg Arg Gly Phe Ala Arg Tyr Gln Leu
65                  70                  75                  80

Arg Arg Tyr Arg Leu Arg Arg Glu Leu Glu Lys Val Gly Met Leu Pro
                85                  90                  95

Asp Ala Ala Leu Ile Gln Leu Pro Leu Leu Glu Leu Trp Glu Leu Arg
            100                 105                 110

Glu Arg Ala Ala Thr Ala Gly Arg Arg Leu Thr Leu Pro Glu Leu Gly
        115                 120                 125

Arg Val Leu Cys His Ile Asn Gln Lys Arg Gly Tyr Arg His Val Lys
    130                 135                 140

Ser Asp Ala Ala Ala Ile Val Gly Asp Glu Gly Glu Lys Lys Lys Asp
145                 150                 155                 160

Ser Asn Ser Ala Tyr Leu Ala Gly Ile Arg Ala Asn Asp Glu Lys Leu
                165                 170                 175

Gln Ala Glu His Lys Thr Val Gly Gln Tyr Phe Ala Glu Gln Leu Arg
            180                 185                 190

Gln Asn Gln Ser Glu Ser Pro Thr Gly Gly Ile Ser Tyr Arg Ile Lys
        195                 200                 205

Asp Gln Ile Phe Ser Arg Gln Cys Tyr Ile Asp Glu Tyr Asp Gln Ile
    210                 215                 220
```

```
Met Ala Val Gln Arg Val His Tyr Pro Asp Ile Leu Thr Asp Glu Phe
225                 230                 235                 240

Ile Arg Met Leu Arg Asp Glu Val Ile Phe Met Gln Arg Pro Leu Lys
                245                 250                 255

Ser Cys Lys His Leu Val Ser Leu Cys Glu Phe Glu Lys Gln Glu Arg
            260                 265                 270

Val Met Arg Val Gln Gln Asp Asp Gly Lys Gly Gly Trp Gln Leu Val
        275                 280                 285

Glu Arg Arg Val Lys Phe Gly Pro Lys Val Ala Pro Lys Ser Ser Pro
    290                 295                 300

Leu Phe Gln Leu Cys Cys Ile Tyr Glu Ala Val Asn Asn Ile Arg Leu
305                 310                 315                 320

Thr Arg Pro Asn Gly Ser Pro Cys Asp Ile Thr Pro Glu Glu Arg Ala
                325                 330                 335

Lys Ile Val Ala His Leu Gln Ser Ser Ala Ser Leu Ser Phe Ala Ala
            340                 345                 350

Leu Lys Lys Leu Leu Lys Glu Lys Ala Leu Ile Ala Asp Gln Leu Thr
        355                 360                 365

Ser Lys Ser Gly Leu Lys Gly Asn Ser Thr Arg Val Ala Leu Ala Ser
    370                 375                 380

Ala Leu Gln Pro Tyr Pro Gln Tyr His His Leu Leu Asp Met Glu Leu
385                 390                 395                 400

Glu Thr Arg Met Met Thr Val Gln Leu Thr Asp Glu Glu Thr Gly Glu
                405                 410                 415

Val Thr Glu Arg Glu Val Ala Val Val Thr Asp Ser Tyr Val Arg Lys
```

```
            420                 425                 430

Pro Leu Tyr Arg Leu Trp His Ile Leu Tyr Ser Ile Glu Glu Arg Glu
        435                 440                 445

Ala Met Arg Arg Ala Leu Ile Thr Gln Leu Gly Met Lys Glu Glu Asp
    450                 455                 460

Leu Asp Gly Gly Leu Leu Asp Gln Leu Tyr Arg Leu Asp Phe Val Lys
465                 470                 475                 480

Pro Gly Tyr Gly Asn Lys Ser Ala Lys Phe Ile Cys Lys Leu Leu Pro
                485                 490                 495

Gln Leu Gln Gln Gly Leu Gly Tyr Ser Glu Ala Cys Ala Ala Val Gly
            500                 505                 510

Tyr Arg His Ser Asn Ser Pro Thr Ser Glu Glu Ile Thr Glu Arg Thr
        515                 520                 525

Leu Leu Glu Lys Ile Pro Leu Leu Gln Arg Asn Glu Leu Arg Gln Pro
    530                 535                 540

Leu Val Glu Lys Ile Leu Asn Gln Met Ile Asn Leu Val Asn Ala Leu
545                 550                 555                 560

Lys Ala Glu Tyr Gly Ile Asp Glu Val Arg Val Glu Leu Ala Arg Glu
                565                 570                 575

Leu Lys Met Ser Arg Glu Glu Arg Glu Arg Met Ala Arg Asn Asn Lys
            580                 585                 590

Asp Arg Glu Glu Arg Asn Lys Gly Val Ala Ala Lys Ile Arg Glu Cys
        595                 600                 605

Gly Leu Tyr Pro Thr Lys Pro Arg Ile Gln Lys Tyr Met Leu Trp Lys
    610                 615                 620
```

```
Glu Ala Gly Arg Gln Cys Leu Tyr Cys Gly Arg Ser Ile Glu Glu Glu
625                 630                 635                 640


Gln Cys Leu Arg Glu Gly Gly Met Glu Val Glu His Ile Ile Pro Lys
                645                 650                 655


Ser Val Leu Tyr Asp Asp Ser Tyr Gly Asn Lys Thr Cys Ala Cys Arg
            660                 665                 670


Arg Cys Asn Lys Glu Lys Gly Asn Arg Thr Ala Leu Glu Tyr Ile Arg
        675                 680                 685


Ala Lys Gly Arg Glu Ala Glu Tyr Met Lys Arg Ile Asn Asp Leu Leu
    690                 695                 700


Lys Glu Lys Lys Ile Ser Tyr Ser Lys His Gln Arg Leu Arg Trp Leu
705                 710                 715                 720


Lys Glu Asp Ile Pro Ser Asp Phe Leu Glu Arg Gln Leu Arg Leu Thr
                725                 730                 735


Gln Tyr Ile Ser Arg Gln Ala Met Ala Ile Leu Gln Gln Gly Ile Arg
            740                 745                 750


Arg Val Ser Ala Ser Glu Gly Gly Val Thr Ala Arg Leu Arg Ser Leu
        755                 760                 765


Trp Gly Tyr Gly Lys Ile Leu His Thr Leu Asn Leu Asp Arg Tyr Asp
    770                 775                 780


Ser Met Gly Glu Thr Glu Arg Val Ser Arg Glu Gly Glu Ala Thr Glu
785                 790                 795                 800


Glu Leu His Ile Thr Asn Trp Ser Lys Arg Met Asp His Arg His His
                805                 810                 815


Ala Ile Asp Ala Leu Val Val Ala Cys Thr Arg Gln Ser Tyr Ile Gln
```

```
            820                 825                 830

Arg Leu Asn Arg Leu Ser Ser Glu Phe Gly Arg Glu Asp Lys Lys Lys
        835                 840                 845

Glu Asp Gln Glu Ala Gln Glu Gln Gln Ala Thr Glu Thr Gly Arg Leu
    850                 855                 860

Ser Asn Leu Glu Arg Trp Leu Thr Gln Arg Pro His Phe Ser Val Arg
865                 870                 875                 880

Thr Val Ser Asp Lys Val Ala Glu Ile Leu Ile Ser Tyr Arg Pro Gly
                885                 890                 895

Gln Arg Val Val Thr Arg Gly Arg Asn Ile Tyr Arg Lys Lys Met Ala
            900                 905                 910

Asp Gly Arg Glu Val Ser Cys Val Gln Arg Gly Val Leu Val Pro Arg
        915                 920                 925

Gly Glu Leu Met Glu Ala Ser Phe Tyr Gly Lys Ile Leu Ser Gln Gly
    930                 935                 940

Arg Val Arg Ile Val Lys Arg Tyr Pro Leu His Asp Leu Lys Gly Glu
945                 950                 955                 960

Val Val Asp Pro His Leu Arg Glu Leu Ile Thr Thr Tyr Asn Gln Glu
                965                 970                 975

Leu Lys Ser Arg Glu Lys Gly Ala Pro Ile Pro Pro Leu Cys Leu Asp
            980                 985                 990

Lys Asp Lys Lys Gln Glu Val Arg  Ser Val Arg Cys Tyr  Ala Lys Thr
        995                 1000                1005

Leu Ser  Leu Asp Lys Ala Ile  Pro Met Cys Phe Asp  Glu Lys Gly
    1010                1015                1020
```

```
Glu Pro  Thr Ala Phe Val Lys  Ser Ala Ser Asn His  His Leu Ala
    1025                1030                1035

Leu Tyr  Arg Thr Pro Lys Gly  Lys Leu Val Glu Ser  Ile Val Thr
    1040                1045                1050

Phe Trp  Asp Ala Val Asp Arg  Ala Arg Tyr Gly Ile  Pro Leu Val
    1055                1060                1065

Ile Thr  His Pro Arg Glu Val  Met Glu Gln Val Leu  Gln Arg Gly
    1070                1075                1080

Asp Ile  Pro Glu Gln Val Leu  Ser Leu Leu Pro Pro  Ser Asp Trp
    1085                1090                1095

Val Phe  Val Asp Ser Leu Gln  Gln Asp Glu Met Val  Val Ile Gly
    1100                1105                1110

Leu Ser  Asp Glu Glu Leu Gln  Arg Ala Leu Glu Ala  Gln Asn Tyr
    1115                1120                1125

Arg Lys  Ile Ser Glu His Leu  Tyr Arg Val Gln Lys  Met Ser Ser
    1130                1135                1140

Ser Tyr  Tyr Val Phe Arg Tyr  His Leu Glu Thr Ser  Val Ala Asp
    1145                1150                1155

Asp Lys  Asn Thr Ser Gly Arg  Ile Pro Lys Phe His  Arg Val Gln
    1160                1165                1170

Ser Leu  Lys Ala Tyr Glu Glu  Arg Asn Ile Arg Lys  Val Arg Val
    1175                1180                1185

Asp Leu  Leu Gly Arg Ile Ser  Leu Leu
    1190                1195
```

<210> 605

<211> 1422
<212> PRT
<213> Prevotella denticola

<400> 605

Met Thr Gln Lys Val Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly
1 5 10 15

Ser Ser Val Arg Asn Leu Asp Leu Ser Asp Asp Leu Lys Gly Gln Leu
20 25 30

Glu Phe Phe Ser Ser Asp Ile Phe Arg Ser Ser Val Asn Lys Glu Ser
35 40 45

Asn Gly Arg Glu Tyr Ser Leu Ala Ala Gln Arg Ser Ala His Ser Arg
50 55 60

Ser Arg Gly Leu Asn Glu Ala Arg Arg Arg Lys Leu Trp Ala Thr Leu
65 70 75 80

Asp Leu Leu Ile Lys Tyr Gly Phe Cys Pro Met Ser Pro Glu Ser Leu
85 90 95

Met Arg Trp Arg Thr Tyr Asp Lys Gln Arg Gly Leu Phe Arg Glu Tyr
100 105 110

Pro Ile Asp Asp Lys Asn Phe Asn Ala Trp Ile Leu Leu Asp Phe Asp
115 120 125

Gly Asp Gly Lys Pro Asp Tyr Ser Ser Pro Tyr Gln Leu Arg Arg Glu
130 135 140

Leu Val Ile Arg Gln Phe Asp Phe Asp Gln Pro Ile Glu Arg Tyr Lys
145 150 155 160

Leu Gly Arg Ala Leu Tyr His Ile Ala Gln His Arg Gly Phe Lys Ser
165 170 175

```
Ser Lys Gly Glu Thr Leu Ser Gln Gln Glu Thr Asn Ser Lys Gln Ser
            180                 185                 190

Leu Thr Asp Asp Thr Ala Asp Val Ala Gly Glu Met Lys Ala Ser Glu
        195                 200                 205

Glu Lys Leu Ser Lys Gly Leu Ser Thr Tyr Met Lys Glu Asn Asn Leu
    210                 215                 220

Leu Thr Val Gly Ala Ala Phe Ala Gln Leu Glu Asp Glu Gly Val Arg
225                 230                 235                 240

Val Arg Asn Asn Asn Asp Tyr Arg Ala Ile Arg Ser Gln Phe Gln Arg
                245                 250                 255

Glu Ile Glu Thr Ile Phe Lys Phe Gln Gln Gly Leu Ser Val Glu Asn
            260                 265                 270

Glu Leu Tyr Glu Arg Leu Val Ser Glu Lys Lys Asn Ile Gly Thr Ile
        275                 280                 285

Phe Tyr Lys Arg Pro Leu Arg Ser Gln Arg Gly Asn Val Gly Lys Cys
    290                 295                 300

Thr Leu Glu Arg Thr Lys Pro Arg Cys Ala Ile Gly His Pro Leu Phe
305                 310                 315                 320

Glu Lys Phe Arg Ala Trp Thr Leu Ile Asn Asn Ile Lys Val Arg Met
                325                 330                 335

Ser Glu Glu Glu Gln Ala Glu Gln Leu Pro Met Lys Leu Arg Phe Glu
            340                 345                 350

Leu Tyr Asn Asp Cys Phe Leu Ala Phe Val Arg Ala Glu Phe Lys Phe
        355                 360                 365

Glu Asp Ile Arg Lys Tyr Leu Glu Lys Arg Leu Gly Val His Phe Ser
    370                 375                 380
```

```
Tyr Asn Asp Lys Thr Ile Asn Tyr Lys Asp Ser Thr Ser Val Ala Gly
385                 390                 395                 400

Cys Pro Ile Thr Ala Arg Phe Arg Lys Leu Leu Gly Glu Asp Trp Glu
                405                 410                 415

Ser Phe His Val Asp Gly Gln Lys Gln Arg Gln Ala His Gly Lys Asn
            420                 425                 430

Asn Ala Ser Phe His Thr Val Ser Tyr Ser Thr Asn Asp Ile Trp His
        435                 440                 445

Phe Cys Tyr Asp Ala Glu Glu Pro Glu Ala Val Leu Ser Phe Ala Gln
    450                 455                 460

Asp Asn Leu Lys Trp Glu Lys Lys Lys Ala Glu Glu Leu Val Arg Ile
465                 470                 475                 480

Trp Ser Ala Ile Pro Gln Gly Tyr Ala Met Leu Ser Gln Lys Ala Ile
                485                 490                 495

Arg Asn Ile Asn Lys Met Leu Ile Leu Gly Leu Lys Tyr Ser Asp Ala
            500                 505                 510

Val Leu Leu Ala Lys Val Pro Glu Ile Val Glu Ile Thr Asp Gly Glu
        515                 520                 525

Ile Leu Ser Val Thr Glu Asp Tyr His Arg Val Glu Ala Gln Val Gly
    530                 535                 540

Tyr Glu Lys Gln Ile Asn Asn Ile Val Asn Ala Leu Ile Ala Lys Tyr
545                 550                 555                 560

Lys Ser Ala Ser Glu Glu Tyr Arg Phe Ala Asp His Asn Tyr Glu Tyr
                565                 570                 575
```

```
Gln Leu Asp Lys Ser Asp Glu Lys Asp Ile Ile Lys Gln Ile Glu Ser
            580                 585                 590

Asn Ile Gly Thr Arg Lys Trp Ser Leu Leu Asp Ala Asp Glu Gln Thr
        595                 600                 605

Asp Ile Leu Gln Lys Val Arg Asp Lys Tyr Gln Asn Phe Phe Arg Ser
    610                 615                 620

His Glu Arg Lys Phe Val Glu Ser Pro Lys Leu Gly Glu Cys Phe Glu
625                 630                 635                 640

Glu Tyr Leu Met Lys Lys Phe Pro Met Val Glu Gly Glu Arg Trp Lys
                645                 650                 655

Lys Leu Tyr His Pro Ser Gln Ile Ala Ile Tyr Arg Pro Val Pro Ala
            660                 665                 670

Asn Lys Asp Arg Ser Ala Leu Arg Leu Gly Asn Pro Asp Ile Gly Ala
        675                 680                 685

Ile Lys Asn Pro Thr Val Leu Arg Val Leu Asn Thr Leu Arg Lys Arg
    690                 695                 700

Val Asn Gln Leu Leu Asp Asp Gly Ile Ile Ser Pro Asp Glu Thr Arg
705                 710                 715                 720

Val Val Val Glu Thr Ala Arg Glu Leu Asn Asp Ala Asn Arg Lys Trp
                725                 730                 735

Ala Leu Asp Thr Tyr Asn Arg Ile Arg His Asp Glu Asn Glu Lys Ile
            740                 745                 750

Lys Lys Ile Leu Ala Glu Phe Tyr Pro Lys Arg Asp Asn Ile Ser Thr
        755                 760                 765

Val Asp Ile Asp Lys Ala Arg Tyr Val Ile Asp Gln Arg Glu Met Asp
    770                 775                 780
```

```
Tyr Phe Thr Glu Ala Lys Thr Tyr His Lys Asp Ile Lys Lys Tyr Lys
785                 790                 795                 800


Leu Trp Leu Glu Gln Gly Gly Gln Cys Met Tyr Thr Gly Arg Thr Ile
                805                 810                 815


Asn Leu Ser Asn Leu Phe Asp Pro Asn Ser Phe Asp Val Glu His Thr
            820                 825                 830


Ile Pro Glu Ser Ile Ser Phe Asp Ser Ser Asp Met Asn Leu Thr Leu
        835                 840                 845


Cys Asp Ala His Tyr Asn Arg Phe Ile Lys Lys Asn His Ile Pro Ala
    850                 855                 860


Asp Leu Pro Asn Tyr Asp Lys Ser Val Val Ile Asp Gly Lys Glu Tyr
865                 870                 875                 880


Ser Pro Ile Lys Pro Arg Leu Gln Arg Trp Ala Asp Arg Val Glu Arg
                885                 890                 895


Leu Asn Arg Asn Val Glu Tyr Trp Arg Gly Gln Ala Arg Arg Ala Gln
            900                 905                 910


Asn Lys Asp Arg Lys Asp Gln Cys Met Arg Glu Met His Leu Trp Lys
        915                 920                 925


Met Glu Leu Glu Tyr Trp Thr Lys Lys Leu Glu Arg Phe Thr Ile Thr
    930                 935                 940


Glu Val Thr Asp Glu Phe Lys Asn Ser Gln Leu Val Asp Thr Arg Val
945                 950                 955                 960


Ile Thr Arg His Ala Val Leu Tyr Leu Lys Ser Ile Phe Pro His Val
                965                 970                 975
```

```
Asp Val Gln Arg Gly Asp Val Thr Ala Lys Phe Arg Lys Ile Leu Gly
            980                 985                 990


Ile Gln Ser Val Asp Glu Lys Lys  Asp Arg Ser Leu His  Ser His His
        995                1000                1005


Ala Ile  Asp Ala Thr Thr Leu  Thr Ile Ile Pro Gly  Ala Ala Lys
    1010                1015                1020


Arg Glu  Arg Met Leu Glu Leu  Phe Ala Lys Ile Glu  Glu Val Asn
    1025                1030                1035


Lys Met  Leu Ser Phe Ser Gly  Asn Glu Asp Arg Thr  Gly Leu Lys
    1040                1045                1050


Gln Glu  Leu Asp Gly Leu Lys  Asn Gln Leu Asn Lys  Glu Val Lys
    1055                1060                1065


Ala Cys  Arg Ile Gly His Asn  Val Ser Glu Ile Gly  Thr Phe Ile
    1070                1075                1080


Asn Asp  Asn Ile Ile Ile Asn  His His Val Lys Asn  Gln Ala Leu
    1085                1090                1095


Thr Pro  Val Arg Arg Arg Leu  Arg Lys Arg Gly His  Ile Val Gly
    1100                1105                1110


Gly Met  Asp Asn Pro Arg Trp  Gln Thr Gly Asp Ala  Leu Arg Gly
    1115                1120                1125


Glu Ile  His Lys Ala Ser Tyr  Tyr Gly Ala Ile Thr  Gln Tyr Ala
    1130                1135                1140


Lys Asp  Lys Glu Gly Lys Val  Leu Met Lys Glu Gly  Arg Pro Gln
    1145                1150                1155


Ile Asn  Pro Thr Ile Lys Phe  Val Ile Arg Arg Glu  Leu Lys Tyr
    1160                1165                1170
```

```
Lys Lys  Ser Ser Thr Asp Ser  Gly Phe Ala Ser Trp  Asp Asp Leu
    1175                1180                1185

Gly Lys  Ala Ile Val Asp Lys  Glu Leu Phe Ala Leu  Met Lys Gly
    1190                1195                1200

Gln Phe  Pro Glu Gly Thr Ser  Phe Lys Asp Ala Cys  Glu Gln Gly
    1205                1210                1215

Ile Tyr  Met Ile Lys Lys Gly  Lys Asn Gly Glu Val  Asp Thr Lys
    1220                1225                1230

Leu Tyr  Arg Ile Arg His Ile  Arg Cys Lys Thr Lys  Gln Lys Asn
    1235                1240                1245

Ala Leu  Lys Ile Lys Glu Gln  Ala Tyr Lys Ser Glu  Lys Glu Tyr
    1250                1255                1260

Lys Arg  Tyr Phe Tyr Ala Ala  Val Gly Asp Leu Tyr  Ala Met Cys
    1265                1270                1275

Cys Tyr  Thr Asn Gly Lys Thr  Arg Glu Phe Lys Ile  Tyr Ser Leu
    1280                1285                1290

Tyr Asp  Ile Ser Cys His Arg  Lys Val Gly Val Glu  Asp Ile Pro
    1295                1300                1305

Glu Phe  Ile Thr Asp Lys Lys  Gly Asn Arg Leu Met  Leu Asp Tyr
    1310                1315                1320

Lys Leu  His Thr Gly Asp Met  Ile Leu Leu Tyr Lys  Glu Asn Pro
    1325                1330                1335

Glu Glu  Leu Tyr Asp Leu Asp  Asn Val Ser Leu Ser  Lys Leu Leu
    1340                1345                1350
```

```
Tyr Lys  Ile Asn Gly Phe Glu  Asn Asp Gly Leu Arg  Ile Arg Met
    1355                1360                1365


Val Asn  His Leu Val Ala Lys  Glu Ala Met Gly Glu  Ser Val Lys
    1370                1375                1380


Asp Tyr  Ala Lys Leu Pro Asp  Ile Ile Arg Cys Gly  Val Lys Thr
    1385                1390                1395


Ile Lys  Phe Leu Val Met Gly  Glu Asn Arg Asp Phe  Val Ile Lys
    1400                1405                1410


Asn Gly  Lys Ile Ser Phe Asn  His Arg
    1415                1420
```

<210> 606
<211> 443
<212> PRT
<213> Prevotella disiens

<400> 606

```
Met Glu Leu Asp Tyr Trp Lys Gly Lys Tyr Asn Arg Phe Thr Met Thr
1               5                   10                  15


Glu Ile Pro Glu Gly Phe Ser Arg Arg Gln Gly Met Gly Ile Gly Leu
            20                  25                  30


Ile Ser Arg Tyr Ala Gly Leu Tyr Leu Lys Thr Ile Phe His Lys Lys
        35                  40                  45


Asp Asn Pro Gln Lys Ser Asn Val Tyr Ile Val Lys Gly Ser Ile Thr
    50                  55                  60


Ala Glu Phe Arg Arg Ile Trp Asn Ile Gln Asp Asp Tyr Glu Lys Lys
65                  70                  75                  80


Cys Arg Asp Asn His Ile His His Cys Ile Asp Ala Ile Val Val Gly
                85                  90                  95
```

```
Cys Ile Gly Lys Arg Glu Tyr Asp Leu Met Ala Gln Phe Tyr Arg Asp
            100                 105                 110

Glu Glu Lys Tyr Arg Trp Glu Lys Lys Lys Lys Pro Phe Phe Lys Lys
        115                 120                 125

Pro Trp Glu Thr Phe Thr Gln Asp Met Leu Ser Leu Lys Asp Glu Val
    130                 135                 140

Leu Thr Val His Phe Asn Pro Ser Asn Phe Thr Lys Lys Ala His Lys
145                 150                 155                 160

Lys Val Phe Thr Pro Lys Gly Ile Phe Val Ala Gln Gly Asp Cys Ala
                165                 170                 175

Arg Val Lys Leu His Lys Glu Ser Tyr Phe Gly Ala Ile Glu Gln Lys
            180                 185                 190

Gly Glu Ile Lys Tyr Val Met Arg Lys Glu Leu Ser Ala Leu Lys Ile
        195                 200                 205

Glu Asp Ile Lys Asn Ile Val Asp Ala Val Val Lys Glu Lys Val Leu
    210                 215                 220

Ala Val Val Lys Lys Lys Gly Phe Lys Gln Ala Met Ala Glu Pro Ile
225                 230                 235                 240

Tyr Met Asn Glu Asp Lys Arg Ile Leu Ile Lys Lys Val Arg Leu Phe
                245                 250                 255

Val Ser Gln Thr Asn Pro Leu Ile Val Lys Lys His Arg Asp Leu Ser
            260                 265                 270

Ser Lys Glu Tyr Lys Gln Asn Tyr Tyr Val Asp Asn Glu Gly Asn Leu
        275                 280                 285

Met Ile Ala Met Tyr Glu Gly Val Lys Lys Asn Gly Lys Ile Asp Arg
```

```
    290                 295                 300

Glu Ile Thr Val Val Asn Asn Leu Glu Ala Ala Lys Phe Phe Arg Gln
305                 310                 315                 320

Ser Gln Lys Asn Asn Ala Glu Lys Gln Leu Ile Ser His Leu Ser Pro
                325                 330                 335

Lys Asn Gly Tyr Pro Leu Lys Thr Val Leu Thr Gln Lys Gln Leu Val
            340                 345                 350

Leu Met Tyr Glu Asp Ser Pro Lys Glu Ile Lys Leu Arg Asp Thr Lys
        355                 360                 365

Asn Met Val Lys Arg Leu Tyr Gln Val Val Glu Ile Glu Lys Asp Gly
    370                 375                 380

Arg Val Lys Leu Lys Phe His Gln Glu Ala Arg Ser Glu Gly Leu Asn
385                 390                 395                 400

Lys Asn Ser Ala Ala Phe Lys Ile Gln Asp Thr Pro Glu Ser Leu Tyr
                405                 410                 415

Arg His Thr Lys Ser Asn Leu Lys Val Leu Val Asn Gly Val Asp Phe
            420                 425                 430

Lys Ile Asn Ile Leu Gly Glu Ile Ser Leu Ile
        435                 440


<210>  607
<211>  1375
<212>  PRT
<213>  Prevotella histicola

<400>  607

Met Lys Lys Ile Leu Gly Leu Asp Leu Gly Thr Thr Ser Ile Gly Trp
1               5                   10                  15
```

```
Ala Leu Val Tyr Glu Ser Glu Asn Thr Asp Glu Lys Ser Ser Ile Val
            20                  25                  30

Arg Leu Gly Val Arg Val Asn Pro Leu Ser Val Asp Glu Lys Gly Asn
        35                  40                  45

Phe Glu Lys Gly Lys Ala Ile Thr Thr Asn Ala Asp Arg Gln Gln Thr
    50                  55                  60

His Gly Ala Arg Ile Asn Leu Gln Arg Tyr Lys Leu Arg Arg Glu Asn
65                  70                  75                  80

Leu Lys Asp Cys Leu Gln Lys Gln Gly Trp Ile Gly Thr Glu Ala Leu
                85                  90                  95

Cys Glu Glu Gly Lys Thr Ser Thr Phe Glu Thr Tyr Met Leu Arg Ala
            100                 105                 110

Lys Ala Ala Glu Glu Glu Ile Ser Leu His Glu Leu Cys Arg Val Leu
        115                 120                 125

Phe Met Met Asn Lys Lys Arg Gly Tyr Lys Ser Asn Arg Lys Ala Asn
    130                 135                 140

Asn Lys Glu Asp Gly Lys Leu Phe Asp Gly Met Thr Val Ala Lys Lys
145                 150                 155                 160

Leu Tyr Glu Glu His Leu Thr Pro Ala Glu Tyr Ser Phe Gln Leu Leu
                165                 170                 175

Ser Ser Gly Lys Lys Phe Lys Gln Glu Tyr Tyr Arg Ser Asp Leu Lys
            180                 185                 190

Glu Glu Phe Asp Arg Ile Trp Asn Glu Gln Gln Lys Tyr Tyr Pro Glu
        195                 200                 205

Ile Leu Thr Asp Asp Phe Lys Gln Gln Leu Gln Gly Lys Ser Lys Gly
    210                 215                 220
```

```
Asn Thr Ser Lys Ile Phe Leu Gly Lys Tyr Gly Ile Tyr Ser Ala Asp
225                 230                 235                 240

Leu Lys Gly Leu Asp Arg Lys Leu Gln Pro Leu Lys Trp Arg Val Glu
                245                 250                 255

Ala Leu Lys Gln Gln Val Asp Lys Glu Val Leu Ala Phe Val Ile Ser
            260                 265                 270

Asp Leu Asn Gly Gln Ile Ala Ser Thr Ser Gly Leu Leu Gly Ala Ile
        275                 280                 285

Ser Asp Arg Ser Lys Glu Leu Tyr Phe Asn Lys Gln Thr Val Gly Gln
    290                 295                 300

Tyr Leu Trp Thr Ser Leu Lys Glu Thr Pro His Val Ser Ile Lys Asn
305                 310                 315                 320

Lys Pro Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe Glu Lys Ile Trp
                325                 330                 335

Glu Thr Gln Ala Thr Tyr His Lys Glu Leu Thr Pro Glu Leu Lys Gln
            340                 345                 350

Glu Ile Arg Asp Ile Ile Ile Phe Tyr Gln Arg Pro Leu Lys Ser Lys
        355                 360                 365

Lys Gly Leu Ile Ser Val Cys Glu Leu Glu Gln Arg Lys Val Lys Val
    370                 375                 380

Thr Ile Asp Gly Lys Glu Lys Glu Ile Ser Ile Gly Pro Lys Val Ala
385                 390                 395                 400

Pro Lys Ser Ser Pro Met Phe Gln Glu Phe Arg Ile Trp Gln Asn Leu
                405                 410                 415
```

```
Asn Asn Ile Leu Leu Ile Asp Lys Gly Asn Asn Ser Ile His Pro Leu
            420                 425                 430

Tyr Glu Glu Glu Lys Asn Leu Leu Tyr Glu Glu Leu Ser Val Lys Glu
        435                 440                 445

Lys Leu Ser Lys Ala Glu Ala Leu Lys Val Leu Asn Lys Asn Ser Lys
    450                 455                 460

Gln Trp Asp Leu Asn Tyr Lys Glu Ile Glu Gly Asn Arg Thr Gln Ala
465                 470                 475                 480

Val Leu Tyr Asp Cys Tyr Asn Arg Ile Ile Val Met Thr Gly His Glu
                485                 490                 495

Glu Tyr Asn Phe Lys Lys Leu Lys Ala Ser Glu Ile Arg Ser Tyr Val
            500                 505                 510

Lys Thr Thr Phe Thr Gly Leu Gly Phe Asn Thr Asp Ile Leu Glu Phe
        515                 520                 525

Asp Ser Ser Leu Thr Gly His Glu Leu Glu Lys Gln Pro Met Tyr Gln
    530                 535                 540

Leu Trp His Leu Leu Tyr Ser Tyr Glu Ser Asp Asn Ser Arg Thr Gly
545                 550                 555                 560

Asn Asp Ala Leu Leu Arg Lys Leu Glu Thr Ala Phe Gly Phe Pro Lys
                565                 570                 575

Glu Tyr Ala Ala Val Leu Ser Asp Val Val Phe Glu Asp Ser Tyr Gly
            580                 585                 590

Asn Leu Ser Val Lys Ala Met Arg Lys Ile Leu Pro His Leu Gln Ala
        595                 600                 605

Gly Leu Asn Tyr Ser Gln Ala Cys Glu Glu Ala Gly Tyr Lys His Ser
    610                 615                 620
```

```
Arg Arg Ser Leu Thr Lys Asn Glu Leu Asp Gln Lys Glu Tyr Lys Glu
625                 630                 635                 640

Lys Leu Glu Leu Leu Pro Lys Asn Ser Leu His Asn Pro Val Val Glu
                645                 650                 655

Lys Ile Leu Asn Gln Met Ile Asn Val Ile Asn Ala Val Ile Asp Glu
            660                 665                 670

Tyr Gly Lys Pro Asp Glu Ile Arg Ile Glu Leu Ala Arg Glu Leu Lys
        675                 680                 685

Ile Gly Ala Ala Glu Arg Glu Asn Met Thr Arg Ser Ile Asn Gln Gly
    690                 695                 700

Asn Ala Glu Asn Lys Arg Ile Arg Glu Ile Leu Glu Lys Glu Phe Ala
705                 710                 715                 720

Leu Ser Tyr Ile Ser Arg Asn Asp Ile Ile Lys Tyr Lys Leu Tyr Glu
                725                 730                 735

Glu Leu Lys Ser Asn Gly Phe Lys Thr Leu Tyr Ser Asp Thr Tyr Ile
            740                 745                 750

Ser Lys Asp Lys Leu Phe Ser Lys Asp Phe Asp Ile Glu His Ile Ile
        755                 760                 765

Pro Lys Ala Arg Leu Phe Asp Asp Ser Leu Ser Asn Lys Thr Ile Glu
    770                 775                 780

Ala Arg Asp Val Asn Ile Ala Lys Ser Asn Lys Thr Ala Phe Asp Phe
785                 790                 795                 800

Ile Ser Glu Lys Tyr Asp Gln Gln Gly Ile Glu Ala Tyr Lys Lys Lys
                805                 810                 815
```

```
Leu Asp Ile Leu Leu Gln Asp Gly Ser Ile Ser Lys Ala Lys Tyr Asn
            820                 825                 830

Arg Leu Leu Met Lys Glu Ala Asp Ile Pro Ser Gly Phe Ile Asp Arg
        835                 840                 845

Asp Leu Arg Asp Thr Gln Tyr Ile Ala Lys Lys Ala Tyr Glu Ile Leu
    850                 855                 860

Ser Asp Leu Val Arg Asn Val Thr Pro Thr Thr Gly Ala Val Thr Ser
865                 870                 875                 880

Arg Leu Arg Glu Asp Trp Gln Leu Val Asp Val Met Lys Glu Leu Asn
                885                 890                 895

Phe Glu Lys Tyr Gln Lys Leu Gly Leu Val Glu Val Ile Glu Asp Arg
            900                 905                 910

Asp Gly Arg Lys Ile Lys Arg Ile Lys Asp Trp Thr Lys Arg Asn Asp
        915                 920                 925

His Arg His His Ala Met Asp Ala Leu Thr Ile Ala Phe Thr Lys Pro
    930                 935                 940

Ser Tyr Ile Gln Tyr Leu Asn Asn Leu Asn Ala Arg Ser Asp Lys Asn
945                 950                 955                 960

Ser Ser Ile Tyr Gly Ile Glu Asn Lys Glu Leu His Arg Glu Asp Asn
                965                 970                 975

Lys Leu Arg Phe Asn Ala Pro Leu Pro Ile Asn Glu Phe Arg Ala Glu
            980                 985                 990

Ala Arg Arg His Leu Lys Ser Ile  Leu Val Ser Val Lys  Ala Lys Asn
        995                 1000                1005

Lys Val  Met Thr Gln Asn Val  Asn Val Ile Lys Thr  Lys His Gly
    1010                1015                1020
```

```
Val Ile  Lys Lys Val Gln Leu  Thr Pro Arg Gly Glu  Leu His Asn
    1025                1030                1035

Ala Thr  Phe Tyr Gly Thr Lys  Lys Arg Pro Ile Ile  Lys Met Val
    1040                1045                1050

Lys Val  Gly Ala Ala Leu Asp  Glu Val Thr Ile Lys  Lys Val Ser
    1055                1060                1065

Ser Ser  Phe Ile Arg Glu Ala  Leu Leu Asp Arg Leu  His Glu Tyr
    1070                1075                1080

Asn Gly  Asp Ala Lys Lys Ala  Phe Thr Gly Arg Asn  Ser Ile Asp
    1085                1090                1095

Lys Asn  Pro Ile Tyr Ile Asp  Glu Glu His Lys Lys  Thr Val Pro
    1100                1105                1110

Ala Leu  Val Lys Thr Ile Glu  Trp Glu Met Tyr His  Pro Thr Arg
    1115                1120                1125

Lys Leu  Ile Ser Pro Asp Leu  Lys Ile Asp Lys Val  Ile Asp Lys
    1130                1135                1140

Gly Ile  Arg Glu Ile Leu Lys  Thr Arg Leu Ala Lys  Phe Asn Gly
    1145                1150                1155

Asp Ala  Gln Lys Ala Phe Ser  Asn Leu Asp Glu Asn  Pro Ile Tyr
    1160                1165                1170

Lys Asp  Glu Ala Lys Lys Ile  Thr Leu Lys Arg Val  Ser Leu Glu
    1175                1180                1185

Gly Val  Ser Ser Val Ile Pro  Leu His Thr Leu Lys  Asp Arg Glu
    1190                1195                1200
```

```
Gly Lys  Leu Val Val Gly Lys  Asp Gly Lys Pro Val  Leu Gly Asp
    1205                 1210                 1215

Tyr Val  Gln Thr Ser Asn Asn  His His Ile Ala Phe  Tyr Met Asp
    1220                 1225                 1230

Glu Asn  Gly Asn Leu Gln Asp  Asn Val Val Ser Phe  Phe Glu Ala
    1235                 1240                 1245

Ala Glu  Arg Lys Ser Gln Gly  Val Pro Val Ile Asp  Lys Asn Tyr
    1250                 1255                 1260

Asn His  Asp Lys Gly Trp Asn  Phe Leu Phe Thr Met  Lys Gln Asn
    1265                 1270                 1275

Glu Tyr  Phe Val Phe Pro Asn  Glu Val Thr Gly Phe  Asn Pro Ser
    1280                 1285                 1290

Glu Val  Asp Leu Met Asp Glu  Ala Asn Tyr Ser Ile  Ile Ser Pro
    1295                 1300                 1305

Asn Leu  Tyr Arg Val Gln Lys  Met Ser Lys Ala Ser  Gly Arg Asp
    1310                 1315                 1320

Tyr Trp  Phe Arg His His Leu  Glu Ala Met Leu Asn  Asp Asp Pro
    1325                 1330                 1335

Lys Leu  Arg Asn Ser Met Phe  Lys Arg Ile Thr Ser  Leu Lys Ala
    1340                 1345                 1350

Leu Glu  Gly Ile Val Lys Val  Arg Ile Asn Cys Ile  Gly Lys Ile
    1355                 1360                 1365

Val Ala  Val Gly Glu Tyr Asp
    1370                 1375
```

<210> 608
<211> 1380

<212> PRT
<213> Prevotella intermedia

<400> 608

```
Met Lys Arg Ile Leu Gly Leu Asp Leu Gly Thr Thr Ser Ile Gly Trp
1               5                  10                  15


Ala Leu Val Asn Glu Ala Glu Asn Asn Asn Glu Ala Ser Ser Ile Val
            20                  25                  30


Arg Leu Gly Val Arg Val Asn Pro Leu Thr Val Asp Glu Lys Ser Asn
        35                  40                  45


Phe Glu Lys Gly Lys Ala Ile Thr Thr Asn Ala Asp Arg Gln Leu Arg
    50                  55                  60


His Gly Ala Arg Ile Asn Leu Gln Arg Tyr Lys Leu Arg Arg Gln Asn
65                  70                  75                  80


Leu His Asp Cys Leu Gln Lys Gln Gly Trp Leu Gly Thr Glu Ala Met
                85                  90                  95


Tyr Glu Glu Gly Lys Ala Ser Thr Phe Glu Thr Tyr Lys Leu Arg Ala
            100                 105                 110


Lys Ala Ala Glu Glu Glu Ile Ser Leu His Glu Phe Ala Arg Val Leu
        115                 120                 125


Phe Met Leu Asn Lys Lys Arg Gly Tyr Lys Ser Asn Arg Lys Ala Asn
    130                 135                 140


Asn Lys Glu Asp Gly Gln Leu Phe Asp Gly Met Thr Ile Ala Lys Lys
145                 150                 155                 160


Leu Tyr Glu Glu His Leu Thr Pro Ala Glu Tyr Ser Leu Gln Leu Leu
                165                 170                 175


Asn Lys Gly Lys Lys Phe Thr Gln Gly Tyr Tyr Arg Ser Asp Leu Asn
```

```
            180                 185                 190

Ala Glu Leu Glu Arg Ile Trp Asp Glu Gln Lys Lys Tyr Tyr Pro Glu
        195                 200                 205

Ile Leu Thr Asp Glu Phe Lys Gln Gln Leu Glu Gly Lys Thr Lys Thr
    210                 215                 220

Asn Thr Ser Lys Ile Phe Leu Ala Lys Tyr Gly Ile Tyr Ser Ala Asp
225                 230                 235                 240

Leu Lys Gly Leu Asp Arg Lys Phe Gln Pro Leu Lys Trp Arg Val Glu
                245                 250                 255

Ala Leu Gln Gln Gln Val Asp Lys Glu Val Leu Ala Phe Val Ile Ser
            260                 265                 270

Asp Leu Lys Gly Gln Ile Ala Asn Thr Ser Gly Leu Leu Gly Ala Ile
        275                 280                 285

Ser Asp Arg Ser Lys Glu Leu Tyr Phe Asn Lys Gln Thr Val Gly Gln
    290                 295                 300

Tyr Leu Trp Ala Ser Leu Glu Glu Asn Pro His Ile Ser Ile Lys Asn
305                 310                 315                 320

Lys Pro Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe Glu Lys Ile Trp
                325                 330                 335

Glu Thr Gln Ala Ala Phe His Lys Gln Leu Thr Pro Glu Leu Lys Gln
            340                 345                 350

Glu Ile Arg Asp Ile Ile Ile Phe Tyr Gln Arg Pro Leu Lys Ser Lys
        355                 360                 365

Lys Ser Leu Ile Ser Val Cys Glu Leu Glu Gln Arg Lys Val Lys Ala
    370                 375                 380
```

```
Thr Ile Asp Gly Lys Glu Lys Glu Ile Thr Ile Gly Pro Lys Val Ala
385                 390                 395                 400

Pro Lys Ser Ser Pro Val Phe Gln Glu Phe Arg Ile Trp Gln Asn Leu
                405                 410                 415

Asn Asn Val Leu Leu Ile Asp Asn Asp Thr Asn Glu Lys Arg Pro Leu
            420                 425                 430

Asp Glu Val Glu Arg Asn Leu Leu Tyr Lys Glu Leu Ser Ile Lys Ala
        435                 440                 445

Lys Leu Ser Lys Thr Glu Ala Leu Lys Ile Leu Asn Lys Lys Gly Lys
    450                 455                 460

Gln Trp Asp Leu Asn Tyr Arg Glu Leu Glu Gly Asn Arg Thr Gln Ala
465                 470                 475                 480

Ile Leu Phe Asp Cys Tyr Asn Arg Ile Ile Thr Leu Thr Gly His Glu
                485                 490                 495

Glu Cys Asp Phe Lys Lys Ile Lys Ala Ser Glu Ile Arg His Tyr Val
            500                 505                 510

Ser Thr Ile Phe Lys Asn Leu Gly Phe Ser Thr Glu Ile Leu Asp Phe
        515                 520                 525

Asp Pro Ser Leu Lys Lys His Glu Leu Glu Lys Gln Pro Met Tyr Gln
    530                 535                 540

Leu Trp His Leu Leu Tyr Ser Tyr Glu Ser Asp Asn Ser Arg Thr Gly
545                 550                 555                 560

Asn Glu Ser Leu Leu Arg Lys Leu Glu Thr Thr Phe Gly Phe Pro Glu
                565                 570                 575

Glu Tyr Ala Thr Val Leu Cys Asp Val Val Phe Glu Glu Asp Tyr Gly
```

```
            580                 585                 590

Asn Leu Ser Val Lys Ala Met Arg Glu Ile Leu Pro Tyr Leu Gln Ala
        595                 600                 605

Gly Asn Asp Tyr Ser Gln Ala Cys Ala Tyr Ala Gly Tyr Asn His Ser
    610                 615                 620

Arg His Ser Leu Thr Lys Glu Glu Leu Asp Gln Lys Val Tyr Lys Glu
625                 630                 635                 640

Arg Leu Glu Leu Leu Pro Lys Asn Ser Leu Arg Asn Pro Val Val Glu
                645                 650                 655

Lys Ile Leu Asn Gln Met Ile Asn Val Ile Asn Ala Ile Ile Asp Glu
            660                 665                 670

Tyr Gly Lys Pro Asp Glu Ile Arg Ile Glu Met Ala Arg Glu Leu Lys
        675                 680                 685

Ser Ser Ala Ala Asp Arg Lys Lys Thr Thr His Ala Ile Ser Gln Gly
    690                 695                 700

Asn Ala Glu Asn Gln Arg Ile Arg Glu Ile Leu Glu Lys Glu Phe Ser
705                 710                 715                 720

Leu Ser Tyr Ile Ser Arg Asn Asp Ile Ile Lys Tyr Lys Leu Tyr Glu
                725                 730                 735

Glu Leu Glu Pro Asn Tyr Tyr Lys Thr Leu Tyr Ser Asp Thr Tyr Ile
            740                 745                 750

Thr Lys Asp Lys Leu Phe Ser Lys Asp Phe Asp Ile Glu His Ile Ile
        755                 760                 765

Pro Lys Ala Arg Leu Phe Asp Asp Ser Phe Ser Asn Lys Thr Leu Glu
    770                 775                 780
```

```
Ala Arg Asn Ile Asn Leu Glu Lys Ser Asn Lys Thr Ala Phe Asp Phe
785                 790                 795                 800

Ile Lys Glu Lys Tyr Gly Glu Asp Gly Ala Glu Ala Tyr Lys Lys Lys
                805                 810                 815

Leu Asp Met Leu Leu Glu Asn Asp Ala Ile Ser Arg Pro Lys Tyr Asn
            820                 825                 830

Asn Leu Leu Arg Ala Glu Ala Asp Ile Pro Ser Asp Phe Ile Asn Arg
        835                 840                 845

Asp Leu Arg Asn Thr Gln Tyr Ile Ala Lys Lys Ala Cys Glu Ile Leu
    850                 855                 860

Gly Glu Leu Val Lys Thr Val Thr Pro Thr Thr Gly Lys Ile Thr Asn
865                 870                 875                 880

Arg Leu Arg Glu Asp Trp Gln Leu Val Asp Val Met Lys Glu Leu Asn
                885                 890                 895

Phe Glu Lys Tyr Glu Lys Leu Gly Leu Thr Glu Ile Val Glu Asp Arg
            900                 905                 910

Asp Gly Arg Lys Ile Lys Arg Ile Lys Asp Trp Thr Lys Arg Asn Asp
        915                 920                 925

His Arg His His Ala Met Asp Ala Leu Ala Ile Ala Phe Thr Lys Pro
    930                 935                 940

Ser Phe Ile Gln Tyr Leu Asn Asn Leu Asn Ala Arg Ser Asn Lys Gly
945                 950                 955                 960

Asp Ser Ile Tyr Ala Ile Glu Asn Lys Glu Leu His Tyr Glu Glu Gly
                965                 970                 975

Lys Leu Arg Phe Asn Ala Pro Ile Pro Val Asn Glu Phe Arg Ala Glu
```

```
           980                 985                 990

Ala Lys Arg His Leu Ser Ala Ile  Leu Val Ser Ile Lys  Ala Lys Asn
        995                1000                1005

Lys Val  Met Thr Gln Asn Val  Asn Lys Ile Lys Thr  Lys His Gly
    1010                1015                1020

Ile Ile  Lys Lys Ile Gln Leu  Thr Pro Arg Gly Pro  Leu His Asn
    1025                1030                1035

Glu Thr  Ile Tyr Gly Thr Lys  Met Arg Pro Ile Ile  Lys Met Val
    1040                1045                1050

Lys Val  Gly Ala Ala Leu Asp  Glu Ala Thr Ile Asn  Lys Val Ser
    1055                1060                1065

Ser Pro  Ala Ile Arg Glu Ala  Leu Leu Lys Arg Leu  Asn Glu Tyr
    1070                1075                1080

Ser Gly  Asn Ala Lys Lys Ala  Phe Thr Gly Lys Asn  Thr Leu Glu
    1085                1090                1095

Lys Asn  Pro Ile Tyr Leu Asn  Ala Gly Arg Thr Lys  Thr Val Pro
    1100                1105                1110

Ser Leu  Val Lys Thr Val Glu  Trp Glu Ser Phe His  Pro Thr Arg
    1115                1120                1125

Lys Leu  Ile Asp Lys Asp Leu  Asn Val Asp Lys Val  Val Asp Lys
    1130                1135                1140

Gly Ile  Arg Glu Ile Leu Lys  Ala Arg Leu Glu Glu  Phe Asn Gly
    1145                1150                1155

Asp Ala  Lys Lys Ala Phe Ser  Asn Leu Glu Glu Asn  Pro Ile Tyr
    1160                1165                1170
```

```
Leu Asp  Glu Ala Lys Lys Ile  Ala Leu Lys Arg Val  Ser Ile Glu
    1175                1180                1185

Gly Val  Leu Ser Ala Ile Pro  Leu His Thr Leu Lys  Asn Gln Ala
    1190                1195                1200

Gly Lys  Pro Ile Thr Gly Lys  Asp Gly Lys Pro Val  Leu Gly Asn
    1205                1210                1215

Tyr Val  Gln Thr Ser Asn Asn  His His Ile Ala Phe  Tyr Tyr Asp
    1220                1225                1230

Glu Asp  Gly Asn Leu Gln Asp  Asn Ala Val Ser Phe  Phe Glu Ala
    1235                1240                1245

Ala Glu  Arg Lys Ser Gln Gly  Ile Pro Val Ile Asp  Lys Asp Tyr
    1250                1255                1260

Asn Arg  Asp Lys Gly Trp Arg  Phe Leu Phe Thr Met  Lys Gln Asn
    1265                1270                1275

Glu Tyr  Phe Val Phe Pro Asn  Glu Ala Thr Gly Phe  Ile Pro Ser
    1280                1285                1290

Glu Val  Asp Leu Thr Asp Glu  Ala Asn Tyr Gly Ile  Ile Ser Pro
    1295                1300                1305

Asn Leu  Tyr Arg Val Gln Lys  Val Ser Arg Ile Asp  Lys Gly Thr
    1310                1315                1320

Ser Ala  Ser Arg Asp Tyr Trp  Phe Arg His His Leu  Glu Thr Ile
    1325                1330                1335

Leu Asn  Asp Asp Ala Lys Leu  Lys Asn Leu Ala Phe  Lys Arg Ile
    1340                1345                1350

Arg Gly  Leu Leu Glu Leu Lys  Asp Ile Ile Lys Val  Arg Ile Asn
```

```
    1355                1360                1365


Ser Thr  Gly Lys Ile Val Ala  Val Gly Glu Tyr Asp
    1370                1375                1380


<210>  609
<211>  129
<212>  PRT
<213>  Prevotella multiformis

<400>  609

Met Gln Lys Gly Gly Thr Gly Cys Lys Ile Asn Arg Gln Thr Val Gly
1               5                   10                  15


Asn Val Glu Val Asn Val Leu Asn Leu Arg Leu Tyr Asp Arg Thr Asp
            20                  25                  30


Asp Arg Glu Val Thr Ala Gly Tyr Leu Pro Thr Lys Glu Asp Tyr Val
        35                  40                  45


Arg Leu Phe Val Tyr Leu Asn Asp Arg Lys Glu Ile Asn Gln Asp Thr
    50                  55                  60


Leu Leu Lys Asp Tyr Phe Arg Leu Lys Lys Val Lys Cys Gly Asn Glu
65                  70                  75                  80


Lys Glu Phe Ala Ile Arg Trp Asn Tyr Ile Glu Asp Lys Glu Lys Lys
                85                  90                  95


Tyr Pro Cys Asn Glu Thr Arg His Glu Leu Leu Ala Ala Leu Asp Arg
            100                 105                 110


Ala Gly Met Glu His Gly Trp Leu Asp Asp Ser Gly Thr Ser Ala Arg
        115                 120                 125


Trp
```

<210> 610
<211> 535
<212> PRT
<213> Prevotella multiformis

<400> 610

Met Val Lys Gly Leu Leu Ser Asn Ile Val Arg Thr Ala Glu Glu Arg
1 5 10 15

Glu Glu Thr Ser Lys Phe Val Ile Ser Cys Thr Gly Arg Ile Thr Asp
20 25 30

Arg Leu Lys Gln Asp Trp Gly Leu Asn Asp Val Trp Asn Ser Leu Val
35 40 45

Tyr Thr Arg Phe Lys Arg Leu Asn Glu Leu Thr Glu Thr Glu Ala Phe
50 55 60

Gly His Trp Gln Asp Lys Asp Arg Arg Val Phe Gln Thr Ser Val Pro
65 70 75 80

Leu Glu Leu Gln Arg Gly Phe Ser Lys Lys Arg Ile Asp His Arg His
85 90 95

His Ala Met Asp Ala Leu Val Ile Ala Cys Ala Ser Arg Asn Ile Ile
100 105 110

Gly Tyr Leu Asn Asn Glu Ser Ala Glu Ser Pro Glu Lys Arg Glu Asp
115 120 125

Leu Arg Arg Lys Leu Cys Asp Lys Asn His Ile Ile Arg Lys Pro Trp
130 135 140

Glu Ser Phe Thr Gln Asp Ala Arg Ala Ala Leu Glu Asp Ile Val Val
145 150 155 160

Ser Phe Lys Asn Tyr Val Arg Ile Ile Asn Lys Ala Thr Asn Tyr Tyr
165 170 175

```
Glu Arg Tyr Asp Ala Asp Gly Arg Lys Thr Lys Ala Glu Gln Lys Gly
            180                 185                 190

Gly Glu Met Trp Ala Val Arg Lys Pro Met His Glu Ala Thr Tyr Tyr
        195                 200                 205

Gly Lys Val Asn Leu Arg Arg Lys Glu Arg Val Ser Leu Lys Ala Ala
    210                 215                 220

Leu Glu Asp Ile Pro Ser Ile Cys Asn Arg Asp Leu Arg Asp Tyr Ile
225                 230                 235                 240

Asn Gly Leu Val Glu Lys His Phe Asn Lys Glu Gln Val Leu Ala Gln
                245                 250                 255

Phe Arg Ser Val Gly Asn Arg Trp Asn Lys Gln His Ile Asp Lys Val
            260                 265                 270

Asp Val Trp Arg Phe Ser Asp Gly Lys Glu Glu Met Val Ala Thr Arg
        275                 280                 285

Lys Pro Leu Asp Thr Ser Phe Asp Ala Lys Arg Ile Glu Ala Val Thr
    290                 295                 300

Asp Thr Gly Ile Gln Arg Ile Leu Ser Asn Tyr Leu Glu Ala Lys Gly
305                 310                 315                 320

Gly Asp Pro Lys Ile Ala Phe Thr Pro Glu Gly Ile Ala Asp Met Asn
                325                 330                 335

Gln His Ile Thr Ala Tyr Asn Asn Gly Lys Gln His Lys Pro Ile Leu
            340                 345                 350

Lys Val Arg Val Ser Thr Lys Leu Gly Lys Lys Tyr Pro Val Gly Gln
        355                 360                 365

Thr Gly Cys Lys Ala Gly Gln Phe Val Val Ala Glu Ala Gly Thr Asn
```

```
    370                 375                 380

Leu Tyr Phe Ala Val Tyr Glu Asp Gly Glu Gly Asn Arg Ser Tyr Asp
385                 390                 395                 400

Thr Ile Pro Leu Asn Glu Ala Val Glu Cys Leu Lys Gln Gly Leu Pro
                405                 410                 415

Pro Val Pro Glu Thr Arg Glu Lys Gly Asp Arg Leu Lys Phe Tyr Leu
            420                 425                 430

Ser Pro Asn Asp Leu Val Tyr Val Pro Ala Gly Asp Glu Glu Asn Glu
        435                 440                 445

Ile Asp Arg Glu Arg Ile Tyr Lys Phe Val Asp Ser Ser Gly Thr Thr
    450                 455                 460

Ala Asn Phe Ile Pro His Arg Thr Ala Gly Leu Ile Tyr Asn Val Asp
465                 470                 475                 480

Lys Lys Leu Ala Glu Ala Leu Cys Asn Gly Ser Ile Ile Gln Asn Glu
                485                 490                 495

Tyr Gly Val Gly Ser Gln Gln Ser Lys Asn Gln Lys Ala Leu Thr Gly
            500                 505                 510

Glu Met Val Lys Ala Val Cys Trp Lys Leu Glu Val Asp Arg Leu Gly
        515                 520                 525

Asn Ile Leu Arg Ile Ile Lys
    530                 535


<210>  611
<211>  1380
<212>  PRT
<213>  Prevotella nigrescens

<400>  611
```

```
Met Lys Arg Ile Leu Gly Leu Asp Leu Gly Thr Thr Ser Ile Gly Trp
1               5                  10                  15

Ala Leu Val Asn Glu Ala Glu Ser Asn Asn Glu Ala Ser Ser Ile Val
            20                  25                  30

Arg Leu Gly Val Arg Val Asn Pro Leu Thr Val Asp Glu Lys Ser Asn
        35                  40                  45

Phe Glu Lys Gly Lys Ala Ile Thr Thr Asn Ala Asp Arg Gln Leu Arg
    50                  55                  60

His Gly Ala Arg Ile Asn Leu Gln Arg Tyr Lys Leu Arg Arg Gln Asn
65                  70                  75                  80

Leu His Asp Cys Leu Gln Lys Gln Gly Trp Leu Gly Thr Glu Ala Met
                85                  90                  95

Tyr Glu Glu Gly Lys Ala Ser Thr Phe Glu Thr Tyr Lys Leu Arg Ala
            100                 105                 110

Lys Ala Ala Glu Glu Glu Ile Ser Leu His Glu Phe Ala Arg Val Leu
        115                 120                 125

Phe Met Leu Asn Lys Lys Arg Gly Tyr Lys Ser Asn Arg Lys Ala Asn
    130                 135                 140

Asn Lys Glu Asp Gly Gln Leu Phe Asp Gly Met Thr Ile Ala Lys Lys
145                 150                 155                 160

Leu Tyr Glu Glu His Leu Thr Pro Ala Glu Tyr Ser Leu Gln Leu Leu
                165                 170                 175

Asn Lys Gly Lys Lys Phe Thr Gln Gly Tyr Tyr Arg Ser Asp Leu Asn
            180                 185                 190

Ala Glu Leu Glu Arg Ile Trp Asp Glu Gln Lys Lys Tyr Tyr Pro Glu
        195                 200                 205
```

```
Ile Leu Thr Asp Glu Phe Lys Gln Gln Leu Glu Gly Lys Thr Lys Thr
    210                 215                 220

Asn Thr Ser Lys Ile Phe Leu Ala Lys Tyr Gly Ile Tyr Ser Ala Asp
225                 230                 235                 240

Leu Lys Gly Leu Asp Arg Lys Leu Gln Pro Leu Lys Trp Arg Val Glu
                245                 250                 255

Ala Leu Lys Gln Gln Val Asp Lys Glu Val Leu Ala Phe Val Ile Ser
            260                 265                 270

Asp Leu Lys Gly Gln Ile Ala Asn Thr Ser Gly Leu Leu Gly Ala Ile
        275                 280                 285

Ser Asp Arg Ser Lys Glu Leu Tyr Phe Asn Lys Gln Thr Val Gly Gln
    290                 295                 300

Tyr Leu Trp Ala Ser Leu Glu Glu Asn Pro His Ile Ser Ile Lys Asn
305                 310                 315                 320

Lys Pro Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe Glu Lys Ile Trp
                325                 330                 335

Glu Thr Gln Ala Thr Phe His Lys Gln Leu Thr Pro Glu Leu Lys Gln
            340                 345                 350

Glu Ile Arg Asp Ile Ile Ile Phe Tyr Gln Arg Pro Leu Lys Ser Lys
        355                 360                 365

Lys Ser Leu Ile Ser Val Cys Glu Leu Glu Gln Arg Lys Val Lys Ala
    370                 375                 380

Thr Ile Asp Gly Lys Glu Lys Glu Ile Thr Ile Gly Pro Lys Val Ala
385                 390                 395                 400
```

```
Pro Lys Ser Ser Pro Val Phe Gln Glu Phe Arg Ile Trp Gln Asn Leu
                405                 410                 415

Asn Asn Val Leu Leu Ile Asp Asn Asp Thr Asn Glu Lys Arg Pro Leu
            420                 425                 430

Asp Glu Asp Glu Arg Tyr Leu Leu Tyr Lys Glu Leu Ser Ile Lys Ala
        435                 440                 445

Lys Leu Ser Lys Thr Glu Ala Leu Lys Ile Leu Asn Lys Lys Gly Lys
    450                 455                 460

Gln Trp Asp Leu Asn Tyr Lys Glu Leu Glu Gly Asn Arg Thr Gln Ala
465                 470                 475                 480

Ile Leu Phe Asp Cys Tyr Asn Arg Ile Ile Thr Leu Thr Gly His Glu
                485                 490                 495

Glu Cys Asp Phe Lys Lys Ile Lys Ala Ser Glu Ile Arg His Tyr Val
            500                 505                 510

Ser Thr Ile Phe Lys Asn Leu Gly Phe Ser Thr Glu Ile Leu Asp Phe
        515                 520                 525

Asp Pro Ser Leu Glu Lys His Glu Leu Glu Lys Gln Pro Met Tyr Gln
    530                 535                 540

Leu Trp His Leu Leu Tyr Ser Tyr Glu Ser Asp Asn Ser Arg Thr Gly
545                 550                 555                 560

Asn Glu Ser Leu Leu Arg Lys Leu Glu Thr Thr Phe Gly Phe Pro Glu
                565                 570                 575

Glu Tyr Ala Thr Val Leu Cys Asp Val Val Phe Glu Glu Asp Tyr Gly
            580                 585                 590

Asn Leu Ser Val Lys Ala Met Arg Lys Ile Leu Pro Tyr Leu Gln Ala
        595                 600                 605
```

```
Gly Asn Asp Tyr Ser Gln Ala Cys Ala Tyr Ala Gly Tyr Asn His Ser
    610                 615                 620

Arg His Ser Leu Thr Lys Glu Glu Leu Asp Gln Lys Val Tyr Lys Glu
625                 630                 635                 640

Arg Leu Glu Leu Leu Pro Lys Asn Ser Leu Arg Asn Pro Val Val Glu
                645                 650                 655

Lys Ile Leu Asn Gln Met Ile Asn Val Ile Asn Ala Ile Ile Asp Glu
            660                 665                 670

Tyr Gly Lys Pro Asp Glu Ile Arg Ile Glu Met Ala Arg Glu Leu Lys
        675                 680                 685

Ser Ser Ala Ala Asp Arg Lys Lys Thr Thr His Ala Ile Asn Gln Gly
    690                 695                 700

Asn Asp Glu Asn Gln Cys Ile Arg Glu Ile Leu Glu Lys Glu Phe Ala
705                 710                 715                 720

Leu Ser Tyr Ile Ser Arg Asn Asp Ile Ile Lys Tyr Lys Leu Tyr Glu
                725                 730                 735

Glu Leu Lys Pro Asn Gly Phe Lys Thr Leu Tyr Ser Asp Thr Tyr Ile
            740                 745                 750

Pro Lys Asp Lys Leu Phe Ser Lys Asp Phe Asp Ile Glu His Ile Ile
        755                 760                 765

Pro Lys Ala Arg Leu Phe Asp Asp Ser Tyr Ser Asn Lys Thr Leu Glu
    770                 775                 780

Ala Arg Asp Ile Asn Leu Ala Lys Ser Asn Lys Thr Ala Phe Asp Phe
785                 790                 795                 800
```

```
Val Lys Glu Lys Tyr Gly Glu Gln Gly Ala Glu Ala Tyr Lys Lys Lys
                805                 810                 815

Leu Asp Met Leu Leu Gly Asn Asn Val Ile Ser Lys Pro Lys Tyr Asn
            820                 825                 830

Lys Leu Leu Met Thr Glu Ala Asp Ile Pro Ser Asp Phe Ile Asn Arg
        835                 840                 845

Asp Leu Arg Asn Thr Gln Tyr Ile Ala Arg Lys Ala Cys Glu Ile Leu
    850                 855                 860

Gly Glu Leu Val Arg Thr Val Thr Pro Thr Thr Gly Lys Ile Thr Asn
865                 870                 875                 880

Arg Leu Arg Glu Asp Trp Gln Leu Val Asp Val Met Lys Glu Leu Asn
                885                 890                 895

Phe Glu Lys Tyr Glu Lys Leu Gly Leu Thr Glu Ile Val Glu Asp Arg
            900                 905                 910

Asp Gly Arg Lys Ile Lys Arg Ile Lys Asp Trp Thr Lys Arg Asn Asp
        915                 920                 925

His Arg His His Ala Met Asp Ala Leu Ala Ile Ala Phe Thr Lys Pro
    930                 935                 940

Ser Tyr Ile Gln Tyr Leu Asn Asn Leu Asn Ala Arg Ser Asn Lys Gly
945                 950                 955                 960

Asp Ser Ile Tyr Ala Ile Glu Asn Lys Glu Leu His Tyr Glu Glu Gly
                965                 970                 975

Lys Leu Arg Phe Asn Ala Pro Ile Pro Val Asn Val Phe Arg Ala Glu
            980                 985                 990

Ala Lys Arg His Leu Ser Ala Ile  Leu Val Ser Ile Lys  Ala Lys Asn
        995                 1000                1005
```

```
Lys Val  Met Thr Gln Asn Val  Asn Lys Ile Lys Thr  Lys His Gly
    1010                1015                1020

Ile Ile  Lys Lys Ile Gln Leu  Thr Pro Arg Gly Pro  Leu His Asn
    1025                1030                1035

Glu Thr  Ile Tyr Gly Thr Lys  Met Arg Pro Ile Ile  Lys Lys Val
    1040                1045                1050

Lys Val  Gly Ala Ala Leu Asp  Glu Ala Thr Ile Asn  Lys Val Ser
    1055                1060                1065

Ser Pro  Ala Ile Arg Glu Val  Leu Leu Lys Arg Leu  Asn Glu Tyr
    1070                1075                1080

Ser Gly  Asn Ala Lys Lys Ala  Phe Thr Gly Lys Asn  Thr Leu Asp
    1085                1090                1095

Lys Asn  Pro Ile Tyr Leu Asn  Ala Glu Arg Thr Lys  Thr Val Pro
    1100                1105                1110

Ala Ser  Val Lys Thr Val Glu  Trp Glu Asn Tyr His  Pro Ile Arg
    1115                1120                1125

Lys Pro  Ile Thr Pro Asp Leu  Lys Val Asp Lys Val  Ile Asp Lys
    1130                1135                1140

Gly Ile  Gly Glu Ile Leu Lys  Ala Arg Leu Glu Glu  Phe Asn Gly
    1145                1150                1155

Asp Ala  Lys Lys Ala Phe Ser  Asn Leu Glu Glu Asn  Pro Ile Tyr
    1160                1165                1170

Leu Asp  Gln Thr Lys Lys Ile  Ala Leu Lys Arg Val  Ser Ile Glu
    1175                1180                1185
```

```
Gly Val  Leu Ser Thr Ile Pro  Leu His Thr Leu Lys  Asn Gln Ala
    1190                1195                1200

Gly Lys  Pro Ile Met Gly Lys  Asp Gly Lys Pro Val  Leu Gly Asn
    1205                1210                1215

Tyr Val  Gln Thr Ser Asn Asn  His His Ile Ala Phe  Tyr Tyr Asp
    1220                1225                1230

Glu Asp  Gly Asn Leu Gln Asp  Asn Ala Val Ser Phe  Phe Glu Ala
    1235                1240                1245

Ala Glu  Arg Lys Ser Gln Gly  Ile Ser Val Ile Asp  Lys Asp Tyr
    1250                1255                1260

Asn Arg  Asp Lys Gly Trp Arg  Phe Leu Phe Thr Met  Lys Gln Asn
    1265                1270                1275

Glu Tyr  Phe Val Phe Pro Asn  Glu Ala Thr Gly Phe  Ile Pro Ser
    1280                1285                1290

Glu Val  Asp Leu Thr Asp Glu  Ala Asn Tyr Gly Ile  Ile Ser Pro
    1295                1300                1305

Asn Leu  Tyr Arg Val Gln Lys  Met Ser Arg Ile Glu  Lys Gly Thr
    1310                1315                1320

Ser Val  Ser Arg Asp Tyr Trp  Phe Arg His His Leu  Glu Thr Ile
    1325                1330                1335

Leu Asn  Asp Asp Ser Arg Leu  Lys Asn Ser Ala Phe  Lys Arg Ile
    1340                1345                1350

Asn Ser  Leu Lys Pro Leu Glu  Gly Ile Ile Lys Val  Arg Ile Asn
    1355                1360                1365

Ser Ile  Gly Lys Ile Val Ala  Val Gly Glu Tyr Asp
    1370                1375                1380
```

<210> 612
<211> 1506
<212> PRT
<213> Prevotella nigrescens

<400> 612

```
Met Lys Thr Ile Leu Gly Leu Asp Leu Gly Pro Asn Ser Ile Gly Trp
1               5                  10                  15


Ala Lys Val Glu Val Asp Asp Glu Gly Asn Tyr Leu Arg Asn Ile Lys
            20                  25                  30


Leu Gly Ser Arg Ile Ile Pro Met Thr Gln Asp Met Leu Gly Asp Phe
        35                  40                  45


Asp Lys Gly Val Lys Val Ser Gln Thr Ala Ile Arg Thr Asp Phe Arg
    50                  55                  60


Gly Asn Arg Arg Leu Ile Glu Arg His Leu Leu Arg Arg Glu Arg Leu
65                  70                  75                  80


His Arg Val Leu His Ala Leu Lys Phe Leu Pro Lys His Tyr Glu Asp
                85                  90                  95


Ala Ile Gly Trp Asp Arg Asn Glu Pro Ala Thr Tyr Gly Lys Phe Val
            100                 105                 110


Asn Asn Ser Glu Pro Lys Leu Ala Trp Glu Arg Gln Glu Asp Gly Ser
        115                 120                 125


Met Arg Phe Leu Phe Met Glu Ser Phe Asn Glu Met Val Ala Asp Phe
    130                 135                 140


Ala Gln Asn Gln Pro Ser Leu Val Ser Asp Gly Lys Lys Ile Pro Leu
145                 150                 155                 160


Asp Trp Thr Ile Tyr Tyr Leu Arg Lys Lys Ala Leu Thr Arg Pro Ile
```

```
                165                 170                 175

Lys Lys Glu Glu Leu Ala Trp Ile Leu Leu Asn Phe Asn Gln Lys Arg
            180                 185                 190

Gly Tyr Tyr Gln Leu Arg Gly Glu Glu Glu Glu Asp Asn Leu Thr Lys
        195                 200                 205

Arg Lys Glu Tyr Tyr Lys Leu Lys Val Val Gly Val Glu Ala Asp Gly
    210                 215                 220

Ala Pro Lys Gly Gly Lys Thr Trp Tyr Asn Ile His Leu Glu Asn Gly
225                 230                 235                 240

Trp Thr Ala Arg Cys Gln Ser Lys Ile Pro Leu Asp Asp Trp Val Gly
                245                 250                 255

Lys Val Lys Glu Tyr Ile Val Thr Thr Glu Tyr Glu Asp Asp Gly Lys
            260                 265                 270

Thr Pro Lys Cys Asp Lys Glu Gly Lys Val Lys Arg Ser Phe Lys Ser
        275                 280                 285

Pro Glu Lys Asp Asp Trp Gln Leu Ile Lys Thr Arg Thr Glu Lys Phe
    290                 295                 300

Ile Asp Asp Ser Asn Lys Thr Val Gly Ala Phe Ile Tyr Asp Tyr Leu
305                 310                 315                 320

Leu Glu Lys Pro Phe Asp Lys Ile Arg Gly Lys Tyr Ile Arg Thr Ile
                325                 330                 335

Glu Arg Lys Tyr Tyr Lys Asn Glu Leu Arg Glu Ile Leu Arg Glu Gln
            340                 345                 350

Thr Lys Tyr His Glu Gly Leu His Ser Leu Glu Ala Leu Lys Ile Cys
        355                 360                 365
```

```
Ala Glu Glu Leu Tyr Lys Asn Asn Gln Gln His Gln Glu Tyr Leu Leu
    370                 375                 380

Lys Lys Asp Met Thr Phe Leu Leu Leu Asn Asp Leu Ile Phe Tyr Gln
385                 390                 395                 400

Arg Pro Leu Lys Ser Lys Lys Ser Leu Ile Ala Asp Cys Pro Tyr Glu
                405                 410                 415

Val Tyr Lys Tyr Asp Asp Lys Leu Thr Gly Lys Lys Gly Gln Lys Lys
            420                 425                 430

Ile Lys Cys Ile Ala Lys Ser Asn Pro Tyr Tyr Gln Glu Phe Arg Leu
        435                 440                 445

Trp Gln Phe Ile Ala Asn Leu Arg Leu Phe Ser Val Thr Asp Gly Lys
    450                 455                 460

Glu Val Thr Ala Glu Tyr Leu Lys Thr Glu Glu Asp Tyr Val Arg Leu
465                 470                 475                 480

Phe Ser Phe Leu Asn Asp Arg Lys Asp Ile Lys Gln Glu Thr Phe Leu
                485                 490                 495

Arg Ser Phe Leu Lys Leu Lys Lys Glu Ser Ile Gly Ser Glu Lys Ile
            500                 505                 510

Tyr Pro Ile Arg Trp Asn Tyr Ile Glu Asp Ala Asn Lys Ser Tyr Pro
        515                 520                 525

Cys Asn Ala Thr Arg His Glu Leu Leu Leu Ala Phe Asp Arg Ala Asp
    530                 535                 540

Ile Pro Arg Glu Leu Leu Asp Val Glu Glu Arg Glu Tyr Arg Leu Trp
545                 550                 555                 560

His Leu Leu Tyr Ser Ile Glu Ala Lys Glu Glu Thr Glu Ser Ala Leu
```

```
                565                 570                 575

Arg Lys Leu Lys Ala Asn Lys Ala Phe Gly Asp Leu Asn Ile Asp Asp
            580                 585                 590

Ala Phe Val Asn Ser Phe Leu Lys Ile Lys Pro Phe Glu Lys Glu Tyr
        595                 600                 605

Gly Ala Tyr Ser Glu Lys Ala Ile Lys Lys Leu Leu Ala Val Met Arg
    610                 615                 620

Arg Gly Ser Leu Trp Lys Glu Ala Asp Ile Cys Glu Ala Thr Lys Gln
625                 630                 635                 640

Asn Ile Ala Lys Ile Leu Gln Asn Asp Ile Asp Glu Lys Leu Lys Lys
                645                 650                 655

Lys Ile Glu Ala Ala Val Ser Ser Phe Asn Lys Leu Ser Asp Phe Gln
            660                 665                 670

Gly Leu Pro Thr Trp Leu Ala Cys Tyr Val Val Tyr Gly Arg His Ser
        675                 680                 685

Glu Ala Ala Gln Ile Gln Cys Trp Gln Ser Pro Glu Asp Leu Lys Thr
    690                 695                 700

Tyr Ile Asn Lys Phe Lys Gln His Ser Leu Arg Asn Pro Ile Val Glu
705                 710                 715                 720

Gln Cys Leu Leu Glu Thr Leu Arg Thr Val Tyr Asp Ile Trp Lys Asp
                725                 730                 735

Ala Gly Gln Ile Asp Glu Ile His Ile Glu Leu Gly Arg Asn Met Lys
            740                 745                 750

Ser Thr Ala Glu Gln Arg Ala Arg Lys Thr Lys Asp Ile Leu Arg Asn
        755                 760                 765
```

```
Glu Asn Thr Asn Leu Arg Ile Lys Asn Leu Leu Val Glu Leu Lys Asn
    770                 775                 780

Asp Asp Lys Ile Glu Asn Val Arg Pro Tyr Ser Pro Ser Gln Gln Glu
785                 790                 795                 800

Ile Leu Arg Ile Tyr Glu Glu Gly Ala Leu Gln Glu Leu Ser Lys Glu
                805                 810                 815

Asp Glu Met Phe Glu Asp Ile Ser Lys Ile Ser Lys Met Ala Gln Pro
            820                 825                 830

Ser Pro Thr Glu Leu Ser Arg Tyr Lys Leu Trp Leu Glu Gln Lys Tyr
        835                 840                 845

Arg Ser Pro Tyr Thr Gly Arg Val Ile Pro Leu Ser Lys Leu Phe Thr
    850                 855                 860

Thr Ala Tyr Gln Ile Glu His Ile Ile Pro Gln Ser Arg Tyr Phe Asp
865                 870                 875                 880

Asp Ser Phe Asn Asn Lys Val Ile Cys Glu Ser Glu Val Asn Ser Leu
                885                 890                 895

Lys Asp Asn Met Leu Gly Tyr Glu Phe Ile Lys Glu Cys Gly Gly Arg
            900                 905                 910

Ile Val His Cys Thr Leu Leu Gly Asp Val Lys Ile Phe Thr Lys Glu
        915                 920                 925

Glu Tyr Lys Asp Phe Val Thr Lys His Tyr Ile Asp Asn Thr Tyr Lys
    930                 935                 940

Arg Asp Lys Leu Leu Leu Glu Asp Ile Pro Gln Glu Phe Ser Ala Arg
945                 950                 955                 960

Gln Leu Asn Asp Ser Arg Tyr Ile Ser Lys Met Val Gln Thr Val Leu
```

```
               965                 970                 975

Ser Asn Ile Val Arg Ala Glu Asn Glu Gln Glu Ala Thr Ser Lys Phe
            980                 985                 990

Val Val Ser Cys Asn Gly Ala Ile  Thr Asn Arg Leu Lys  Lys Asp Trp
        995                 1000                1005

Gly Leu  Asn Asp Val Trp Ser  Ser Ile Val Cys Pro  Arg Phe Lys
    1010                1015                1020

Arg Leu  Asn Glu Ile Thr Lys  Thr Asn Ala Phe Gly  His Trp Glu
    1025                1030                1035

Asp Lys  Ala Gly Lys His Val  Phe Gln Thr Thr Val  Pro Leu Glu
    1040                1045                1050

Leu Gln  Arg Gly Phe Ser Lys  Lys Arg Ile Asp His  Arg His His
    1055                1060                1065

Ala Met  Asp Ala Leu Val Ile  Ala Cys Ala Ser Arg  Asn Ile Val
    1070                1075                1080

Asn Tyr  Leu Asn Asn Glu Ser  Ala Asn Ser Pro Glu  Lys Arg Glu
    1085                1090                1095

Asp Leu  Arg Lys Lys Leu Cys  Asp Glu Lys Arg Lys  Ile Arg Lys
    1100                1105                1110

Pro Trp  Lys Thr Phe Thr Gln  Asp Ala Arg Glu Ala  Leu Ser Asp
    1115                1120                1125

Val Val  Val Ser Phe Lys Asn  Tyr Val Arg Val Ile  Asn Lys Ala
    1130                1135                1140

Thr Asn  Tyr Tyr Glu His Tyr  Ser Ser Ser Gly Asn  Lys Val Met
    1145                1150                1155
```

```
Ile Ser  Gln Lys Gly Asn Asp  Met Trp Ala Ile Arg  Lys Pro Leu
    1160                1165                1170

His Lys  Glu Ser Val Phe Gly  Arg Val Asn Leu Cys  Arg Lys Val
    1175                1180                1185

Ile Val  Ser Leu Lys Lys Ala  Leu Glu Asn Ile Pro  Ala Ile Cys
    1190                1195                1200

Asp Lys  Thr Leu Arg Asp Tyr  Ile Asn Ala Leu Val  Glu Lys His
    1205                1210                1215

Phe Asn  Thr Arg Gln Leu Leu  Ala His Phe Lys Ser  Ile Asn Tyr
    1220                1225                1230

Arg Leu  Asn Arg Gln Cys Val  Glu Lys Val Glu Val  Trp Gln Phe
    1235                1240                1245

Ser Asp  Glu Lys Ile Glu Met  Val Ala Arg Arg Lys  Ser Leu Asp
    1250                1255                1260

Thr Ser  Phe Asp Asp Lys Gln  Ile Ser Ser Ile Thr  Asp Thr Gly
    1265                1270                1275

Ile Gln  Lys Ile Leu Leu Asn  Tyr Leu Gln Thr Lys  Asp Gly Asn
    1280                1285                1290

Ala Glu  Ile Ala Phe Thr Pro  Glu Gly Ile Glu Glu  Met Asn Lys
    1295                1300                1305

Asn Ile  Ser Leu Tyr Asn Asp  Gly Lys Ala His Gln  Pro Ile Leu
    1310                1315                1320

Lys Val  Arg Val Ala Thr Pro  Lys Gly Met Lys Tyr  Pro Val Gly
    1325                1330                1335

Gln Thr  Gly Asn Lys Ala Thr  Lys Phe Val Val Ala  Glu Lys Gly
```

```
    1340                1345                1350

Thr Asn  Leu Tyr Phe Ala Ile  Tyr Glu Asn Glu Leu  Gly Val Arg
    1355                1360                1365

Ser Tyr  Asp Thr Ile Pro Leu  Asn Ile Val Val Glu  Arg Leu Lys
    1370                1375                1380

Glu Gly  Leu Ser Pro Val Pro  Gln Ala Asn Glu Ala  Asp Ile Pro
    1385                1390                1395

Leu Lys  Phe Tyr Leu Ser Pro  Asn Asp Leu Val Tyr  Val Pro Thr
    1400                1405                1410

Lys Glu  Asn Glu Asp Glu Leu  Cys Arg Asp Arg Ile  Tyr Lys Phe
    1415                1420                1425

Val Asp  Ser Ser Gly Thr Thr  Ala Asn Phe Val Pro  His Thr Ser
    1430                1435                1440

Ala Asn  Thr Ile Tyr Asn Val  Asp Lys Glu Tyr Ala  Glu Lys Cys
    1445                1450                1455

Cys Asn  Gly Ala Val Phe Leu  Asn Glu Tyr Gly Leu  Gly Ser Pro
    1460                1465                1470

Gln Ser  Lys Asn Gln Arg Ala  Leu Thr Gly Glu Met  Ile Lys Glu
    1475                1480                1485

Ile Cys  Trp Lys Leu Lys Val  Asp Arg Leu Gly Asn  Ile Ile Lys
    1490                1495                1500

Val Ile  Lys
    1505
```

<210> 613
<211> 774
<212> PRT

<213> Prevotella oulorum

<400> 613

```
Met Glu Gln Cys Ile Leu Glu Thr Leu Arg Thr Val Tyr Asp Ile Trp
1               5                  10                  15


Lys Glu Ala Gly Gln Ile Asp Glu Ile His Val Glu Leu Gly Arg Glu
            20                  25                  30


Met Lys Gln Thr Ala Glu Gln Arg Ala His Leu Thr Glu Lys Val Leu
        35                  40                  45


Arg Asn Glu Asn Thr Asn Leu Arg Ile Lys Ser Leu Leu Met Glu Leu
    50                  55                  60


Lys Asn Asp Ala Asp Met Lys Asp Val Arg Pro Tyr Ser Pro Met Gln
65                  70                  75                  80


Gln Glu Ile Leu Arg Ile Tyr Glu Glu Gly Ala Leu Gln Thr Leu Ser
                85                  90                  95


Lys Asp Asp Ala Ala Phe Thr Glu Ile Met Lys Ile Ser Lys Met Ala
            100                 105                 110


Gln Pro Ser Ala Ser Glu Leu Gln Arg Tyr Arg Leu Trp Leu Glu Gln
        115                 120                 125


Lys Tyr Arg Ser Pro Tyr Thr Gly Lys Pro Ile Ser Leu Ser Lys Leu
    130                 135                 140


Phe Thr Ser Ala Tyr Gln Ile Glu His Ile Ile Pro Lys Lys Arg Tyr
145                 150                 155                 160


Phe Asp Asp Ser Phe Ser Asn Lys Val Ile Cys Glu Ala Glu Val Asn
                165                 170                 175


Gly Lys Lys Asp Ser Met Leu Ala Tyr Glu Phe Ile Lys Asp Cys Gly
            180                 185                 190
```

```
Gly Asp Val Ile His Cys Thr Thr Leu Gly Asp Val Thr Ile Leu Ser
        195                 200                 205

Glu Ala Glu Tyr Lys Ala Leu Val Thr Glu Leu Tyr Ala Asn Asn Lys
    210                 215                 220

Ser Lys Lys Asp Lys Leu Leu Met Glu Asp Ile Pro Gln Asp Phe Ile
225                 230                 235                 240

Asn Arg Gln Leu Asn Asp Ser Arg Tyr Ile Ser Arg Val Val Met Thr
                245                 250                 255

Leu Leu Ser Asn Ile Val Arg Ile Glu Gly Glu Glu Glu Ala Thr Ser
            260                 265                 270

Lys Phe Val Ile Pro Cys Ser Gly Gly Ile Thr Asp Lys Leu Lys Lys
        275                 280                 285

Asp Trp Gly Leu Asn Asp Val Trp Asn Asn Ile Val Tyr Pro Arg Phe
    290                 295                 300

Glu Arg Leu Asn Ala Leu Thr Asn Thr Ser Asp Phe Gly Gln Trp Glu
305                 310                 315                 320

Asn Lys Glu Gly Lys Arg Val Phe Gln Thr Ser Val Pro Leu Glu Leu
                325                 330                 335

Gln Arg Gly Tyr Gln Lys Lys Arg Ile Asp His Arg His His Ala Met
            340                 345                 350

Asp Ala Leu Val Ile Ala Cys Ala Ser Arg Lys Ile Ile Asn Tyr Leu
        355                 360                 365

Asn Asn Gln Glu Ala Asn Asp Pro Thr Lys Gln Glu Asn Ala Arg Lys
    370                 375                 380
```

```
Gln Leu Cys Ile Lys Ser Arg Ile Ile Arg Lys Pro Trp Glu Thr Phe
385                 390                 395                 400

Thr Gln Asp Ala Tyr Lys Ala Leu Asp Asn Ile Val Val Ser Phe Lys
                405                 410                 415

Asn Tyr Val Arg Val Ile Asn Lys Ala Thr Asn Tyr Tyr Glu Arg Tyr
            420                 425                 430

Asn Ala Asp Gly Lys Lys Ala Val Asp Glu Gln Lys Gly Glu Ala Met
        435                 440                 445

Trp Ala Ile Arg Lys Pro Met His Lys Asp Thr Val Phe Gly His Val
    450                 455                 460

Asn Leu Arg Arg Lys Ala Val Val Lys Leu Lys Asp Ala Leu Glu Asn
465                 470                 475                 480

Ile Pro Ala Ile Cys Asp Lys Thr Leu Arg His Tyr Ile Gln Asp Leu
                485                 490                 495

Gln Lys Lys His Phe Asn Thr Lys Gln Leu Leu Ala His Phe Lys Ser
            500                 505                 510

Ile Asn Tyr Arg Leu Asn Lys Gln Ala Val Asp Lys Val Glu Val Trp
        515                 520                 525

Gln Tyr Ser Asp Asp Lys Glu Gln Leu Ala Ala Thr Arg Lys Pro Leu
    530                 535                 540

Gly Pro Ser Phe Asp Ala Lys Cys Ile Ala Ala Ile Thr Asp Thr Gly
545                 550                 555                 560

Ile Gln Lys Ile Leu Leu Asn Tyr Leu Gln Ala Lys Gly Gly Asp Pro
                565                 570                 575

Ala Ile Ala Phe Thr Pro Glu Gly Ile Ala Glu Met Asn Gln Asn Ile
            580                 585                 590
```

```
Ala Val Tyr Asn Gly Gly Lys Gln His Gln Pro Ile Leu Lys Val Arg
        595                 600                 605

Ile Ala Lys Pro Met Gly Lys Lys Phe Pro Ile Gly Gln Thr Gly Asn
    610                 615                 620

Lys Ala Phe Gln Tyr Val Ile Ala Glu Glu Gly Thr Asn Leu Tyr Phe
625                 630                 635                 640

Ala Ile Tyr Glu Asp Glu Glu Gly Asn Arg Thr Tyr Asp Thr Ile Ala
                645                 650                 655

Leu Arg Glu Val Val Glu Arg Leu Lys Gln Gly Leu Thr Pro Val Pro
            660                 665                 670

Glu Lys Asn Glu Lys Gly Val Ala Leu Lys Phe His Leu Ser Pro Asn
        675                 680                 685

Asp Leu Val Tyr Val Pro Thr Ala Asp Glu Leu Leu Ser Lys Val Cys
    690                 695                 700

Ser Leu Asp Lys Asn Arg Ile Tyr Lys Met Val Ser Ala Thr Lys Ser
705                 710                 715                 720

Glu Cys Leu Phe Ile Pro His Ser Val Ala Lys Thr Ile Tyr Asp Lys
                725                 730                 735

Val Glu Phe Glu Ala Leu Asn Lys Met Gly Arg Ala Leu Thr Gly Glu
            740                 745                 750

Met Ile Lys Ser Val Cys Trp Lys Ile Glu Val Asp Arg Leu Gly His
        755                 760                 765

Ile Val Asn Ile Ile Lys
    770
```

<210> 614
<211> 691
<212> PRT
<213> Prevotella oulorum

<400> 614

```
Met Lys Thr Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Lys Val Ile Val Asp Asp Asn Glu Asn Tyr Leu Arg Asp Ile Gln
            20                  25                  30


Leu Gly Ser Arg Ile Ile Pro Met Ser Gln Asp Val Leu Gly Lys Phe
        35                  40                  45


Asp Lys Gly Val Thr Glu Ser Gln Thr Ala Ile Arg Thr Ser Phe Arg
    50                  55                  60


Gly Val Arg Arg Leu Arg Glu Arg Thr Leu Gln Arg Arg Glu Arg Leu
65                  70                  75                  80


His Arg Val Leu His Thr Leu His Tyr Leu Pro Pro His Tyr Asp Ser
                85                  90                  95


Ala Ile Gly Trp Asp Arg Lys Thr Pro Thr Thr Tyr Gly Lys Phe Leu
            100                 105                 110


Asn His Gly Glu Pro Lys Leu Ala Trp Glu Arg Arg Glu Asp Gly Thr
        115                 120                 125


Met Gln Phe Leu Phe Met Asp Ala Phe His Glu Met Ile Ala Asp Phe
    130                 135                 140


Ala Lys Tyr Gln Pro Ala Leu Val Ala Asp Gly Lys Lys Val Pro Leu
145                 150                 155                 160


Asp Trp Thr Ile Tyr Tyr Leu Arg Lys Lys Ala Leu Thr Gln Pro Ile
                165                 170                 175
```

```
Lys Lys Glu Glu Leu Ala Trp Ile Leu Leu Asn Phe Asn Gln Lys Arg
            180                 185                 190

Gly Tyr Tyr Gln Leu Arg Gly Glu Glu Asp Glu Glu Asn Ala Ala Lys
        195                 200                 205

His Glu Glu Tyr His Glu Leu Lys Val Val Gly Val Glu Val Asp Glu
    210                 215                 220

Ala Gly Lys Gly Asp Asn Thr Trp Tyr Asn Val Lys Leu Glu Asn Gly
225                 230                 235                 240

Trp Thr Tyr His Arg Gln Ser Lys Ile Pro Leu Asp Asp Trp Val Gly
                245                 250                 255

Lys Val Arg Ala Phe Ile Val Thr Thr Glu Tyr Glu Lys Asp Gly Thr
            260                 265                 270

Thr Pro Lys Lys Asp Lys Glu Gly Asn Val Lys Arg Ser Phe Arg Ser
        275                 280                 285

Pro Asp Glu Lys Asp Trp Gly Leu Arg Lys Lys Gln Thr Glu His Ser
    290                 295                 300

Leu Glu Ala Ser Gly Thr Pro Val Gly Ala Phe Ile Tyr Asp His Leu
305                 310                 315                 320

Leu Lys Glu Pro Ser Asp Lys Ile Arg Gly Lys Phe Ile His Thr Ile
                325                 330                 335

Glu Arg Lys Tyr Tyr Lys Gln Glu Leu Ala Ala Ile Leu Arg Glu Gln
            340                 345                 350

Ser Lys His His Glu Lys Leu Cys Ser Lys Asp Met Leu Lys Ala Cys
        355                 360                 365

Ile Glu Glu Leu Tyr Pro Asn Asn Pro Leu His Arg Glu Ser Leu Leu
```

```
    370                 375                 380

Lys Lys Asp Met Pro Tyr Leu Leu Ile Glu Asp Leu Ile Phe Tyr Gln
385                 390                 395                 400

Arg Pro Leu Lys Ser Lys Lys Ser Leu Ile Ala Glu Cys Pro Tyr Glu
                405                 410                 415

Ala Tyr Ser Tyr Val Asp Lys Glu Thr Gly Glu Met Lys Arg Gln Gly
            420                 425                 430

Ile Lys Cys Ile Ala Lys Ser Asn Pro Tyr Tyr Gln Glu Phe Arg Leu
        435                 440                 445

Trp Gln Leu Ile Ala Asn Leu Arg Leu Arg Asn Arg Ser Asp Glu Arg
    450                 455                 460

Asp Val Thr Ala Glu Tyr Leu Pro His Gln Glu Asp Tyr Val Arg Leu
465                 470                 475                 480

Phe Thr Tyr Leu Asn Asp Arg Lys Glu Ile Asn Gln Glu Thr Leu Leu
                485                 490                 495

Lys Asp Phe Phe Lys Leu Lys Lys Val Thr Ile Gly Gly Glu Lys Val
            500                 505                 510

Phe Pro Ile Arg Trp Asp Tyr Ile Glu Asp Lys Glu Lys Lys Tyr Pro
        515                 520                 525

Cys Asn Ala Thr Arg His Glu Leu Leu Leu Ala Leu Asp Arg Ala Gly
    530                 535                 540

Ile Glu His Asp Trp Leu Asn Asp Arg Asp Leu Ala Tyr Arg Leu Trp
545                 550                 555                 560

His Leu Leu Tyr Ser Val Asp Ser Lys Asp Glu Thr Glu Arg Ala Leu
                565                 570                 575
```

```
Arg Lys Leu Lys Asp Asp Asp Ala Phe Val Glu Ser Phe Leu Lys Ile
            580                 585                 590

Lys Pro Phe Glu Lys Glu Tyr Gly Ala Tyr Ser Glu Lys Ala Ile Lys
        595                 600                 605

Lys Leu Leu Pro Val Met Arg Arg Gly Ser Leu Trp Asn Glu Ala Asp
    610                 615                 620

Leu Cys Pro Ser Thr Lys Glu Arg Ile Ala Asn Ile Leu Gln Gly Thr
625                 630                 635                 640

Ile Asp Glu Lys Leu Lys Lys Lys Ile Gly Ala Phe Ile Ser Ser Cys
                645                 650                 655

Gln Gln Val Ser Asp Phe Gln Gly Leu Pro Glu Trp Leu Ala Cys Tyr
            660                 665                 670

Val Val Tyr Gly Arg His Ser Glu Ala Thr Asp Ile Gln Arg Trp Glu
        675                 680                 685

Thr Pro Glu
    690
```

<210> 615
<211> 242
<212> PRT
<213> Prevotella saccharolytica

<400> 615

```
Met Lys Leu Val Leu Gly Leu Asp Leu Gly Val Gly Ser Val Gly Trp
1               5                   10                  15

Ala Leu Ile Phe Ile Thr Asp Ser Gly Glu Pro Ile Lys Ile Leu Ala
            20                  25                  30

Leu Gly Glu Arg Ile Val Ser Met Asp Ser Asn Asn Ser Asn Glu Phe
        35                  40                  45
```

```
Ser Ala Gly Ala Thr Cys Thr Leu Asn Gln Lys Lys Thr Lys Ala Lys
    50                  55                  60

Ser Val Arg Lys Gly Tyr Ser Arg Tyr Val Gln Arg Arg Asp Ala Leu
65                  70                  75                  80

Thr Ala Glu Leu Arg His Ile Gly Met Met Pro Asp Glu Thr Leu Ile
                85                  90                  95

Lys Leu Pro Val Leu Asp Leu Trp Gln Leu Arg Ala Asn Ala Ala Thr
            100                 105                 110

Glu Gly Lys Lys Leu Ser Leu Ala Glu Ile Gly Arg Val Leu Tyr His
        115                 120                 125

Ile Asn Gln Arg Arg Gly Tyr Lys His Gly Lys Ser Asp Val Ser Ser
    130                 135                 140

Asp Asn Lys Gln Lys Gly Tyr Val Lys Ala Val Asn Glu Arg Tyr Cys
145                 150                 155                 160

Met Ile Gln Glu Arg Gln Gln Thr Ile Gly Gln Tyr Phe Ala Leu Lys
                165                 170                 175

Leu Lys Glu Thr Ala Val Thr Thr Glu Lys Gly Thr Phe Tyr Thr Phe
            180                 185                 190

Arg Ile Lys Asp Gln Val Phe Pro Arg Glu Ala Tyr Glu Glu Glu Phe
        195                 200                 205

Val Val Ala Tyr Ser Thr Lys Val Leu Lys Phe Lys Gln Ile Thr Thr
    210                 215                 220

Leu Leu Asn Val Val Ile Cys Leu Met Met Leu Leu Leu Ile Val Gln
225                 230                 235                 240
```

Arg Tyr

<210> 616
<211> 1174
<212> PRT
<213> Prevotella sp.

<400> 616

```
Met Glu Phe His Pro Glu Leu Cys Asp Ala Glu Leu Leu Lys Ala Cys
1               5                  10                  15


Ala Glu Glu Leu Tyr Arg Asn Asn Glu Ala His Arg Ala Gln Leu Leu
            20                  25                  30


Ala Lys Asp Phe Lys His Leu Leu Val Glu Asp Val Leu Phe Tyr Gln
        35                  40                  45


Arg Pro Leu Lys Ser Lys Lys Ser Leu Ile Ala Asn Cys Pro Tyr Glu
    50                  55                  60


Thr Arg Gln Tyr Ile Asn Lys Glu Thr Gly Glu Ile Lys Asp Val Asn
65                  70                  75                  80


Val Lys Cys Ile Ala Lys Ser Asn Pro Tyr Phe Gln Glu Phe Arg Leu
                85                  90                  95


Trp Gln Trp Ile Ser Asn Leu Arg Leu Leu Arg Gln Ala Asp Gly Gln
            100                 105                 110


Asp Val Thr Ala Ala Tyr Ile Lys Gly Asn Glu Asp Lys Glu Arg Leu
        115                 120                 125


Phe Asp Leu Leu Asn Asn Gln Gly Glu Ile Lys Gln Glu His Ile Leu
    130                 135                 140


Arg Asp Phe Leu Lys Leu Lys Lys Pro Lys Gly Gly Glu Phe Pro Leu
145                 150                 155                 160
```

```
Arg Trp Asn Tyr Val Asp Asp Lys Ile Tyr Pro Ala Asn Glu Thr Arg
                165                 170                 175

His Ala Ile Asn Lys Ala Ile Lys Gly Met Ala Val Asp Lys Glu Glu
            180                 185                 190

Lys Glu Thr Leu Gly Gln Leu Leu Asp Gln Pro Ala Val Ala Tyr Met
        195                 200                 205

Leu Trp Asn Leu Leu Tyr Ser Ile Thr Asp Arg Asn Glu Leu Ala Arg
    210                 215                 220

Ala Leu Arg Arg Phe Ala Leu Thr His Gly Val Ser Ser Val Asp Ala
225                 230                 235                 240

Phe Val Glu Ser Phe Leu Lys Val Lys Pro Phe Lys Lys Glu Tyr Gly
                245                 250                 255

Ala Tyr Ser Glu Lys Ala Thr Lys Lys Leu Leu Gln Val Met Arg Leu
            260                 265                 270

Gly Lys Tyr Trp Cys Gly Asp Glu Leu Pro Glu Pro Ala Lys Arg Thr
        275                 280                 285

Lys Gly Asn Lys Gln Ala Val Tyr Asp Glu Met Ala His Arg Gly Ile
    290                 295                 300

Cys Lys Gln Thr Leu Gln Asn Ile Ser Asn Ile Ile Glu Glu Asn Ile
305                 310                 315                 320

Asp Glu Arg Leu Met Gly Ala Leu Leu Asn Pro Glu Arg Pro Leu Thr
                325                 330                 335

Glu Leu Ser His Phe Gln Gly Leu Ser Val Ser Asp Ala Cys Tyr Val
            340                 345                 350

Val Tyr Gly Arg His Ser Glu Val Ala Glu Ile Val Lys Trp Lys Asp
```

```
        355                 360                 365

Ala Asp Glu Leu Asn Thr Phe Ile Asn Asn Phe Lys Gln His Ser Met
    370                 375                 380

Arg Asn Pro Ile Val Glu Gln Cys Val Leu Glu Thr Leu Arg Thr Val
385                 390                 395                 400

Arg Asp Val Trp Glu Gln Glu Gly Gln Ile Asp Glu Ile His Val Glu
                405                 410                 415

Leu Gly Arg Asn Met Lys Arg Thr Ala Glu Gln Arg Ala Arg Asp Thr
            420                 425                 430

Gln Ala Ile Gln Arg Asn Glu Asn Thr Asn Met Arg Ile Ser Leu Leu
        435                 440                 445

Leu Thr Glu Leu Lys Asn Asp Pro Ser Ile Ser Asp Val Arg Pro Tyr
    450                 455                 460

Ser Pro Ser Gln Arg Glu Leu Leu Lys Ile Tyr Glu Glu Gly Ala Leu
465                 470                 475                 480

Glu Asn Leu Thr Asn Gln Asp Glu Asp Ile Ala Lys Ile Ser Arg Leu
                485                 490                 495

Ala Gln Pro Ser Ala Ser Glu Leu Arg Arg Tyr Lys Leu Trp Leu Asp
            500                 505                 510

Gln Lys Tyr Val Ser Pro Tyr Thr Gly Arg Pro Ile Pro Leu Ala Lys
        515                 520                 525

Leu Phe Thr Pro Ala Tyr Glu Ile Glu His Ile Ile Pro Gln Ser Arg
    530                 535                 540

Tyr Phe Asp Asn Ser Phe Ser Asn Lys Val Ile Cys Glu Ala Glu Val
545                 550                 555                 560
```

```
Asn Lys Leu Lys Asp Asn Leu Leu Gly Met Glu Phe Ile Lys Lys Phe
               565                 570                 575

Gly Gly Lys Thr Lys Gly Ile Leu Asp Glu Glu Ala Tyr Lys Leu His
            580                 585                 590

Val Thr Thr Asn Tyr Ala His Asn Pro Ala Lys Arg Ser Lys Leu Leu
        595                 600                 605

Met Glu Asp Leu Pro Thr Asp Phe Asn Ser Arg Gln Leu Asn Asp Thr
    610                 615                 620

Arg Tyr Ile Ser Lys Thr Val Met Ala Leu Leu Ser Asn Val Val Arg
625                 630                 635                 640

Glu Glu Gly Glu Arg Glu Thr Arg Ser Lys His Val Val Val Cys Thr
               645                 650                 655

Gly Gly Val Thr Asp Thr Leu Lys Lys Asp Trp Gly Leu His Asp Val
            660                 665                 670

Trp His Asn Leu Val Tyr Pro Arg Phe Ile Arg Leu Asn Asn Leu Thr
        675                 680                 685

Gly Ser Gln Asn Phe Gly Tyr Trp Arg Tyr Leu Asn Glu Glu Asn Ser
    690                 695                 700

Lys Lys Gly Glu Asp Ser Lys Lys Val Phe Gln Ile Thr Leu Pro Pro
705                 710                 715                 720

Glu Cys Gln Arg Gly Phe Val Lys Lys Arg Ile Asp His Arg His His
               725                 730                 735

Ala Met Asp Ala Leu Val Ile Ala Cys Ala Ser Ala Asn Ile Val Asn
            740                 745                 750

Tyr Leu Asn Asn Gln Ser Ala Ala Asn Pro His Ile His Glu Asn Leu
```

```
        755                 760                 765

Gln Arg Leu Leu Cys Asp Arg Lys Arg Glu Ile Arg Lys Pro Trp Pro
    770                 775                 780

Thr Phe Thr Gln Asp Ala Gln Ala Ala Leu Lys Asp Leu Val Val Ser
785                 790                 795                 800

Phe Lys Asn Thr Val Arg Val Val Asn Lys Ala Ser Asn Thr Tyr Leu
                805                 810                 815

Arg Tyr Asp Lys Asp Gly Lys Lys Lys Arg Phe Lys Gln Glu Gly Glu
            820                 825                 830

Gly Leu Lys Ala Ile Arg Lys Pro Met His Lys Glu Thr Tyr Tyr Gly
        835                 840                 845

Glu Val Asn Leu Ile Arg Lys Glu Met Val Pro Leu Lys Arg Ala Leu
    850                 855                 860

Asp Asp Val Asn Ala Ile Val Asp Lys Glu Leu Arg Ala Ser Ile Lys
865                 870                 875                 880

Gly Leu Leu Arg Asp Gly Phe Asn Pro Gln Gln Val Leu Ala Asn Phe
                885                 890                 895

Lys Ala Lys Asp Phe Lys Phe Asp Lys Arg Asp Ile Lys Lys Val Glu
            900                 905                 910

Val Tyr Val Ser Ser Glu Lys Ser Thr Pro Met Val Ala Thr Arg Lys
        915                 920                 925

Ser Leu Asp Thr Ser Phe Asn Ala Lys Arg Ile Ala Asp Ile Thr Asp
    930                 935                 940

Thr Gly Ile Gln Lys Ile Leu Leu Asn Tyr Leu Lys Ala Asn Asp Asn
945                 950                 955                 960
```

```
Ser Pro Glu Gln Ala Phe Thr Pro Glu Gly Ile Ala Tyr Leu Asn Glu
               965                 970                 975


His Ile Ala Glu Tyr Asn Asp Gly Lys Pro His Gln Pro Ile Leu Lys
            980                 985                 990


Val Arg Val Ser Glu Val Lys Gly  Ala Lys Phe Ala Val  Gly Gln Thr
        995                 1000                1005


Gly Ser  Lys Lys Asp Lys Phe  Val Glu Ala Gln Ser  Gly Thr Asn
    1010                1015                1020


Leu Tyr  Phe Ala Ile Tyr Glu  Asp Lys Glu Gly Lys  Arg His Phe
    1025                1030                1035


Glu Thr  Ile Ala Leu Lys Val  Ala Ala Glu Arg Leu  Lys Asp Lys
    1040                1045                1050


Gln Met  Pro Val Pro Glu Ile  Asn Asp Ala Gly Leu  Pro Leu Lys
    1055                1060                1065


Phe Tyr  Leu Ser Pro Asn Asp  Leu Val Tyr Val Pro  Thr Asp Glu
    1070                1075                1080


Asp Arg  Ala Thr Ala His Pro  Ser Ile Asp Lys Met  Arg Ile Tyr
    1085                1090                1095


Lys Met  Val Ser Ala Thr Asp  Arg Gln Cys Phe Phe  Leu Pro Phe
    1100                1105                1110


Thr Val  Ala Ser Val Ile Ser  Asn Lys Val Glu Phe  Glu Ala Leu
    1115                1120                1125


Asn Lys  Met Glu Arg Val Leu  Asp Ala Ser Glu Tyr  Ser Ser Ala
    1130                1135                1140


Tyr Asp  Ser Ser His Val Asn  Lys Val Met Val Lys  Asn Val Cys
```

```
    1145                1150                1155

Trp Lys  Leu Glu Val Asp Arg  Leu Gly Asn Ile Thr  Lys Ile Val
    1160                1165                1170

Arg
```

<210> 617
<211> 992
<212> PRT
<213> Prevotella sp.

<400> 617

```
Met Ile Thr Arg Ile Leu Gly Leu Asp Thr Gly Thr Asn Ser Leu Ala
1               5                   10                  15

Trp Ala Val Val Asp Arg Asp Ala Asn Gly Asn Tyr Thr Leu Val Lys
            20                  25                  30

Arg Gly Asp Val Ile Phe Thr Glu Gly Val Lys Ile Glu Lys Gly Ile
        35                  40                  45

Glu Ser Ser Lys Ala Ala Glu Arg Thr Ala His Lys Ala Leu Arg Val
    50                  55                  60

His Tyr Ser Arg Arg Arg Leu His Lys Ile Asp Thr Leu Lys Val Leu
65                  70                  75                  80

Val Glu Leu Asn Leu Cys Pro Cys Leu Ser Asp Glu Gln Leu Ser Gln
                85                  90                  95

Trp Lys Ala Lys Lys Thr Tyr Pro Leu Thr Asp Asp Phe Met Leu Trp
            100                 105                 110

Gln Arg Ser Gly Ser Ala Glu Glu Asn Asn Pro Tyr Tyr Cys Arg His
        115                 120                 125
```

```
Arg Cys Leu Thr Gln Lys Leu Asp Leu Thr Asp Gln Ser Gln Arg Phe
    130                 135                 140

Leu Leu Gly Arg Ala Phe Tyr His Leu Ala Gln Arg Arg Gly Phe Leu
145                 150                 155                 160

Ser Asn Arg Leu Asp Thr Ser Ala Asp Ser Asp Glu Ser Gly Lys Val
                165                 170                 175

Lys Ser Gly Ile Ala Gln Leu Ser Val Glu Met Glu Lys Ala Gly Cys
            180                 185                 190

Glu Phe Leu Gly Glu Tyr Phe Tyr Gln Leu Tyr Lys Gln His Gly Asn
        195                 200                 205

Thr Ile Lys Leu Arg Ser Arg Tyr Thr Asp Arg Glu Glu His Tyr Lys
    210                 215                 220

Lys Glu Phe Leu Ala Ile Cys Glu Lys Gln Glu Leu Asp Pro Lys Trp
225                 230                 235                 240

Val Glu Ala Leu Gln Arg Ala Ile Tyr Phe Gln Arg Pro Leu Lys Ser
                245                 250                 255

Gln Arg Lys Gly Val Gly Lys Cys Thr Phe Glu Pro Lys Lys Pro Arg
            260                 265                 270

Cys Ala Glu Ser His Pro Asp Tyr Glu Ala Phe Arg Met Leu Cys Phe
        275                 280                 285

Leu Asn Asn Val Lys Ile Gln Thr Pro Asn Asp Thr Ser Leu Arg Pro
    290                 295                 300

Leu Asn Glu Asp Glu Arg Glu Lys Ile Trp Pro Ile Phe Phe Arg Lys
305                 310                 315                 320

Ser Lys Pro Asn Phe Asp Phe Glu Asp Ile Ala Lys Ala Leu Ala Gly
                325                 330                 335
```

```
Lys Asn Asn Tyr Ala Trp Tyr Lys Asp Ala Gly Glu Lys Pro Phe Lys
            340                 345                 350

Phe Asn Tyr Arg Met Gln Gln Gly Val Ser Gly Cys Pro Val Thr Ala
        355                 360                 365

Gln Leu Ile Asp Ile Phe Gly Ser Asp Trp Gln Thr Ala Ile Ala Glu
    370                 375                 380

Thr Tyr Thr Ala Val Glu Lys Lys Asn Gly Thr Lys Thr Ile Asp Glu
385                 390                 395                 400

Met Ala Asp Asp Val Trp Asn Val Leu Tyr Ser Phe Ser Ser Lys Asp
                405                 410                 415

Lys Leu Lys Ala Phe Ala Thr Glu Lys Leu Gln Leu Asp Glu Ala Ser
            420                 425                 430

Ala Thr Lys Phe Ala Asn Ala Lys Leu Pro His Gly Phe Ala Ser Leu
        435                 440                 445

Ser Leu Lys Ala Ile Arg Asn Ile Leu Pro Phe Leu Arg Gln Gly Phe
    450                 455                 460

Ile Tyr Ala His Ala Val His Leu Ala Lys Ile Pro Asp Ile Val Thr
465                 470                 475                 480

Lys Ala Val Trp Asn Asp Ala Asp Lys Arg Glu Met Ile Leu Ser Gly
                485                 490                 495

Leu Met Glu Ile Ile Glu Asn Tyr Asn Pro Lys Asp Arg Gly Val Glu
            500                 505                 510

Gly Thr Ile Asp Phe Cys Ile Lys Ser His Leu Gln Asp Val Ile Asp
        515                 520                 525
```

```
Leu Arg Pro Gly Ala Ala Asp Ala Leu Tyr His Pro Ser Met Ile Glu
    530                 535                 540

Thr Tyr Pro Asp Ala Lys Leu Asn Lys Met Gly Val Phe Gln Leu Gly
545                 550                 555                 560

Ser Pro Arg Thr Asn Ala Ile Arg Asn Pro Met Ala Met Arg Ser Leu
                565                 570                 575

His Ile Leu Arg Ser Val Val Asn Gln Leu Leu Arg Asp Gly Ile Ile
            580                 585                 590

Asp Arg Asp Thr Glu Val His Val Glu Tyr Ala Arg Glu Leu Asn Asp
        595                 600                 605

Ala Asn Lys Arg Lys Ala Ile Ala Asp Tyr Gln Arg Glu Gln Glu Lys
    610                 615                 620

Lys Arg Lys Gln Tyr Arg Asp Asp Ile Ile Ala Leu Tyr Lys Ser Glu
625                 630                 635                 640

Cys His Lys Glu Ile Glu Pro Thr Asp Thr Asp Ile Leu Lys Phe Gln
                645                 650                 655

Leu Trp Glu Glu Gln Asn His Leu Cys Leu Tyr Thr Gly Thr Gln Ile
            660                 665                 670

Gly Ile Cys Asp Phe Leu Gly Asp Asn Pro Lys Phe Asp Ile Glu His
        675                 680                 685

Thr Val Pro Arg Ser Val Gly Gly Asp Ser Thr Gln Met Asn Leu Thr
    690                 695                 700

Leu Cys Asp Ala Thr Phe Asn Arg Gln Val Lys Gly Ala Gln Leu Pro
705                 710                 715                 720

Ser Gln Leu Ser Asn His Ala Asp Ile Leu Val Arg Ile Asp His Trp
                725                 730                 735
```

```
Lys Ser Lys Cys Glu Asp Leu Arg Lys Gln Leu Asp Lys Ile Arg Thr
            740                 745                 750

Tyr Gly Gly Met Glu Lys Asn Met Lys Asp Arg Leu Ile Gln Lys Arg
        755                 760                 765

His Arg Leu Lys Met Asp Leu Asp Tyr Trp Gln Gly Lys Tyr Ser Arg
    770                 775                 780

Phe Thr Met Thr Glu Val Pro Glu Gly Phe Ser Arg Arg Gln Gly Ala
785                 790                 795                 800

Gly Ile Gly Leu Val Ser Lys Tyr Ala Gly Leu Phe Leu Lys Ser Leu
                805                 810                 815

Phe His Asn Glu Gln Asn Pro Asn Lys Ser Asn Val Tyr Val Val Lys
            820                 825                 830

Gly Val Thr Thr Ala Glu Phe Arg Arg Met Trp Gly Leu Gln Gly Glu
        835                 840                 845

Tyr Glu Lys Lys Ser Arg Leu Asn His Cys His His Cys Ile Asp Ala
    850                 855                 860

Ile Thr Ile Ala Cys Ile Gly Lys Ala Glu Tyr Asp Lys Met Ala Gln
865                 870                 875                 880

Tyr Tyr His Asp Glu Glu Leu Phe Gln Trp Arg Gly Thr Thr Thr Lys
                885                 890                 895

Pro His Phe Asn Lys Pro Trp Pro Thr Phe Thr Glu Asp Val Leu Ala
            900                 905                 910

Ile Glu Gln Ser Leu Leu Val Lys His Leu Thr Lys Asp Asn Met Pro
        915                 920                 925
```

```
Lys Gln Ala Lys Lys Arg Val Arg Thr Ala Thr Gly Lys Tyr Leu Ala
    930                 935                 940

Gln Gly Asp Thr Ala Arg Gly Ser Leu His Lys Asp Thr Tyr Tyr Gly
945                 950                 955                 960

Ala Ile Glu Gln Asn Gly Glu Ile Arg Tyr Val Leu Arg Lys Pro Leu
                965                 970                 975

Asn Lys Phe Glu Asn Glu Ala Glu Leu Glu Lys Ile Val Asp Gln Ala
            980                 985                 990
```

<210> 618
<211> 1375
<212> PRT
<213> Prevotella sp.

<400> 618

```
Met Lys Lys Ile Leu Gly Leu Asp Leu Gly Thr Thr Ser Ile Gly Trp
1               5                   10                  15

Ala Leu Val Asn Glu Ser Glu Asn Lys Asp Glu Gln Ser Ser Ile Val
            20                  25                  30

Arg Leu Gly Val Arg Val Ile Pro Leu Thr Val Asp Glu Lys Gly Asn
        35                  40                  45

Phe Glu Lys Gly Lys Ala Ile Thr Thr Asn Ala Asp Arg Gln Gln Val
    50                  55                  60

His Ala Ala Arg Ile Asn Leu Gln Arg Tyr Lys Leu Arg Arg Glu Asn
65                  70                  75                  80

Leu Arg Asp Cys Leu Gln Lys Gln Gly Trp Ile Gly Ser Glu Pro Met
                85                  90                  95

Cys Glu Asp Gly Lys Ser Ser Thr Phe Glu Thr Tyr Lys Leu Arg Ala
            100                 105                 110
```

```
Lys Ala Ala Val Glu Glu Val Ser Leu His Glu Phe Ala Arg Val Leu
        115                 120                 125

Phe Met Leu Asn Lys Lys Arg Gly Tyr Lys Ser Asn Arg Lys Ala Asn
    130                 135                 140

Asp Lys Glu Glu Gly Lys Leu Phe Asp Gly Met Thr Ile Ala Lys Lys
145                 150                 155                 160

Leu Tyr Glu Glu His Leu Thr Pro Ala Glu Tyr Ser Leu Gln Leu Leu
                165                 170                 175

Asn Thr Gly Arg Lys Phe Thr Pro Glu Tyr Tyr Arg Ser Asp Leu Ile
            180                 185                 190

Glu Glu Phe Glu Lys Ile Trp Asn Glu Gln Gln Lys Tyr Tyr Pro Glu
        195                 200                 205

Ile Leu Thr Asp Glu Phe Lys Gln Gln Leu Glu Gly Lys Ala Lys Ser
    210                 215                 220

Asn Thr Ser Lys Leu Phe Leu Gly Lys Tyr Gly Ile Tyr Ser Ala Asp
225                 230                 235                 240

Thr Lys Gly Leu Asp Arg Arg Leu Gln Pro Leu Lys Trp Arg Val Glu
                245                 250                 255

Ala Met Lys Gln Gln Val Asp Lys Asp Val Leu Ala Phe Val Ile Ser
            260                 265                 270

Asp Leu Lys Gly Gln Ile Ala Asn Thr Ser Gly Leu Leu Gly Ala Ile
        275                 280                 285

Ser Asp Arg Ser Lys Glu Leu Tyr Phe Ser Lys Gln Thr Ile Gly Gln
    290                 295                 300

Tyr Leu Trp Ala Ser Leu Gln Glu Asn Pro His Ile Ser Ile Lys Asn
```

```
305                 310                 315                 320

Gln Pro Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe Glu Lys Ile Trp
                325                 330                 335

Glu Thr Gln Ala Thr Tyr His Lys Glu Leu Thr Ser Glu Leu Lys Gln
            340                 345                 350

Glu Ile Arg Asp Ile Ile Ile Phe Tyr Gln Arg Pro Leu Lys Ser Lys
        355                 360                 365

Lys Asn Leu Ile Ala Val Cys Glu Leu Glu Gln Arg Lys Val Lys Val
    370                 375                 380

Thr Val Asp Gly Lys Glu Lys Glu Ile Thr Ile Gly Pro Lys Ile Ala
385                 390                 395                 400

Pro Lys Ser Ser Pro Met Phe Gln Glu Phe Arg Ile Trp Gln Asn Leu
                405                 410                 415

Asn Asn Ile Leu Leu Leu Asp His Glu Thr Asn Ser Lys Arg Pro Leu
            420                 425                 430

Tyr Glu Glu Glu Arg Asn Leu Leu Tyr Glu Glu Leu Ser Val Lys Glu
        435                 440                 445

Lys Leu Ser Lys Thr Glu Ala Leu Lys Val Leu Gly Lys Lys Ser Lys
    450                 455                 460

Gln Trp Asp Leu Asn Tyr Lys Glu Leu Glu Gly Asn Arg Thr Gln Ala
465                 470                 475                 480

Val Leu Tyr Asp Cys Tyr Asn Arg Ile Ile Val Met Ser Gly His Glu
                485                 490                 495

Glu Cys Asn Phe Lys Lys Leu Lys Ala Ser Asp Ile Arg His Tyr Val
            500                 505                 510
```

```
Lys Met Ile Phe Lys Asn Leu Ala Phe Asn Thr Asp Ile Leu Cys Phe
        515                 520                 525

Asp Ser Ser Leu Lys Gly His Glu Leu Glu Arg Gln Pro Met Cys Gln
    530                 535                 540

Leu Trp His Leu Leu Tyr Ser Tyr Glu Gly Asp Asn Ser Arg Thr Gly
545                 550                 555                 560

Asn Asp Ala Leu Leu Arg Lys Leu Glu Thr Ser Phe Gly Phe Pro Lys
                565                 570                 575

Glu Tyr Ala Ala Val Leu Ala Asp Val Ile Phe Glu Asp Ser Tyr Gly
            580                 585                 590

Asn Leu Ser Val Lys Ala Met Arg Asn Ile Leu Pro His Leu Gln Ala
        595                 600                 605

Gly Lys Asp Tyr Ser Gln Ala Cys Glu Glu Ala Gly Tyr Lys His Ser
    610                 615                 620

Arg Arg Ser Leu Thr Lys Glu Glu Leu Asn Gln Lys Val Tyr Lys Glu
625                 630                 635                 640

Lys Leu Glu Leu Leu Pro Lys Asn Ser Leu His Asn Pro Val Val Glu
                645                 650                 655

Lys Ile Leu Asn Gln Met Val Asn Val Ile Asn Ala Val Ile Glu Glu
            660                 665                 670

Tyr Gly Lys Pro Asp Glu Ile Arg Ile Glu Leu Ala Arg Asp Leu Lys
        675                 680                 685

Ile Gly Ala Ala Glu Arg Glu Asn Met Thr Arg Ser Ile Asn Gln Gly
    690                 695                 700

Asn Ala Glu Asn Lys Arg Ile Arg Glu Ile Leu Glu Lys Glu Phe Ala
```

```
705                 710                 715                 720

Leu Ser Tyr Leu Ser Arg Asn Asp Ile Ile Lys Tyr Lys Leu Tyr Glu
                725                 730                 735

Glu Leu Lys Ser Asn Gly Phe Lys Thr Leu Tyr Ser Asp Thr Tyr Ile
            740                 745                 750

Ser Lys Asp Lys Leu Phe Ser Lys Asp Phe Asp Ile Glu His Ile Ile
        755                 760                 765

Pro Lys Ala Arg Leu Phe Asp Asp Ser Leu Ser Asn Lys Thr Ile Glu
    770                 775                 780

Ala Arg Asp Val Asn Ile Ala Lys Ser Asn Lys Thr Ala Phe Asp Phe
785                 790                 795                 800

Ile Leu Glu Arg Tyr Gly Glu Gln Gly Val Lys Thr Tyr Lys Thr Lys
                805                 810                 815

Leu Leu Arg Leu Leu Glu Asp Gly Ala Ile Ser Asn Lys Lys Tyr Asn
            820                 825                 830

Asn Leu Leu Lys Thr Glu Ala Asp Ile Pro Ser Gly Phe Ile Asp Arg
        835                 840                 845

Asp Leu Arg Asn Thr Gln Tyr Ile Ala Lys Lys Ala Tyr Glu Ile Leu
    850                 855                 860

Ser Glu Leu Val Lys Ile Val Thr Pro Thr Thr Gly Ser Val Thr Asn
865                 870                 875                 880

Arg Leu Arg Glu Asp Trp Gln Leu Val Asp Val Met Lys Glu Leu Asn
                885                 890                 895

Phe Glu Lys Tyr Gln Lys Leu Gly Leu Ala Asp Val Ile Glu Asp Arg
            900                 905                 910
```

```
Asp Gly Arg Lys Val Lys Arg Ile Lys Asp Trp Thr Lys Arg Asn Asp
        915                 920                 925

His Arg His His Ala Met Asp Ala Leu Thr Ile Ala Phe Thr Lys Pro
    930                 935                 940

Ser Tyr Ile Gln Tyr Leu Asn Asn Leu Asn Ala Arg Ser Asp Lys Ser
945                 950                 955                 960

Ser Ser Ile Tyr Gly Ile Glu Val Lys Glu Leu His Arg Glu Glu Gly
                965                 970                 975

Lys Phe Arg Phe Asn Ala Pro Leu Pro Ile Asn Glu Phe Arg Ala Glu
            980                 985                 990

Ala Lys Arg His Leu Lys Ser Val  Leu Val Ser Ile Lys  Ala Lys Lys
        995                 1000                1005

Lys Val  Met Thr Gln Asn Val  Asn Lys Ile Lys Thr  Lys His Gly
    1010                1015                1020

Ile Ile  Lys Lys Val Gln Leu  Thr Pro Arg Gly Glu  Leu His Asn
    1025                1030                1035

Ala Thr  Tyr Tyr Gly Thr Lys  Lys Arg Pro Leu Val  Arg Met Val
    1040                1045                1050

Lys Val  Gly Ala Ala Leu Asp  Glu Ala Thr Ile Lys  Arg Val Cys
    1055                1060                1065

Ser Pro  Ala Ile Arg Ala Ala  Leu Leu Lys Arg Leu  Asn Ala Tyr
    1070                1075                1080

Asn Gly  Asp Ala Lys Glu Ala  Phe Thr Gly Arg Asn  Ser Ile Asp
    1085                1090                1095

Lys Asn  Pro Ile Tyr Leu Asp  Ile Glu Gln Thr Lys  Leu Val Pro
```

```
    1100                1105                1110

Val Leu  Val Lys Thr Ile Glu  Trp Gly Met Tyr His  Pro Ile Arg
    1115                1120                1125

Lys Arg  Ile Thr Pro Asp Leu  Lys Ile Asp Lys Val  Ile Asp Lys
    1130                1135                1140

Gly Ile  Arg Glu Lys Leu Lys  Ala Arg Leu Ala Glu  Phe Asn Gly
    1145                1150                1155

Asp Ala  Gln Lys Ala Phe Ser  Asn Leu Asp Glu Asn  Pro Ile Tyr
    1160                1165                1170

Met Asp  Glu Ala Lys Arg Ile  Thr Leu Lys Arg Val  Ser Ile Glu
    1175                1180                1185

Gly Val  Leu Ser Ala Ile Pro  Leu His Thr Leu Lys  Asp Lys Ala
    1190                1195                1200

Gly Lys  Pro Val Ile Gly Ser  Asp Gly Lys Pro Val  Phe Gly Asp
    1205                1210                1215

Tyr Val  Gln Thr Ser Asn Asn  His His Ile Ala Phe  Tyr Ile Asp
    1220                1225                1230

Asp Lys  Gly Asn Leu Gln Asp  Asn Pro Val Ser Phe  Phe Glu Ala
    1235                1240                1245

Ala Glu  Arg Lys Ser Gln Gly  Val Pro Val Ile Asp  Arg Arg Tyr
    1250                1255                1260

Asn Cys  Asp Lys Gly Trp His  Phe Val Phe Thr Met  Lys Gln Asn
    1265                1270                1275

Glu Tyr  Phe Val Phe Pro Asn  Glu Ala Thr Gly Phe  Ile Pro Ser
    1280                1285                1290
```

```
Glu Val  Asp Leu Leu Asp Glu  Ala Asn Tyr Cys Ile  Ile Ser Pro
    1295                1300                1305


Asn Leu  Tyr Arg Val Gln Lys  Leu Ser Lys Ala Ser  Gly Arg Asp
    1310                1315                1320


Tyr Trp  Phe Arg His His Leu  Glu Thr Met Leu Asn  Asp Asp Leu
    1325                1330                1335


Arg Leu  Lys Asn Ser Thr Phe  Lys Arg Ile Gln Ser  Leu Lys Gly
    1340                1345                1350


Leu Glu  Asp Ile Val Lys Val  Arg Ile Asn Ser Ile  Gly Lys Ile
    1355                1360                1365


Val Ala  Val Gly Lys Tyr Asp
    1370                1375
```

<210> 619
<211> 1483
<212> PRT
<213> Prevotella sp.

<400> 619

```
Met Lys Thr Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Lys Val Ser Val Asp Asp Tyr Gly Asn Tyr Leu His Asp Ile Lys
            20                  25                  30


Leu Gly Ser Arg Ile Ile Pro Met Ser Gln Asp Val Leu Gly Asn Phe
        35                  40                  45


Asp Ser Gly Val Thr Val Ser Gln Thr Ala Gln Arg Thr Glu Phe Arg
    50                  55                  60


Ser Lys Arg Arg Leu Val Gln Arg Asn Leu Gln Arg Arg Glu Arg Leu
65                  70                  75                  80
```

```
His Arg Val Leu His Val Leu Asp Phe Leu Pro Ala His Tyr Asp Ala
               85                  90                  95

Ala Ile Gly Trp Asp Arg Thr Glu Ala Val Thr Tyr Gly Lys Phe Leu
            100                 105                 110

Asn His Ala Glu Pro Lys Leu Ala Trp Glu Glu Leu Gly Asn Gly Lys
        115                 120                 125

Arg Arg Phe Leu Phe Met Asp Ser Phe His Glu Met Val Ala Asp Phe
    130                 135                 140

Ala Arg Cys Gln Pro Ala Leu Val Ala Asp Gly Lys Lys Ile Pro Leu
145                 150                 155                 160

Asp Trp Thr Ile Tyr Tyr Leu Arg Lys Lys Ala Leu Thr Gln Ala Ile
               165                 170                 175

Thr Lys Glu Glu Leu Ala Trp Ile Leu Leu Asn Phe Asn Gln Lys Arg
            180                 185                 190

Gly Tyr Tyr Gln Leu Arg Gly Glu Glu Glu Glu Glu Asn Pro Thr Lys
        195                 200                 205

Gln Glu Glu Tyr Tyr Glu Leu Lys Val Val Ser Val Glu Ala Thr Asp
    210                 215                 220

Ser Arg Lys Gly Asn Asp Thr Trp Tyr Asn Val His Leu Glu Asn Gly
225                 230                 235                 240

Trp Ile Tyr Arg Arg Ser Ser Lys Ile Ser Leu Asp Asp Trp Val Gly
               245                 250                 255

Lys Val Lys Gln Phe Ile Val Thr Thr Glu Tyr Glu Lys Asp Gly Thr
            260                 265                 270
```

```
Thr Leu Lys Thr Asp Lys Glu Gly Asn Val Lys Arg Ser Phe Arg Ala
        275                 280                 285

Pro Asn Glu Asn Asp Trp Gly Leu Arg Lys Lys Arg Thr Glu Thr Leu
    290                 295                 300

Leu Glu Met Ser Gly Lys Thr Val Gly Ala Phe Ile Tyr Asp His Leu
305                 310                 315                 320

Leu Gln Glu Pro Ala Asp Lys Ile Arg Gly Asn Phe Ile Arg Thr Ile
                325                 330                 335

Glu Arg His Tyr Tyr Lys Ala Glu Leu Glu Ala Ile Leu Ala Glu Gln
            340                 345                 350

Cys Lys Tyr His Ile Glu Leu Arg Asp Lys Glu Met Leu Glu Ala Cys
        355                 360                 365

Ala Arg Glu Leu Tyr Leu Asn Asn Leu Pro His Gln Arg Ser Leu Met
    370                 375                 380

Lys Lys Asp Met Thr Tyr Leu Leu Leu Tyr Asp Leu Ile Phe Tyr Gln
385                 390                 395                 400

Arg Pro Leu Lys Ser Lys Lys Ala Leu Ile Ala Asn Cys Pro Tyr Glu
                405                 410                 415

Tyr Tyr Glu Tyr Val Asp Lys Glu Thr Gly Glu Ile Lys Arg Gln Asn
            420                 425                 430

Ile Lys Cys Ile Ala Lys Ser Asn Pro Tyr Phe Gln Glu Phe Arg Leu
        435                 440                 445

Trp Gln Phe Val Leu Asn Leu Arg Leu Phe Asp Arg Val Glu Asp Lys
    450                 455                 460

Glu Val Thr Ala Asn Tyr Leu Pro Thr Ala Asp Asp His Ala Arg Leu
465                 470                 475                 480
```

```
Phe Thr Tyr Leu Asn Asp Arg Lys Glu Ile Asn Gln Glu Thr Leu Leu
                485                 490                 495

Lys Asp Tyr Phe Lys Leu Lys Lys Val Lys Ile Gly Asn Glu Lys Glu
            500                 505                 510

Tyr Pro Ile Arg Trp Asn Tyr Ile Glu Asp Lys Glu Lys Lys Tyr Pro
        515                 520                 525

Cys Asn Glu Thr Arg Tyr Glu Leu Leu Met Ala Leu Asp Arg Ala Gly
    530                 535                 540

Ile Glu His Lys Trp Leu Asp Asp Asn Asn Leu Glu Tyr Arg Leu Trp
545                 550                 555                 560

His Leu Leu Tyr Ser Val Glu Val Lys Ser Glu Ser Glu Thr Ala Leu
                565                 570                 575

Arg Lys Leu Lys Asn Asp Asp Ala Phe Val Asn Ser Phe Leu Lys Val
            580                 585                 590

Lys Pro Phe Lys Lys Glu Tyr Gly Ala Tyr Ser Glu Lys Ala Ile Lys
        595                 600                 605

Arg Leu Leu Ala Val Met Arg Lys Gly Phe Leu Trp Asn Glu Gln Asp
    610                 615                 620

Ile Cys Asp Glu Thr Arg Lys Arg Ile Glu Ile Ile Ile Lys Gly Asp
625                 630                 635                 640

Val Asp Glu Lys Val Lys Glu Arg Met Gly His Ala Ala Tyr Ser Phe
                645                 650                 655

Asp Arg Val Ser Asp Phe Gln Gly Leu Pro Glu Trp Leu Ala Cys Tyr
            660                 665                 670
```

```
Val Val Tyr Gly Arg His Ser Glu Ala Met Asp Ile Gln Arg Trp Asp
        675                 680                 685

Ser Pro Glu Arg Leu Met Ala Tyr Ile Asn Asn Phe Lys Gln Tyr Ser
    690                 695                 700

Leu Arg Asn Pro Ile Val Glu Gln Cys Ile Leu Glu Thr Leu Arg Thr
705                 710                 715                 720

Val His Asp Ile Trp Lys Glu Thr Gly Gln Ile Asp Glu Ile His Val
                725                 730                 735

Glu Leu Gly Arg Glu Met Lys Ser Thr Ser Glu Glu Arg Ala Arg Arg
            740                 745                 750

Thr Gln Asn Val Leu Arg Asn Glu Asn Thr Asn Leu Arg Ile Lys Ser
        755                 760                 765

Leu Leu Ile Glu Leu Lys Asn Asp Thr Asp Ile Cys Asn Val His Pro
    770                 775                 780

Tyr Ser Pro Met Gln Gln Glu Ile Leu Arg Ile Tyr Glu Glu Gly Ala
785                 790                 795                 800

Leu Gln Glu Leu Asn Arg Glu Asp Glu Asp Phe Glu Glu Ile Ser Lys
                805                 810                 815

Ile Ser Gln Met Ser Gln Pro Ser Gly Lys Glu Leu Asn Arg Tyr Lys
            820                 825                 830

Leu Trp Leu Glu Gln Lys Tyr Arg Ser Pro Tyr Thr Gly Lys Ala Ile
        835                 840                 845

Ser Leu Ala Lys Leu Phe Thr Pro Ala Tyr Gln Ile Glu His Val Ile
    850                 855                 860

Pro Gln Ser Arg Tyr Phe Asp Asp Ser Phe Thr Asn Lys Val Ile Cys
865                 870                 875                 880
```

```
Glu Ala Glu Val Asn Thr Leu Lys Ser Asn Leu Leu Gly Tyr Glu Phe
               885                 890                 895


Ile Lys Lys His Gly Gly Glu Ile Ile His Cys Thr Thr Leu Gly Asp
            900                 905                 910


Val Arg Ile Phe Ser Glu Ser Glu Tyr Lys Ala Phe Val Met Asp His
        915                 920                 925


Tyr Ala Asn Asn Lys Ser Lys Lys Asp Lys Leu Leu Met Glu Asp Ile
    930                 935                 940


Pro Gln Glu Phe Leu Ser Arg Gln Met Asn Asp Ser Arg Tyr Ile Ser
945                 950                 955                 960


Lys Val Val Lys Thr Leu Leu Ser Asn Ile Val Arg Met Ala Asp Glu
               965                 970                 975


Ser Glu Ala Thr Ser Lys Ser Val Ile Val Cys Thr Gly Gly Val Thr
            980                 985                 990


Asp Arg Leu Lys Lys Asp Trp Gly  Leu Asn Asp Val Trp  Asn Ser Ile
        995                 1000                1005


Val Tyr  Ser Arg Phe Glu Arg  Leu Asn Arg Leu Thr  Gly Thr Glu
    1010                1015                1020


Ala Phe  Gly His Trp Glu Asn  Lys Asp Gly Lys Arg  Val Phe Gln
    1025                1030                1035


Thr Ser  Met Pro Leu Glu Leu  Gln Arg Gly Phe Arg  Lys Lys Arg
    1040                1045                1050


Ile Asp  His Arg His His Ala  Met Asp Ala Leu Val  Ile Ala Cys
    1055                1060                1065
```

```
Ala Ser  Arg Asn Ile Val Asn  Tyr Leu Asn Asn Glu  Ser Ala Asn
    1070                1075                1080

Asn Pro  Lys Lys Arg Glu Asp  Leu Arg Arg Gln Leu  Cys Asp Lys
    1085                1090                1095

Asn Arg  Val Ile Arg Lys Pro  Trp Glu Thr Phe Thr  Gln Asp Ala
    1100                1105                1110

Tyr Asn  Ala Leu Glu Asn Val  Val Val Ser Phe Lys  Asn Tyr Val
    1115                1120                1125

Arg Val  Ile Asn Lys Ala Thr  Asn Arg Tyr Glu His  Tyr Asp Glu
    1130                1135                1140

Asn Gly  Lys Lys Arg Phe Val  Gln Gln Lys Gly Ser  Glu Leu Trp
    1145                1150                1155

Ala Ile  Arg Lys Pro Met His  Lys Glu Thr Tyr Tyr  Gly His Val
    1160                1165                1170

Asn Leu  Arg Arg Lys Glu Leu  Val Thr Leu Gln Lys  Ala Leu Asp
    1175                1180                1185

Asp Ile  Pro Ser Ile Cys Asp  Lys Lys Leu Arg Asp  Tyr Ile Ser
    1190                1195                1200

Ala Leu  Val Glu Lys His Phe  Asn Lys Arg Gln Leu  Leu Ala His
    1205                1210                1215

Phe Lys  Ser Thr Asp Tyr Tyr  Trp Gln Lys Gln Tyr  Val Asn Lys
    1220                1225                1230

Val Tyr  Val Trp Thr Phe Ser  Asp Asp Ile Lys Pro  Leu Val Ala
    1235                1240                1245

Thr Arg  Lys Leu Leu Asp Thr  Ser Phe Asp Ala Lys  Arg Ile Gly
    1250                1255                1260
```

```
Thr Ile  Thr Asp Thr Gly Ile  Gln Lys Ile Leu Arg  Asn Tyr Leu
    1265                1270                1275

Glu Ala  Lys Gly Gly Asn Ala  Thr Leu Ala Phe Thr  Pro Glu Gly
    1280                1285                1290

Ile Val  Glu Met Asn Gln Asn  Ile Ser Lys Tyr Asn  Asp Gly Lys
    1295                1300                1305

Pro His  Gln Pro Ile Leu Lys  Val Arg Ile Thr Glu  Pro Met Gly
    1310                1315                1320

Ala Lys  Tyr Arg Val Gly Gln  Thr Glu Asn Lys Met  Ala Lys Tyr
    1325                1330                1335

Val Glu  Ala Gln Ser Gly Thr  Asn Leu Tyr Phe Ala  Ile Tyr Glu
    1340                1345                1350

Asp Ser  Glu Gly Lys Arg Ser  Tyr Thr Thr Val Pro  Leu Asp Glu
    1355                1360                1365

Val Ala  Glu Arg Leu Lys Gln  Arg Leu Ser Pro Val  Pro Glu Lys
    1370                1375                1380

Asp Glu  Asn Asp Val Pro Leu  Lys Phe Tyr Leu Ser  Pro Asn Asp
    1385                1390                1395

Leu Val  Tyr Val Pro Thr Glu  Glu Glu Leu Gln Leu  Arg Glu Cys
    1400                1405                1410

Lys Leu  Asn Lys Asp Arg Ile  Tyr Lys Met Val Ser  Ser Thr Gly
    1415                1420                1425

Ser Glu  Cys His Phe Ile Pro  Tyr Tyr Val Ala Asn  Val Ile Tyr
    1430                1435                1440
```

```
Asn Lys  Val Glu Phe Glu Ala  Lys Asn Lys Ile Gly  Arg Ala Leu
    1445                 1450                 1455


Thr Gly  Glu Met Ile Lys Ala  Val Cys Trp Lys Leu  Glu Ile Asp
    1460                 1465                 1470


Arg Leu  Gly Asn Ile Leu Lys  Val Ile Lys
    1475                 1480
```

<210> 620
<211> 593
<212> PRT
<213> Prevotella sp.

<400> 620

```
Met Asn Thr Arg Ile Leu Gly Leu Asp Thr Gly Thr Asn Ser Leu Ala
1               5                   10                  15


Trp Ala Val Val Asp Arg Asp Ala Lys Gly Asn Tyr Thr Leu Val Arg
            20                  25                  30


Arg Gly Asp Val Ile Phe Thr Glu Gly Val Asn Val Asp Gly Gln Pro
        35                  40                  45


Val Pro Ser Lys Ala Ala Val Lys Ser Lys Tyr Lys Ser Leu Arg Val
    50                  55                  60


Gln Tyr Ala Arg Arg Arg Leu Arg Lys Ile Asp Thr Leu Lys Val Leu
65                  70                  75                  80


Val Ser Leu Asp Leu Cys Pro Tyr Leu Ser Asp Gln Gln Leu Ser Gln
                85                  90                  95


Trp Lys Ala Lys Lys Thr Tyr Pro Leu Thr Asp Asp Phe Met Leu Trp
            100                 105                 110


Gln Arg Ser Gly Ser Ala Glu Glu Asn Asn Pro Tyr Tyr Cys Arg Tyr
        115                 120                 125
```

```
Arg Cys Leu Thr Gln Lys Leu Asp Leu Thr Asp Gln Ser Gln Arg Phe
    130                 135                 140

Leu Leu Gly Arg Ala Phe Tyr His Leu Ala Gln Arg Arg Gly Phe Leu
145                 150                 155                 160

Ser Asn Arg Leu Asp Thr Thr Ser Asp Ser Ala Glu Ser Gly Lys Val
                165                 170                 175

Lys Ser Gly Ile Ala Gln Leu Ser Val Glu Met Glu Lys Ala Gly Cys
            180                 185                 190

Thr Phe Leu Gly Glu Tyr Phe Tyr Gln Leu Tyr Lys Gln His Gly Asn
        195                 200                 205

Thr Val Arg Leu Arg Ser Arg Tyr Thr Asp Arg Glu Glu His Tyr Ile
    210                 215                 220

Lys Glu Phe Leu Ala Ile Cys Glu Lys Gln Glu Leu Asp Ala Gln Trp
225                 230                 235                 240

Val Glu Lys Leu Gln Arg Ala Leu Tyr Phe Gln Arg Pro Leu Lys Ser
                245                 250                 255

Gln Arg Lys Gly Val Gly Lys Cys Thr Phe Glu Pro Lys Lys Pro Arg
            260                 265                 270

Cys Ala Glu Ser His Pro Asp Tyr Glu Ala Phe Arg Met Leu Cys Ile
        275                 280                 285

Leu Asn Asn Ile Lys Ile Lys Thr Pro Lys Asp Val Ser Leu Arg Pro
    290                 295                 300

Leu Asn Ala Glu Glu Arg Glu Lys Val Trp Pro Leu Phe Phe Arg Lys
305                 310                 315                 320

Ser Lys Pro Asn Phe Asp Phe Glu Asp Ile Ala Lys Ala Leu Ala Gly
```

```
                325                 330                 335

Lys Asn Asn Tyr Ala Trp Tyr Lys Asp Ala Gly Glu Lys Pro Phe Arg
            340                 345                 350

Phe Asn Tyr Arg Met His Gln Gly Val Ser Gly Cys Pro Val Thr Ala
        355                 360                 365

Gln Leu Ile Asp Ile Phe Gly Ser Asp Trp Lys Ala Gly Ile Ala Glu
    370                 375                 380

Thr Tyr Thr Ala Val Gly Lys Lys Asn Gly Thr Lys Thr Ile Asp Glu
385                 390                 395                 400

Met Ala Asp Asp Val Trp Asn Val Leu Tyr Ser Phe Ser Ser Lys Asp
                405                 410                 415

Lys Leu Lys Ala Phe Ala Thr Asp Lys Leu Gln Leu Asp Glu Ala Arg
            420                 425                 430

Ala Thr Lys Phe Ala Asn Ala Lys Leu Pro His Gly Phe Ala Ala Leu
        435                 440                 445

Ser Leu Lys Ala Ile Arg Asn Ile Leu Pro Phe Leu Arg Gln Gly Phe
    450                 455                 460

Ile Tyr Ala His Ala Val Leu Leu Ala Lys Ile Pro Asp Ile Val Thr
465                 470                 475                 480

Ala Ala Val Trp Asp Asp Ala Asp Lys Arg Glu Gln Ile Leu Ser Gly
                485                 490                 495

Leu Leu Glu Val Ile Glu Asn Tyr Asn Pro Asp Asp Arg Gly Ile Glu
            500                 505                 510

Gly Thr Ile Asp Phe Cys Ile Lys Ser His Leu Gln Asp Val Val Asp
        515                 520                 525
```

```
Leu Arg Pro Gly Ala Ala Asp Ala Leu Tyr His Pro Ser Met Ile Glu
    530                 535                 540

Ala Tyr Pro Asp Ala Lys Leu Asn Lys Met Gly Val Phe Gln Leu Gly
545                 550                 555                 560

Ser Pro Arg Thr Asn Ala Ile Arg Asn Pro Met Ala Met Arg Ser Leu
                565                 570                 575

His Ile Leu Arg Ser Val Val Asn Leu Leu Leu Arg Asp Gly Met Leu
            580                 585                 590

Ser
```

<210> 621
<211> 1424
<212> PRT
<213> Prevotella sp.

<400> 621

```
Met Thr Gln Lys Val Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly
1               5                   10                  15

Ser Ala Val Arg Asn Leu Asp Leu Ser Asp Asp Leu Gln Trp Gln Leu
            20                  25                  30

Glu Phe Phe Ser Ser Asp Ile Phe Arg Ser Ser Val Asn Lys Glu Ser
        35                  40                  45

Asn Gly Arg Glu Tyr Ser Leu Ala Ala Gln Arg Ser Ala His Arg Arg
    50                  55                  60

Ser Arg Gly Leu Asn Glu Val Arg Arg Arg Arg Leu Trp Ala Thr Leu
65                  70                  75                  80

Asn Leu Leu Ile Lys His Gly Phe Cys Pro Met Ser Ser Glu Ser Leu
                85                  90                  95
```

```
Met Arg Trp Cys Thr Tyr Asp Lys Arg Lys Gly Leu Phe Arg Glu Tyr
            100                 105                 110

Pro Ile Asp Asp Lys Asp Phe Asn Ala Trp Ile Leu Leu Asp Phe Asn
        115                 120                 125

Gly Asp Gly Arg Pro Asp Tyr Ser Ser Pro Tyr Gln Leu Arg Arg Glu
    130                 135                 140

Leu Val Thr Arg Gln Phe Asp Phe Glu Gln Pro Ile Glu Arg Tyr Lys
145                 150                 155                 160

Leu Gly Arg Ala Leu Tyr His Ile Ala Gln His Arg Gly Phe Lys Ser
                165                 170                 175

Ser Lys Gly Glu Thr Leu Ser Gln Gln Glu Thr Asn Ser Lys Pro Ser
            180                 185                 190

Ser Thr Asp Glu Ile Pro Asp Val Ala Gly Ala Met Lys Ala Ser Glu
        195                 200                 205

Glu Lys Leu Ser Lys Gly Leu Ser Thr Tyr Met Lys Glu His Asn Leu
    210                 215                 220

Leu Thr Val Gly Ala Ala Phe Ala Gln Leu Glu Asp Glu Gly Val Arg
225                 230                 235                 240

Val Arg Asn Asn Asn Asp Tyr Arg Ala Ile Arg Ser Gln Phe Gln His
                245                 250                 255

Glu Ile Glu Thr Ile Phe Lys Phe Gln Gln Gly Leu Ser Val Glu Ser
            260                 265                 270

Glu Leu Tyr Glu Arg Leu Ile Ser Glu Lys Lys Asn Val Gly Thr Ile
        275                 280                 285
```

```
Phe Tyr Lys Arg Pro Leu Arg Ser Gln Arg Gly Asn Val Gly Lys Cys
    290                 295                 300

Thr Leu Glu Arg Ser Lys Pro Arg Cys Ala Ile Gly His Pro Leu Phe
305                 310                 315                 320

Glu Lys Phe Arg Ala Trp Thr Leu Ile Asn Asn Ile Lys Val Arg Met
                325                 330                 335

Ser Val Asp Thr Leu Asp Glu Gln Leu Pro Met Lys Leu Arg Leu Asp
            340                 345                 350

Leu Tyr Asn Glu Cys Phe Leu Ala Phe Val Arg Thr Glu Phe Lys Phe
        355                 360                 365

Glu Asp Ile Arg Lys Tyr Leu Glu Lys Arg Leu Gly Ile His Phe Ser
    370                 375                 380

Tyr Asn Asp Lys Thr Ile Asn Tyr Lys Asp Ser Thr Ser Val Ala Gly
385                 390                 395                 400

Cys Pro Ile Thr Ala Arg Phe Arg Lys Met Leu Gly Glu Glu Trp Glu
                405                 410                 415

Ser Phe Arg Val Glu Gly Gln Lys Glu Arg Gln Ala His Ser Lys Asn
            420                 425                 430

Asn Ile Ser Phe His Arg Val Ser Tyr Ser Ile Glu Asp Ile Trp His
        435                 440                 445

Phe Cys Tyr Asp Ala Glu Glu Pro Glu Ala Val Leu Ala Phe Ala Gln
    450                 455                 460

Glu Thr Leu Arg Leu Glu Arg Lys Lys Ala Glu Glu Leu Val Arg Ile
465                 470                 475                 480

Trp Ser Ala Met Pro Gln Gly Tyr Ala Met Leu Ser Gln Lys Ala Ile
                485                 490                 495
```

```
Arg Asn Ile Asn Lys Ile Leu Met Leu Gly Leu Lys Tyr Ser Asp Ala
            500                 505                 510

Val Ile Leu Ala Lys Val Pro Glu Leu Val Asp Val Ser Asp Glu Glu
        515                 520                 525

Leu Leu Ser Ile Ala Lys Asp Tyr Tyr Leu Val Glu Ala Gln Val Asn
    530                 535                 540

Tyr Asp Lys Arg Ile Asn Ser Ile Val Asn Gly Leu Ile Ala Lys Tyr
545                 550                 555                 560

Lys Ser Val Ser Glu Glu Tyr Arg Phe Ala Asp His Asn Tyr Glu Tyr
                565                 570                 575

Leu Leu Asp Glu Ser Asp Glu Lys Asp Ile Ile Arg Gln Ile Glu Asn
            580                 585                 590

Ser Leu Gly Ala Arg Arg Trp Ser Leu Met Asp Ala Asn Glu Gln Thr
        595                 600                 605

Asp Ile Leu Gln Lys Val Arg Asp Arg Tyr Gln Asp Phe Phe Arg Ser
    610                 615                 620

His Glu Arg Lys Phe Val Glu Ser Pro Lys Leu Gly Glu Ser Phe Glu
625                 630                 635                 640

Asn Tyr Leu Thr Lys Lys Phe Pro Met Val Glu Arg Glu Gln Trp Lys
                645                 650                 655

Lys Leu Tyr His Pro Ser Gln Ile Thr Ile Tyr Arg Pro Val Ser Val
            660                 665                 670

Gly Lys Asp Arg Ser Val Leu Arg Leu Gly Asn Pro Asp Ile Gly Ala
        675                 680                 685
```

```
Ile Lys Asn Pro Thr Val Leu Arg Val Leu Asn Thr Leu Arg Arg Arg
    690                 695                 700

Val Asn Gln Leu Leu Asp Asp Gly Val Ile Ser Pro Asp Glu Thr Arg
705                 710                 715                 720

Val Val Val Glu Thr Ala Arg Glu Leu Asn Asp Ala Asn Arg Lys Trp
                725                 730                 735

Ala Leu Asp Thr Tyr Asn Arg Ile Arg His Asp Glu Asn Glu Lys Ile
            740                 745                 750

Lys Lys Ile Leu Glu Glu Phe Tyr Pro Lys Arg Asp Gly Ile Ser Thr
        755                 760                 765

Asp Asp Ile Asp Lys Ala Arg Tyr Val Ile Asp Gln Arg Glu Val Asp
    770                 775                 780

Tyr Phe Thr Gly Ser Lys Thr Tyr Asn Lys Asp Ile Lys Lys Tyr Lys
785                 790                 795                 800

Phe Trp Leu Glu Gln Gly Gly Gln Cys Met Tyr Thr Gly Arg Thr Ile
                805                 810                 815

Asn Leu Ser Asn Leu Phe Asp Pro Asn Ala Phe Asp Ile Glu His Thr
            820                 825                 830

Ile Pro Glu Ser Leu Ser Phe Asp Ser Ser Asp Met Asn Leu Thr Leu
        835                 840                 845

Cys Asp Ala His Tyr Asn Arg Phe Ile Lys Lys Asn His Ile Pro Thr
    850                 855                 860

Asp Met Pro Asn Tyr Asp Lys Ala Ile Thr Ile Asp Gly Lys Glu Tyr
865                 870                 875                 880

Pro Ala Ile Thr Ser Gln Leu Gln Arg Trp Val Glu Arg Val Glu Arg
                885                 890                 895
```

```
Leu Asn Arg Asn Val Glu Tyr Trp Lys Gly Gln Ala Arg Arg Ala Gln
            900                 905                 910

Asn Lys Asp Arg Lys Asp Gln Cys Met Arg Glu Met His Leu Trp Lys
        915                 920                 925

Met Glu Leu Glu Tyr Trp Lys Lys Lys Leu Glu Arg Phe Thr Val Thr
    930                 935                 940

Glu Val Thr Asp Gly Phe Lys Asn Ser Gln Leu Val Asp Thr Arg Val
945                 950                 955                 960

Ile Thr Arg His Ala Val Leu Tyr Leu Lys Ser Ile Phe Pro His Val
                965                 970                 975

Asp Val Gln Arg Gly Asp Val Thr Ala Lys Phe Arg Lys Ile Leu Gly
            980                 985                 990

Ile Gln Ser Val Asp Glu Lys Lys  Asp Arg Ser Leu His  Ser His His
        995                 1000                1005

Ala Ile  Asp Ala Thr Thr Leu  Thr Ile Ile Pro Val  Ser Ala Lys
    1010                1015                1020

Arg Asp  Arg Met Leu Glu Leu  Phe Ala Lys Ile Glu  Glu Ile Asn
    1025                1030                1035

Lys Met  Leu Ser Phe Ser Gly  Ser Glu Asp Arg Thr  Gly Leu Ile
    1040                1045                1050

Gln Glu  Leu Glu Gly Leu Lys  Asn Lys Leu Gln Met  Glu Val Lys
    1055                1060                1065

Val Cys  Arg Ile Gly His Asn  Val Ser Glu Ile Gly  Thr Phe Ile
    1070                1075                1080
```

```
Asn Asp  Asn Ile Ile Val Asn  His His Ile Lys Asn  Gln Ala Leu
    1085                1090                1095

Thr Pro  Val Arg Arg Arg Leu  Arg Lys Lys Gly Tyr  Ile Val Gly
    1100                1105                1110

Gly Val  Asp Asn Pro Arg Trp  Gln Thr Gly Asp Ala  Leu Arg Gly
    1115                1120                1125

Glu Ile  His Lys Ala Ser Tyr  Tyr Gly Ala Ile Thr  Gln Phe Ala
    1130                1135                1140

Lys Asp  Asp Glu Gly Lys Val  Leu Met Lys Glu Gly  Arg Pro Gln
    1145                1150                1155

Val Asn  Pro Thr Ile Lys Phe  Val Ile Arg Arg Glu  Leu Lys Tyr
    1160                1165                1170

Lys Lys  Ser Ala Ala Asp Ser  Gly Phe Ala Ser Trp  Asp Asp Leu
    1175                1180                1185

Gly Lys  Ala Ile Val Asp Lys  Glu Leu Phe Ala Leu  Met Lys Gly
    1190                1195                1200

Gln Phe  Pro Ala Glu Thr Ser  Phe Lys Asp Ala Cys  Glu Gln Gly
    1205                1210                1215

Ile Tyr  Met Ile Lys Lys Gly  Lys Asn Gly Met Pro  Asp Ile Lys
    1220                1225                1230

Leu His  His Ile Arg His Val  Arg Cys Glu Ala Pro  Gln Ser Gly
    1235                1240                1245

Leu Lys  Ile Lys Glu Gln Thr  Tyr Lys Ser Glu Lys  Glu Tyr Lys
    1250                1255                1260

Arg Tyr  Phe Tyr Ala Ala Val  Gly Asp Leu Tyr Ala  Met Cys Cys
    1265                1270                1275
```

```
Tyr Thr  Asn Gly Lys Ile Arg  Glu Phe Arg Ile Tyr  Ser Leu Tyr
    1280                1285                1290

Asp Val  Ser Cys His Arg Lys  Ser Asp Ile Glu Asp  Ile Pro Glu
    1295                1300                1305

Phe Ile  Thr Asp Lys Lys Gly  Asn Arg Leu Met Leu  Asp Tyr Lys
    1310                1315                1320

Leu Arg  Thr Gly Asp Met Ile  Leu Leu Tyr Lys Asp  Asn Pro Ala
    1325                1330                1335

Glu Leu  Tyr Asp Leu Asp Asn  Val Asn Leu Ser Arg  Arg Leu Tyr
    1340                1345                1350

Lys Ile  Asn Arg Phe Glu Ser  Gln Ser Asn Leu Val  Leu Met Thr
    1355                1360                1365

His His  Leu Ser Thr Ser Lys  Glu Arg Gly Arg Ser  Leu Gly Lys
    1370                1375                1380

Thr Val  Asp Tyr Gln Asn Leu  Pro Glu Ser Ile Arg  Ser Ser Val
    1385                1390                1395

Lys Ser  Leu Asn Phe Leu Ile  Met Gly Glu Asn Arg  Asp Phe Val
    1400                1405                1410

Ile Lys  Asn Gly Lys Ile Ile  Phe Asn His Arg
    1415                1420
```

<210> 622
<211> 241
<212> PRT
<213> Prevotella sp.

<400> 622

```
Gln Ala Val Lys Glu Lys Ile Lys Glu Ala Ile Ala Gly Lys Asn Phe
```

```
1               5                   10                  15

Lys Thr Ala Ile Ala Glu Pro Ile Phe Met Asn Lys Glu Lys Gly Ile
            20                  25                  30

Arg Ile Asn Lys Val Arg Tyr Tyr Val Lys Ala Gln Glu Arg Leu Lys
        35                  40                  45

Ile Arg Gln Gln Arg Asp Leu Ser Ser Lys Glu Tyr Lys Gln Phe Phe
    50                  55                  60

Cys Val Glu Asn Glu Ser Asn Tyr Leu Leu Ala Ile Tyr Glu Gly Glu
65                  70                  75                  80

Leu Lys Gly Lys Lys Glu Arg Asp Phe Cys Val Val Asn Asn Leu Asp
                85                  90                  95

Ser Ala Ala Cys Leu Lys Arg Ser Asn Lys Gly Lys Ala Ala Pro Leu
            100                 105                 110

Val Pro Glu Arg Ser Glu Glu Arg Asn Leu Pro Leu Leu Ala Val Leu
        115                 120                 125

Lys Arg Gly Thr Gln Val Leu Phe Tyr Glu Asn Ser Pro Glu Glu Ile
    130                 135                 140

Leu Phe Asp Asn Pro Gln Asp Leu Val Arg Arg Leu Tyr Lys Val Thr
145                 150                 155                 160

Gly Ile Asn Thr Lys Lys Asp Val Lys Asn Gly Lys Thr Tyr Leu Tyr
                165                 170                 175

Gly Asn Ile Glu Leu Arg Phe His Gln Asn Ala Gln Lys Lys Asp Asp
            180                 185                 190

Val Lys Met Gln Ser Gly Val Tyr Lys Asn Asn Glu Val Leu Arg Gln
        195                 200                 205
```

```
Gly Ile Val Leu Ser His Lys Gln Phe Lys Ala Leu Val Glu Gly Val
    210                 215                 220

Asp Phe Glu Phe Asn Val Leu Gly Glu Ile Lys Lys Lys Glu Arg His
225                 230                 235                 240

Ala
```

<210> 623
<211> 1216
<212> PRT
<213> Prevotella stercorea

<400> 623

```
Met Thr Lys Ile Leu Gly Ile Asp Thr Gly Thr Asn Ser Leu Gly Trp
1               5                   10                  15

Ala Ile Val Asp Lys Thr Ala Asp Asn Tyr Asn Leu Leu Asp Lys Gly
            20                  25                  30

Val Asn Ile Phe Gln Glu Gly Val Lys Ile Glu Lys Gly Ile Glu Ser
        35                  40                  45

Ser Lys Ala Ala Glu Arg Thr Glu His Arg Ala Thr Arg Val Arg Tyr
    50                  55                  60

Tyr Arg Ile Lys Leu Arg Lys Ile Arg Leu Leu Arg Ile Leu Ser Asp
65                  70                  75                  80

Asn His Leu Cys Pro Pro Leu Ser Gln Glu Glu Leu Ser Thr Trp Arg
                85                  90                  95

Leu Lys Lys Val Tyr Pro Lys Asn Glu Leu Phe Met Gln Trp Gln Arg
            100                 105                 110

Thr Asp Asp Asp Thr Glu Lys Thr Pro Tyr Ala Tyr Arg His Lys Cys
        115                 120                 125
```

```
Ile His Glu Lys Leu Asp Leu Ser Asp Val Thr Asp Arg Tyr Ile Leu
    130                 135                 140

Gly Arg Ala Phe Tyr His Ile Ile Gln Arg Arg Gly Phe Leu Ser Asn
145                 150                 155                 160

Arg Lys Glu Gln Gly Gly Glu Asp Ser Gly Lys Val Lys Glu Gly Ile
                165                 170                 175

Ser Thr Leu Thr His Glu Met Asn Glu Ala Gly Tyr Glu Tyr Leu Gly
            180                 185                 190

Asp Tyr Phe Tyr Ala Leu Tyr Asn Lys Gly Glu Lys Ile Arg Lys His
        195                 200                 205

Tyr Thr Ala Arg Asn Glu His Phe Leu Ser Glu Phe Lys Ala Ile Cys
    210                 215                 220

Glu Lys Gln Asp Leu Glu Lys Glu Leu Gly Ser Glu Val Val Arg Asn
225                 230                 235                 240

Ile Glu Lys Ala Ile Phe Asp Gln Arg Pro Leu Lys Ser Gln Lys Gly
                245                 250                 255

Gln Val Gly Lys Cys Val Phe Glu Lys Asn Lys Thr Lys Cys Pro Ser
            260                 265                 270

Ser His Pro Met Tyr Glu Glu Phe Arg Met Leu Thr Phe Ile Asn Asn
        275                 280                 285

Ile Lys Ile Lys Thr Pro Asn Asp Asp Val Leu Arg Pro Leu Asn Thr
    290                 295                 300

Gly Glu Arg Glu Lys Ile Met Pro Leu Phe Phe Arg Lys Ser Lys Lys
305                 310                 315                 320
```

```
Gln Phe Asp Phe Glu Asp Ile Thr Lys Lys Leu Ala Pro Lys Lys Met
                325                 330                 335

Tyr Gly Phe Tyr Lys Lys Glu Glu Asp Ala Glu Met Pro Phe Leu Phe
            340                 345                 350

Asn Tyr Pro Met Asp Thr Ser Val Ser Gly Cys Pro Val Thr Ala Ala
        355                 360                 365

Leu Lys Asp Val Phe Gly Asp Asp Trp Ile Thr Ala Ile Cys Glu Thr
    370                 375                 380

Tyr Thr Leu Gly Glu Gly Lys Ser Arg Phe Asp Ile Val Asn Asp Ile
385                 390                 395                 400

Trp His Ala Leu Tyr Phe Tyr Ser Asp Lys Asp Lys Leu Ala Glu Phe
                405                 410                 415

Ala Ile Asn Arg Leu Gln Leu Ser Glu Asp Glu Ala Lys Ile Phe Ser
            420                 425                 430

Glu Ile Ser Leu Pro Ala Asp Tyr Ala Ser Leu Ser Leu Lys Ala Ile
        435                 440                 445

Cys Lys Ile Leu Pro Tyr Leu Arg Arg Gly Leu Ile Tyr Ser His Ala
    450                 455                 460

Val Phe Leu Gly Asn Leu Cys Glu Val Met Pro Lys Tyr Glu Trp Ser
465                 470                 475                 480

Ile Lys Glu Met Arg Glu Thr Ile Ile Asp Asn Ile Ile Met Glu Met
                485                 490                 495

Asp Lys Cys Asp Thr Lys Asp Lys Arg Thr Phe Glu Val Cys Ile Lys
            500                 505                 510

Asp Tyr Leu Lys Gly Gln Tyr Asn Val Ser Asp Asn Ser Leu Lys Lys
        515                 520                 525
```

```
Leu Tyr His Pro Ser Met Ile Glu Thr Tyr Pro Arg Val Gln Tyr Thr
    530                 535                 540

Asn Glu His Gly Val Tyr Gln Leu Gly Ser Pro Arg Ile Asp Ser Val
545                 550                 555                 560

Arg Asn Pro Met Ala Met Arg Ser Met Phe Arg Leu Arg Lys Leu Val
                565                 570                 575

Asn Arg Leu Leu Val Glu Gly Lys Ile Asp Gln Asn Thr Glu Val His
            580                 585                 590

Ile Glu Phe Ala Arg Glu Leu Asn Asp Ala Asn Lys Arg Asn Ala Ile
        595                 600                 605

Ala Leu Phe Val Lys Glu Asn Gln Ser Ala Asn Asp Glu Ala Arg Lys
    610                 615                 620

Gln Ile Ile Thr Leu Phe Lys Lys Glu Thr Gly Thr Asp Ile Glu Pro
625                 630                 635                 640

Thr Asp Lys Asp Ile Leu Lys Tyr Val Leu Trp Glu Glu Gln Asn His
                645                 650                 655

Ile Cys Leu Tyr Thr Gly Lys Gln Ile Arg Ile Ser Asp Phe Ile Gly
            660                 665                 670

Ala Asn Pro Lys Phe Asp Ile Glu His Thr Ile Pro Arg Ser Val Gly
        675                 680                 685

Gly Asp Ser Thr Lys Met Asn Leu Thr Leu Cys Asp Ser Arg Phe Asn
    690                 695                 700

Arg Glu Val Lys Lys Thr Lys Leu Pro Val Glu Leu Pro Asn His Asp
705                 710                 715                 720
```

```
Glu Ile Met Glu Arg Ile Lys Glu Trp Lys Lys Asn Tyr Glu Leu Leu
                725                 730                 735

Asp Ile Gln Ile Arg Lys Asn Lys Lys Leu Ser Lys Gly Ala Thr Thr
            740                 745                 750

Lys Glu Gln Lys Asp Thr Ile Ile Arg Lys Arg His Leu Leu Glu Leu
        755                 760                 765

Arg Arg Asp Tyr Trp Arg Gly Lys Tyr Glu Arg Phe Thr Met Glu Ser
    770                 775                 780

Val Pro Glu Gly Phe Ser Arg Arg Gln Gly Thr Asp Ile Ser Val Ile
785                 790                 795                 800

Ser Lys Tyr Ala Arg Leu Tyr Leu Lys Ser Leu Phe Asn Arg Val Tyr
                805                 810                 815

Thr Val Lys Gly Ile Ala Thr Ser Asp Phe Arg Lys Ile Trp Gly Ile
            820                 825                 830

Gln Asp Ile Tyr Ser Lys Lys Glu Arg Ile Asn His Val His His Cys
        835                 840                 845

Ile Asp Ala Ile Val Ile Ala Cys Ile Gly Leu Asp Glu Tyr Asn Lys
    850                 855                 860

Leu Gly Ala Tyr Tyr His Asp Glu Glu Asn Asn Lys Trp Tyr Gly Met
865                 870                 875                 880

Ser Lys Ala Ser Phe Lys Lys Pro Trp Ala Thr Phe Val Glu Asp Ile
                885                 890                 895

Lys Lys Ile Gln Asp Glu Ile Leu Val Tyr His Tyr Thr Pro Asp Asn
            900                 905                 910

Met Pro Lys Gln Gly Arg Arg Arg Ile Lys Ile Asp Gly Lys Lys Ile
        915                 920                 925
```

```
Leu Cys Lys Gly Asp Ala Ala Arg Gly Ser Leu His Asn Asp Thr Tyr
    930                 935                 940

Tyr Gly Ala Ile Glu Asn Asp Gly Ala Val Lys Tyr Val Lys Arg Ile
945                 950                 955                 960

Asp Leu Ala Ser Leu Glu Glu Lys Asp Val Lys Asn Ile Val Asp Asp
                965                 970                 975

Thr Val Arg Ser Ile Ile Glu Ala Ala Ile Lys Glu Lys Gly Phe Lys
            980                 985                 990

Asp Ala Met Ala Ser Thr Ile Trp  Met Asn Glu Glu Lys  Arg Val Pro
        995                 1000                1005

Ile Lys  Lys Val Arg Cys Phe  Thr Pro Ser Ile Thr  Lys Pro Leu
    1010                1015                1020

Asn Ile  Arg Lys Gln Arg Asp  Val Ser Ile Lys Glu  Tyr Lys Gln
    1025                1030                1035

Gln Tyr  His Val Ala Asn Asp  Ser Asn Tyr Leu Leu  Ala Leu Tyr
    1040                1045                1050

Ile Gly  Thr Asp Asn Lys Gly  Lys Glu Lys Arg Glu  Phe Glu Ile
    1055                1060                1065

Val Asn  Ile Leu Gln Ala Ala  Gln Tyr Tyr Arg Thr  Ser Asn Asp
    1070                1075                1080

Lys Glu  Val Val Asp Arg His  Ile Val Pro Ile Lys  Ser Glu His
    1085                1090                1095

Asp Tyr  Pro Phe Ala Tyr Thr  Leu Lys Ile Gly Thr  Met Val Leu
    1100                1105                1110
```

```
Leu Tyr  Glu Lys Ser Pro Asn  Glu Val Trp Asp Ala  Thr Ile Lys
    1115                1120                1125


Glu Arg  Asn Arg Arg Leu Tyr  Lys Val Thr Gly Leu  Ser Thr Met
    1130                1135                1140


Arg Met  Lys Gly Arg Asn Gly  Glu Tyr Ala Tyr Ala  Thr Val Lys
    1145                1150                1155


Leu Ile  His Asn Glu Glu Ala  Arg Pro Ser Lys Asp  Ile Lys Ala
    1160                1165                1170


Lys Asn  Gly Glu Tyr Glu Gln  Gly Glu Glu Phe Arg  Pro Ala Ile
    1175                1180                1185


Ile Met  Leu His Thr Gln Leu  Asn Ala Leu Val Gln  Gly Tyr Asp
    1190                1195                1200


Phe Glu  Ile Asn Glu Leu Gly  Glu Ile Arg Arg Leu  Arg
    1205                1210                1215
```

<210> 624
<211> 1487
<212> PRT
<213> Prevotella timonensis

<400> 624

```
Met Lys Asn Ile Leu Gly Leu Asp Leu Gly Ser Asn Ser Val Gly Trp
1               5                   10                  15


Ala Leu Val Lys Val Glu Glu Asn Gly Asn Pro Ile Gly Ser Ile Lys
            20                  25                  30


Met Gly Ser Arg Ile Ile Pro Met Ser Gln Asp Ile Leu Gly Ser Phe
        35                  40                  45


Glu Lys Gly Asp Thr Val Ser Gln Thr Ala Gln Arg Thr Leu Tyr Arg
    50                  55                  60
```

```
Gly Lys Arg Arg Leu Ile Glu Arg His Val Leu Arg Arg Glu Arg Leu
65                  70                  75                  80

Cys Arg Val Leu His Ile Met Asn Phe Leu Pro Ala His Phe Asp Arg
                85                  90                  95

Leu Leu Gly Trp Asp Lys Thr Asp Asn Lys Thr Tyr Gly Lys Phe Ile
            100                 105                 110

Asp Asp Ser Glu Pro Lys Leu Ala Trp Arg Gln Asn Lys Asn Glu Met
        115                 120                 125

Gly Lys Met Glu Phe Val Phe Met Asp Ser Phe His Glu Met Leu Ser
    130                 135                 140

Asp Phe Ala Lys His Gln Pro Gln Leu Ile Ala Asn Gly Lys Lys Val
145                 150                 155                 160

Pro Leu Asp Trp Thr Ile Tyr Tyr Leu Arg Lys Lys Ala Leu Thr Gln
                165                 170                 175

Leu Ile Ser Lys Glu Glu Leu Ala Trp Ile Leu Leu Asn Phe Asn Lys
            180                 185                 190

Lys Arg Gly Tyr Tyr Gln Leu Arg Gly Glu Glu Glu Glu Glu Gln Pro
        195                 200                 205

Thr Lys Lys Glu Glu Tyr Lys Val Leu Lys Val Ile Ser Val Asp Ala
    210                 215                 220

Asp Glu Gly Gln Lys Gly Asn Gly Ile Trp Tyr Asn Ile His Leu Glu
225                 230                 235                 240

Asp Gly Gly Ile Tyr Lys Lys Lys Ser Asp Ile Pro Leu Tyr Asp Trp
                245                 250                 255

Val Gly Lys Thr Leu Gln Leu Ile Val Val Thr Thr Tyr Glu Lys Asp
```

```
            260                 265                 270

Gly Lys Thr Pro Lys Ile Phe Asp Ser Gly Lys Gln Asn Pro Ser Tyr
        275                 280                 285

Arg Leu Pro Lys Glu Asp Asp Trp Gly Leu Val Lys Lys Arg Thr Glu
    290                 295                 300

Ser Gln Leu Gln Ser Ser Gly Lys Thr Val Gly Ala Phe Ile Tyr Asp
305                 310                 315                 320

Asn Ile Leu Ser Lys Pro Asp Asp Lys Ile Arg Gly Asn Leu Val Arg
                325                 330                 335

Thr Ile Glu Arg Lys Tyr Tyr Lys Lys Glu Leu Ile Glu Ile Leu Gln
            340                 345                 350

Gln Gln Ala Lys Tyr His Asp Glu Leu His Asn Gln Asn Leu Leu Glu
        355                 360                 365

Ser Cys Ala Lys Glu Leu Tyr Ala His Asn Asp Val His Tyr Asn Glu
    370                 375                 380

Val Ile Lys Ser Asn Met Ile Asn Leu Leu Val Asn Asp Ile Ile Phe
385                 390                 395                 400

Tyr Gln Arg Pro Leu Lys Ser Lys Lys Ser Leu Ile Ala Asn Cys Lys
                405                 410                 415

Tyr Glu Ser Tyr Glu Tyr Val Asp Lys Glu Thr Gly Glu Ile Lys Glu
            420                 425                 430

Met Pro Ile Lys Cys Ile Ala Lys Ser Asn Pro Tyr Tyr Gln Glu Phe
        435                 440                 445

Arg Leu Trp Gln Phe Ile His Asn Leu Arg Leu Ser Asp Val Val Thr
    450                 455                 460
```

```
Arg Glu Asp Val Thr Ala Gln Tyr Leu Ser Thr Pro Gln Asp Tyr Cys
465                 470                 475                 480

Asn Leu Phe Thr Tyr Leu Asn Asp Arg Lys Glu Ile Lys Gln Asp Ile
                485                 490                 495

Leu Leu Lys Asp Phe Phe Lys Ile Lys Lys Val Gln Ile Asp Lys Glu
            500                 505                 510

Lys Val Phe Pro Ile Glu Trp Asn Tyr Ile Lys Asp Ala Thr Lys Ser
        515                 520                 525

Tyr Pro Cys Asn Glu Thr Arg Tyr Glu Leu Leu Ser Ala Leu Lys Arg
    530                 535                 540

Ala Gly Met Asp Lys Gln Trp Leu Asp Asp Thr Pro Asn Met Gln Tyr
545                 550                 555                 560

Arg Leu Trp His Leu Leu Tyr Ser Val Glu Glu Lys Glu Glu Ser Ala
                565                 570                 575

Lys Ala Leu Arg Lys Leu Tyr Asp Asp Asp Lys Phe Val Thr Ser Phe
            580                 585                 590

Leu Lys Ile Lys Pro Phe Asn Lys Cys Tyr Gly Ala Tyr Ser Glu Lys
        595                 600                 605

Ala Ile Lys Arg Leu Leu Thr Leu Met Arg Met Gly Lys Ala Trp Asn
    610                 615                 620

Glu Gln Ala Ile Asp Ala Lys Thr Leu Lys Cys Ile Gln Gln Ile Ile
625                 630                 635                 640

Thr Asp Asn Val Asp Ser Lys Leu Lys Glu Lys Ile Asp Asp Ser Arg
                645                 650                 655

Tyr Val Leu His His Val Ser Asp Phe Gln Gly Leu Pro Thr Tyr Leu
```

```
            660                 665                 670

Ala Ser Tyr Val Ile Tyr Gly Arg His Ser Glu Val Thr Asp Ile Gln
        675                 680                 685

Cys Trp Asp Ser Pro Glu Asp Leu Leu Lys Phe Ile Arg Asp Phe Lys
    690                 695                 700

Gln His Ser Leu Arg Asn Pro Ile Val Glu Gln Val Ile Leu Glu Thr
705                 710                 715                 720

Leu Arg Val Val Tyr Asp Ile Trp Lys Ala Glu Lys His Ile Asp Glu
                725                 730                 735

Ile His Val Glu Val Ala Arg Glu Met Lys Leu Thr Ala Gln Gln Arg
            740                 745                 750

Asn Glu Ala Asn Leu Arg Asn Leu Asn Asn Glu Ala Thr Asn Leu Arg
        755                 760                 765

Ile Lys Tyr Leu Leu Glu Glu Leu Lys Asn Asp Thr Phe Ile Lys Asp
    770                 775                 780

Val Arg Pro Leu Ser Pro Ile His Gln Glu Lys Met Arg Ile Tyr Glu
785                 790                 795                 800

Gln Ala Val Leu Gly Asn Leu Asn Lys Gln Asp Lys Asp Tyr Asp Asp
                805                 810                 815

Ile Ile Lys Ile Ser Lys Lys Glu His Pro Thr Asn Ala Glu Leu Ile
            820                 825                 830

Arg Tyr Lys Leu Trp Leu Glu Gln Arg Tyr Cys Ser Pro Tyr Thr Gly
        835                 840                 845

Lys Ala Ile Ser Leu Ser Lys Leu Phe Thr Thr Ala Tyr Glu Ile Glu
    850                 855                 860
```

```
His Ile Ile Pro Gln Ser Arg Tyr Phe Asp Asn Ser Phe Asn Asn Lys
865                 870                 875                 880


Val Ile Cys Glu Ala Glu Val Asn Lys Ala Lys Gly Asn Met Leu Gly
                885                 890                 895


Tyr Glu Phe Ile Lys Lys Gln Gly Gly Gln Lys Ile Tyr Cys Thr Gln
            900                 905                 910


Leu Gly Lys Ala Val Thr Ile Leu Lys Glu Glu Ala Tyr Lys Gln Phe
        915                 920                 925


Val Asn Glu His Tyr Ala His Asn Lys Arg Lys Arg Asp Asn Leu Leu
    930                 935                 940


Ala Glu Asn Ile Pro Glu Ser Phe Ser Ser Arg Gln Leu Asn Asp Thr
945                 950                 955                 960


Arg Tyr Ile Thr Lys Thr Ile Met Ser Leu Leu Ser Asn Val Val Arg
                965                 970                 975


Gln Gln Ser Glu Glu Glu Ala Thr Ala Lys Asn Leu Leu Pro Ser Ser
            980                 985                 990


Gly Ser Val Thr Asp Arg Leu Lys  Asn Asp Trp Gly Leu  Lys Asp Val
        995                 1000                1005


Trp Asn  Thr Ile Val Thr Pro  Arg Phe Glu Arg Leu  Asn Lys Leu
    1010                1015                1020


Ser Gly  Thr Asn Asp Phe Gly  Glu Met Lys Glu Glu  Asn Gly Asn
    1025                1030                1035


Arg Tyr  Phe Gln Thr Asn Val  Pro Leu Glu Tyr Glu  Lys Gly Phe
    1040                1045                1050


Lys Lys  Lys Arg Ile Asp His  Arg His His Ala Met  Asp Ala Leu
```

```
    1055                1060                1065

Val Ile  Ala Cys Thr Thr Arg  Asn Met Val Asn Tyr  Ile Ser Asn
    1070                1075                1080

Ala Asn  Ala Asn Ser Pro Lys  Gln Arg Glu Asp Leu  Arg Gln Leu
    1085                1090                1095

Leu Cys  Asp Lys Asn Arg Ile  Ile Asn Lys Pro Trp  Asp Thr Phe
    1100                1105                1110

Thr Gln  Asp Ala Leu Lys Ala  Leu Asn Asp Ile Val  Val Ser Phe
    1115                1120                1125

Lys Asn  Asn Val Arg Ile Ile  Asn Arg Ala Thr Asn  Arg Tyr Gln
    1130                1135                1140

Arg Tyr  Asp Lys Asn Gly Lys  Lys Ile Ile Phe Ser  Gln Lys Gly
    1145                1150                1155

Asp Asp  Met Trp Ala Ile Arg  Lys Ser Met His Lys  Glu Thr Val
    1160                1165                1170

Phe Gly  Arg Val Asn Leu Ile  Arg Lys Glu Val Leu  Pro Ile Ala
    1175                1180                1185

Lys Ala  Leu Asp Asn Ile Ser  Ala Ile Cys Asn Ala  Gln Leu Arg
    1190                1195                1200

Ala Tyr  Val Asn Asp Leu Val  Asp Lys His Phe Asn  Lys Lys Gln
    1205                1210                1215

Leu Val  Ala His Phe Lys Ser  Leu Asn Tyr Lys Trp  Asn Arg Gln
    1220                1225                1230

Asp Val  Ser Lys Val Glu Val  Trp Ile Ser Ser Asp  Asn Lys Thr
    1235                1240                1245
```

```
Pro Met  Val Ala Val Arg Lys  Pro Leu Asp Thr Ser  Phe Asp Lys
    1250                1255                1260

Lys Lys  Ile Ala Ser Ile Thr  Asp Thr Gly Ile Gln  Thr Ile Leu
    1265                1270                1275

Leu Asn  Tyr Leu Glu Ser Lys  Gly Gly Asp Ala Ser  Val Ala Phe
    1280                1285                1290

Ala Pro  Glu Gly Ile Gln Glu  Met Asn Ser Asn Ile  Glu Leu Tyr
    1295                1300                1305

Asn Asn  Gly Lys Ala His Lys  Pro Ile Lys Asn Val  Arg Leu Ser
    1310                1315                1320

Glu Pro  Leu Gly Ala Lys Tyr  Gln Val Gly Glu Arg  Gly Ala Lys
    1325                1330                1335

Thr Lys  Lys Tyr Val Glu Ala  Asp Lys Gly Thr Asn  Leu Phe Phe
    1340                1345                1350

Ala Ile  Tyr Glu Asp Glu Glu  Gly Lys Arg Tyr Tyr  Tyr Ser Val
    1355                1360                1365

Pro Leu  Arg Glu Ala Ile Glu  Arg Gln Lys Gln Lys  Leu Ser Pro
    1370                1375                1380

Val Pro  Glu Tyr Asn Glu Lys  Gly Val Ala Leu Lys  Phe Tyr Leu
    1385                1390                1395

Ser Pro  Asn Asp Leu Val Tyr  Val Pro Thr Glu Glu  Glu Arg Thr
    1400                1405                1410

Met Gly  Thr Cys His Ile Asp  Lys Ala Arg Ile Tyr  Lys Met Val
    1415                1420                1425

Ser Ser  Thr Gly Cys Ser Cys  Tyr Phe Val Pro Ser  Thr Phe Ala
```

```
    1430                1435                1440

Lys Val  Ile Val Asp Lys Val  Glu Leu Gln Ser Leu  Asn Lys Met
    1445                1450                1455

Glu Lys  Ala Ile Thr Asp Glu  Cys Ile Lys Glu Val  Cys Trp Lys
    1460                1465                1470

Leu Lys  Val Asp Arg Leu Gly  Asn Ile Ile Asn Val  Ile Lys
    1475                1480                1485
```

<210> 625
<211> 770
<212> PRT
<213> Pseudoramibacter alactolyticus

<400> 625

```
Met Ala Lys Gly Tyr Phe Ala Ser Asp Glu Glu Ile Asp Phe Ser Gly
1               5                   10                  15

Val Asp Asp Gly Phe Lys Asn Thr Leu Ser Ser His Gln Lys Phe Lys
            20                  25                  30

Glu Ile Phe Asp Val Glu Val Leu Asn Asp Trp Gln Lys Ser Met Ser
        35                  40                  45

Glu Lys Ile Ile Phe Trp Ala Thr Val Tyr Gly Asp Ser Lys Lys Phe
    50                  55                  60

Leu Lys Glu Arg Leu Glu Asp Ala Tyr Gly Asn Glu Leu Asp Gln Lys
65                  70                  75                  80

Gln Ile Lys Arg Ile Leu Gly Leu Arg Phe Lys Asp Trp Gly Arg Leu
                85                  90                  95

Ser Glu Ala Phe Leu Asn Leu Glu Gly Lys Asn Ser Lys Thr Asn Gln
            100                 105                 110
```

```
Ser Gln Thr Ile Ile Glu Ala Leu Trp Asn Gly Asp Gly Thr Asn Asn
        115                 120                 125

Phe Asn Leu Met Glu Leu Leu Ser Ser Gln Phe Thr Tyr Arg Asp Thr
    130                 135                 140

Leu Lys Lys Arg Ala Leu Lys Gly Glu Lys Thr Leu Thr Asn Ile Thr
145                 150                 155                 160

Tyr Glu Asp Leu Ser Asp Leu Tyr Leu Ser Pro Ser Val Arg Arg Met
                165                 170                 175

Val Trp Gln Thr Ile Leu Ile Val Lys Glu Leu Arg Gln Val Leu Gly
            180                 185                 190

Ala Gly Pro Ala Lys Ile Phe Ile Glu Met Ala Arg Asp Val Thr Leu
        195                 200                 205

Lys Ala Gly Thr Arg Thr Thr Ser Arg Arg Gln Gln Leu Leu Asp Leu
    210                 215                 220

Tyr Lys Asn Val Gln Thr Glu Ser Arg Asn Trp Val Glu Glu Ile Glu
225                 230                 235                 240

Thr Gln Glu Glu Ser Arg Phe Arg Ser Lys Lys Ile Phe Leu Tyr Tyr
                245                 250                 255

Thr Gln Met Gly Gln Cys Met Tyr Thr Gly Glu Pro Ile Val Phe Lys
            260                 265                 270

Asp Leu Phe Asn Arg Asn Leu Tyr Asp Ile Asp His Ile Tyr Pro Arg
        275                 280                 285

His Phe Val Lys Asp Asp Ser Leu Ile Asn Asn Leu Val Leu Val Lys
    290                 295                 300

Lys Gln Ala Asn Ser His Lys Ser Asp Thr Phe Pro Ile Glu Asn Ser
305                 310                 315                 320
```

```
Ile Gln Gln Ala Arg Arg Asp Phe Trp Lys Trp Leu Ser Glu Lys Gly
               325                 330                 335

Leu Ile Ser Arg Glu Lys Phe Asn Arg Leu Thr Arg Arg Thr Ser Phe
            340                 345                 350

Ser Asp Glu Glu Leu Ala Gly Phe Ile Ser Arg Gln Ile Val Glu Thr
        355                 360                 365

Arg Gln Gly Thr Lys Ala Val Ala Gln Ile Phe Glu Asn Ala Leu Pro
    370                 375                 380

Asp Ser Glu Val Val Tyr Val Lys Ala Gly Asn Val Ser Asp Phe Arg
385                 390                 395                 400

His His Phe Asn Leu Leu Lys Cys Arg Glu Ile Asn Asp Leu His His
               405                 410                 415

Ala Gln Asp Ala Tyr Leu Asn Val Val Val Gly Asn Val Tyr His Thr
            420                 425                 430

Lys Phe Thr Lys Asn Pro Ile Asn Phe Ile Lys Gly Tyr Arg Lys Asp
        435                 440                 445

Arg Lys Ala Tyr Ala Tyr His Met Asp Gln Ile Phe Asp His Pro Val
    450                 455                 460

Lys Arg Asn Asp Ile Ile Ala Trp Gln Thr Asp Lys Asn Gln Ser Ile
465                 470                 475                 480

Ala Thr Val Lys Lys Val Met Ala Lys Gly Thr Pro Leu Val Thr Arg
               485                 490                 495

Met Ser Tyr Glu Glu His Gly Glu Leu Ser Asn Gln Asn Ile Cys Ser
            500                 505                 510
```

```
Ala Lys Ala Ala Gln Lys Ala Glu Gly Lys Gly Tyr Leu Pro Ile Lys
        515                 520                 525

Asn Ser Glu Arg Leu Ser Asn Thr Gln Arg Tyr Gly Gly Tyr Asn Lys
    530                 535                 540

Tyr Ala Gly Ser Tyr Phe Phe Leu Val Glu His Thr Leu Lys Lys Asn
545                 550                 555                 560

Arg Val Arg Thr Ile Glu Thr Met Pro Leu Phe Leu Arg Asp Thr Ile
                565                 570                 575

Lys Thr Ser Lys Asp Leu Leu Lys Tyr Cys Cys Glu Ser Leu Lys Leu
            580                 585                 590

Glu Ala Pro Ser Ile Arg Val Met Lys Ile Lys Met Gly Ser Leu Leu
        595                 600                 605

Ser Val Asn Gly Ala Phe Val Tyr Leu Thr Gly Arg Ser Gly Lys Lys
    610                 615                 620

Leu Ile Thr Pro Asn Gly Phe Gln Leu Ile Leu Pro Gln Lys Trp Gln
625                 630                 635                 640

Asp Tyr Ile Arg Leu Leu Ile Lys Thr Lys Asp Ser Pro Asp Asp Val
                645                 650                 655

Glu Gly Ile Ser Gly Gly Lys Asn Ile Glu Phe Tyr Asp Ile Leu Val
            660                 665                 670

Glu Lys His Thr Lys Thr Cys Leu Lys Asn Arg Pro Asn Pro Ile Gly
        675                 680                 685

Glu Lys Leu Arg Glu Trp Arg Asn Asp Phe Ile Ala Leu Asp Asn Gln
    690                 695                 700

Lys Gln Ser Asp Ile Leu Leu Glu Ile Leu Lys Leu Thr Thr Phe Asp
705                 710                 715                 720
```

Asn Ser Gly Ala Asp Leu Arg Ala Ile Gly Gly Lys Asn Gln Ser Gly
725 730 735

Val Ser Thr Ile Gly Lys Lys Ile Ser Ser Gln Lys Ser Val Val Leu
740 745 750

Val His Arg Ser Val Thr Gly Ile Phe Glu Lys Gln Val Asp Leu Leu
755 760 765

Ser Ile
770

<210> 626
<211> 103
<212> PRT
<213> Rhizobium etli

<400> 626

Met Ser Gly Glu Gln Leu Thr Arg Glu Ile Gly Arg Ser Gly Val Lys
1 5 10 15

Ala Ser Ala Val Gly Leu Gly Thr Trp Ala Ile Gly Gly Trp Met Trp
20 25 30

Gly Gly Thr Asp Glu Ala Gln Ser Ile Ala Ala Ile Gln Ala Ser Leu
35 40 45

Asp Ala Gly Val Thr Leu Ile Asp Thr Ala Pro Ala Tyr Gly Leu Gly
50 55 60

Arg Ser Glu Glu Ile Val Gly Lys Ala Leu Ala Gly Arg Arg Asp Lys
65 70 75 80

Ala Val Ile Ala Thr Lys Cys Gly Leu Val Trp His Thr Gln Lys Gly
85 90 95

Asn His Phe Phe Asp Gln Asp

100

<210> 627
<211> 1059
<212> PRT
<213> Rhodovulum sp.

<400> 627

Met Gly Ile Arg Phe Ala Phe Asp Leu Gly Thr Asn Ser Ile Gly Trp
1 5 10 15

Ala Val Trp Arg Thr Gly Pro Gly Val Phe Gly Glu Asp Thr Ala Ala
20 25 30

Ser Leu Asp Gly Ser Gly Val Leu Ile Phe Lys Asp Gly Arg Asn Pro
35 40 45

Lys Asp Gly Gln Ser Leu Ala Thr Met Arg Arg Val Pro Arg Gln Ser
50 55 60

Arg Lys Arg Arg Asp Arg Phe Val Leu Arg Arg Arg Asp Leu Leu Ala
65 70 75 80

Ala Leu Arg Lys Ala Gly Leu Phe Pro Val Asp Val Glu Glu Gly Arg
85 90 95

Arg Leu Ala Ala Thr Asp Pro Tyr His Leu Arg Ala Lys Ala Leu Asp
100 105 110

Glu Ser Leu Thr Pro His Glu Met Gly Arg Val Ile Phe His Leu Asn
115 120 125

Gln Arg Arg Gly Phe Arg Ser Asn Arg Lys Ala Asp Arg Gln Asp Arg
130 135 140

Glu Lys Gly Lys Ile Ala Glu Gly Ser Lys Arg Leu Ala Glu Thr Leu
145 150 155 160

```
Ala Ala Thr Asn Cys Arg Thr Leu Gly Glu Phe Leu Trp Ser Arg His
                165                 170                 175

Arg Gly Thr Pro Arg Thr Arg Ser Pro Thr Arg Ile Arg Met Glu Gly
            180                 185                 190

Glu Gly Ala Lys Ala Leu Tyr Ala Phe Tyr Pro Thr Arg Glu Met Val
        195                 200                 205

Arg Ala Glu Phe Glu Arg Leu Trp Thr Ala Gln Ser Arg Phe Ala Pro
    210                 215                 220

Asp Leu Leu Thr Pro Glu Arg His Glu Glu Ile Ala Gly Ile Leu Phe
225                 230                 235                 240

Arg Gln Arg Asp Leu Ala Pro Pro Lys Ile Gly Cys Cys Thr Phe Glu
                245                 250                 255

Pro Ser Glu Arg Arg Leu Pro Arg Ala Leu Pro Ser Val Glu Ala Arg
            260                 265                 270

Gly Ile Tyr Glu Arg Leu Ala His Leu Arg Ile Thr Thr Gly Pro Val
        275                 280                 285

Ser Asp Arg Gly Leu Thr Arg Pro Glu Arg Asp Val Leu Ala Ser Ala
    290                 295                 300

Leu Leu Ala Gly Lys Ser Leu Thr Phe Lys Ala Val Arg Lys Thr Leu
305                 310                 315                 320

Lys Ile Leu Pro His Ala Leu Val Asn Phe Glu Glu Ala Gly Glu Lys
                325                 330                 335

Gly Leu Asp Gly Ala Leu Thr Ala Lys Leu Leu Ser Lys Pro Asp His
            340                 345                 350

Tyr Gly Ala Ala Trp His Gly Leu Ser Phe Ala Glu Lys Asp Thr Phe
        355                 360                 365
```

```
Val Gly Lys Leu Leu Asp Glu Ala Asp Glu Glu Arg Leu Ile Arg Arg
    370                 375                 380

Leu Val Thr Glu Asn Arg Leu Ser Glu Asp Ala Ala Arg Arg Cys Ala
385                 390                 395                 400

Ser Ile Pro Leu Ala Asp Gly Tyr Gly Arg Leu Gly Arg Thr Ala Asn
                405                 410                 415

Thr Glu Ile Leu Ala Ala Leu Val Glu Glu Thr Asp Glu Thr Gly Thr
            420                 425                 430

Val Val Thr Tyr Ala Glu Ala Val Arg Arg Ala Gly Glu Arg Thr Gly
        435                 440                 445

Arg Asn Trp His His Ser Asp Glu Arg Asp Gly Val Ile Leu Asp Arg
    450                 455                 460

Leu Pro Tyr Tyr Gly Glu Ile Leu Gln Arg His Val Val Pro Gly Ser
465                 470                 475                 480

Gly Glu Pro Glu Glu Lys Asn Glu Ala Ala Arg Trp Gly Arg Leu Ala
                485                 490                 495

Asn Pro Thr Val His Ile Gly Leu Asn Gln Leu Arg Lys Val Val Asn
            500                 505                 510

Arg Leu Ile Ala Ala His Gly Arg Pro Asp Gln Ile Val Val Glu Leu
        515                 520                 525

Ala Arg Glu Leu Lys Leu Asn Arg Glu Gln Lys Glu Arg Leu Asp Arg
    530                 535                 540

Glu Asn Arg Lys Asn Arg Glu Glu Asn Glu Arg Arg Thr Ala Ile Leu
545                 550                 555                 560
```

```
Ala Glu His Gly Gln Arg Asp Thr Ala Glu Asn Lys Ile Arg Leu Arg
                565                 570                 575

Leu Phe Glu Glu Gln Ala Arg Ala Asn Ala Gly Ile Ala Leu Cys Pro
            580                 585                 590

Tyr Thr Gly Arg Ala Ile Gly Ile Ala Glu Leu Phe Thr Ser Glu Val
        595                 600                 605

Glu Ile Asp His Ile Leu Pro Val Ser Leu Thr Leu Asp Asp Ser Leu
    610                 615                 620

Ala Asn Arg Val Leu Cys Arg Arg Glu Ala Asn Arg Glu Lys Arg Arg
625                 630                 635                 640

Gln Thr Pro Phe Gln Ala Phe Gly Ala Thr Pro Ala Trp Asn Asp Ile
                645                 650                 655

Val Ala Arg Ala Ala Lys Leu Pro Pro Asn Lys Arg Trp Arg Phe Asp
            660                 665                 670

Pro Ala Ala Leu Glu Arg Phe Glu Arg Glu Gly Gly Phe Leu Gly Arg
        675                 680                 685

Gln Leu Asn Glu Thr Lys Tyr Leu Ser Arg Leu Ala Lys Ile Tyr Leu
    690                 695                 700

Gly Lys Ile Cys Asp Pro Asp Arg Val Tyr Val Thr Pro Gly Thr Leu
705                 710                 715                 720

Thr Gly Leu Leu Arg Ala Arg Trp Gly Leu Asn Ser Ile Leu Ser Asp
                725                 730                 735

Ser Asn Phe Lys Asn Arg Ser Asp His Arg His His Ala Val Asp Ala
            740                 745                 750

Val Val Ile Gly Val Leu Thr Arg Gly Met Ile Gln Arg Ile Ala His
        755                 760                 765
```

```
Asp Ala Ala Arg Ala Glu Asp Gln Asp Leu Asp Arg Val Phe Arg Asp
    770                 775                 780

Val Pro Val Pro Phe Glu Asp Phe Arg Asp His Val Arg Glu Arg Val
785                 790                 795                 800

Ser Thr Ile Thr Val Ala Val Lys Pro Glu His Gly Lys Gly Gly Ala
                805                 810                 815

Leu His Glu Asp Thr Ser Tyr Gly Leu Val Pro Asp Thr Asp Pro Asn
            820                 825                 830

Ala Ala Leu Gly Asn Leu Val Val Arg Lys Pro Ile Arg Ser Leu Thr
        835                 840                 845

Ala Gly Glu Val Asp Arg Val Arg Asp Arg Ala Leu Arg Ala Arg Leu
    850                 855                 860

Gly Ala Leu Ala Ala Pro Phe Arg Asp Glu Ser Gly Arg Val Arg Asp
865                 870                 875                 880

Ala Lys Gly Leu Ala Gln Ala Leu Glu Ala Phe Gly Ala Glu Asn Gly
                885                 890                 895

Ile Arg Arg Val Arg Ile Leu Lys Pro Asp Ala Ser Val Val Thr Ile
            900                 905                 910

Ala Asp Arg Arg Thr Gly Val Pro Tyr Arg Ala Val Ala Pro Gly Glu
        915                 920                 925

Asn His His Val Asp Ile Val Gln Met Arg Asp Gly Ser Trp Arg Gly
    930                 935                 940

Phe Ala Ala Ser Val Phe Glu Val Asn Arg Pro Gly Trp Arg Pro Glu
945                 950                 955                 960
```

```
Trp Glu Val Lys Lys Leu Gly Gly Lys Leu Val Met Arg Leu His Lys
                965                 970                 975


Gly Asp Met Val Glu Leu Ser Asp Lys Asp Gly Gln Arg Arg Val Lys
            980                 985                 990


Val Val Gln Gln Ile Glu Ile Ser  Ala Asn Arg Val Arg  Leu Ser Pro
        995                 1000                1005


His Asn  Asp Gly Gly Lys Leu  Gln Asp Arg His Ala  Asp Ala Asp
    1010                1015                1020


Asp Pro  Phe Arg Trp Asp Leu  Ala Thr Ile Pro Leu  Leu Lys Asp
    1025                1030                1035


Arg Gly  Cys Val Ala Val Arg  Val Asp Pro Ile Gly  Val Val Thr
    1040                1045                1050


Leu Arg  Arg Ser Asn Val
    1055
```

<210> 628
<211> 1405
<212> PRT
<213> Riemerella anatipestifer

<400> 628

```
Met Lys Thr Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Leu Val Lys Glu Ala Glu Asn Ser Asn Glu Lys Ser Glu Ile Ile
            20                  25                  30


Lys Leu Gly Val Arg Val Asn Pro Leu Thr Val Asp Glu Lys Thr Asn
        35                  40                  45


Phe Glu Ala Gly Arg Pro Leu Ser Thr Asn Ala Asp Arg Thr Ala Lys
    50                  55                  60
```

```
Arg Ser Ala Arg Arg Asn Leu Gln Arg Tyr Lys Leu Arg Arg Lys Asn
65                  70                  75                  80

Leu Ile Asp Leu Leu Ile Lys Asn Gln Leu Ile Asp Lys Asp Thr Pro
                85                  90                  95

Leu Thr Glu Ile Gly Lys Asn Thr Thr His Gln Thr Leu Glu Leu Arg
            100                 105                 110

Ala Lys Ala Ala Arg Glu Arg Ile Glu Leu Glu Asp Leu Ala Arg Val
        115                 120                 125

Phe Leu Ala Ile Asn Lys Lys Arg Gly Tyr Arg Ser Ser Arg Lys Val
    130                 135                 140

Asn Asn Glu Glu Glu Gly Gln Ala Val Asp Gly Met Ala Val Ala Lys
145                 150                 155                 160

Lys Leu Tyr Asp Glu Asn Leu Thr Pro Gly Gln Tyr Ala Tyr Glu Leu
                165                 170                 175

Leu Ser Lys Gly Lys Lys Tyr Val Pro Asp Phe Tyr Arg Ser Asp Leu
            180                 185                 190

Gln Ala Glu Phe Asn Ala Ile Trp Glu Tyr Gln Lys Gln Phe Tyr Ala
        195                 200                 205

Asp Ile Leu Asp Asp Glu Leu Tyr Asn Ala Leu Lys Gly Gln Gly Gln
    210                 215                 220

Gln Asn Ser Arg Lys Arg Phe Leu Ala Ile Lys Gly Val Tyr Thr Ala
225                 230                 235                 240

Glu Asn Lys Gly Lys Arg Asp Asp Val Lys Leu Arg His Tyr Lys Trp
                245                 250                 255

Arg Ser Glu Ala Ile Ser Lys Lys Ile Asn Ile Glu Glu Val Ala Tyr
```

```
            260                 265                 270

Val Leu Val Glu Ile Asn Asn Asp Leu Asn Lys Ser Ser Gly Tyr Leu
        275                 280                 285

Gly Ala Ile Ser Asp Arg Ser Lys Glu Leu Tyr Phe Asn Lys Glu Thr
    290                 295                 300

Val Gly Glu Asn Leu Trp Lys Gln Ile Gln Lys Asn Pro His Thr Ser
305                 310                 315                 320

Leu Lys Asn Gln Val Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe Glu
                325                 330                 335

Gln Ile Trp Glu Thr Gln Ala Gln Phe His Pro Gln Leu Thr Leu Ala
            340                 345                 350

Leu Lys Glu Gln Ile Arg Asp Val Ile Ile Phe Tyr Gln Arg Lys Leu
        355                 360                 365

Lys Ser Gln Lys Gly Leu Leu Ser Phe Cys Gln Phe Glu Ser Trp Glu
    370                 375                 380

Ile Glu Arg Lys Asp Glu Asn Gly Asn Val Ile Leu Asn Lys Thr Thr
385                 390                 395                 400

Gln Leu Pro Lys Arg Gln Thr Val Gly Arg Arg Val Ala Pro Lys Ser
                405                 410                 415

Ser Pro Leu Phe Gln Glu Phe Lys Ile Trp Gln Asn Ile Asn Asn Leu
            420                 425                 430

Glu Val Thr Lys Ile Ser Glu Gly Ala Ser Lys Asn Lys Lys Glu Thr
        435                 440                 445

Glu Thr Leu Ser Asp Asp Glu Arg Lys Leu Leu Phe Glu Glu Leu Asn
    450                 455                 460
```

```
Leu Arg Gly Asn Leu Ser Gln Lys Glu Val Leu Gln Ile Leu Gly Leu
465                 470                 475                 480

Lys Asp Lys Glu Tyr Lys Thr Asn Phe Ser Glu Gly Leu Glu Gly Asn
                485                 490                 495

Arg Thr Asn Ala Ala Leu Phe Asn Ile Tyr Gln Gln Ile Ala Glu Asn
            500                 505                 510

Glu Gly Tyr Gly Phe Asp Trp Ser Lys Lys Ser Ala Gln Glu Ile Lys
        515                 520                 525

Glu Glu Leu Lys Ala Val Phe Pro Gln Ile Gly Ile Gln Ala Asp Ile
    530                 535                 540

Leu Asp Phe Asn Ala Asn Leu Asp Gly Lys Glu Phe Glu Asn Gln Ala
545                 550                 555                 560

Ser Tyr Gln Leu Trp His Leu Leu Tyr Ser Ala Glu Glu Asp Asp Lys
                565                 570                 575

Ile Asn Glu Glu Asp Gln Ile Ile Tyr Gly Asn Ser Ala Val Ser Leu
            580                 585                 590

Lys Lys Lys Leu Cys Glu Lys Phe Gly Phe Thr Pro Glu Tyr Ala Lys
        595                 600                 605

Trp Ile Ala Asn Val Ser Leu Gln Asp Asp Tyr Gly Asn Leu Ser Thr
    610                 615                 620

Lys Ala Met Arg Lys Ile Ile Pro Tyr Leu Ile Asp Gly Asn Asp Tyr
625                 630                 635                 640

Ser Glu Ala Cys Ala Leu Ala Gly Tyr Asn His Ser Asn Ser Leu Thr
                645                 650                 655

Lys Glu Glu Asn Asp Asn Arg Glu Leu Leu Asp Lys Leu Glu Leu Leu
```

```
            660                 665                 670

Pro Lys Asn Ser Leu Arg Asn Pro Val Val Glu Lys Ile Leu Asn Gln
        675                 680                 685

Met Val Asn Val Val Asn Gln Val Ile Glu Thr Tyr Gly Lys Pro Asp
    690                 695                 700

Glu Val Arg Ile Glu Leu Ala Arg Glu Leu Lys Lys Ser Ala Glu Lys
705                 710                 715                 720

Arg Ala Glu Met Thr Lys Ser Ile Asn Glu Ala Thr Arg Arg Asn Glu
                725                 730                 735

Asp Ile Lys Lys Leu Ile Thr Lys Asp Phe Gly Ile Pro Asn Pro Thr
            740                 745                 750

Lys Ser Asp Val Val Arg Tyr Arg Leu Trp Glu Glu Leu Ala Pro Leu
        755                 760                 765

Ala Tyr Lys Asp Val Phe Thr Gly Lys Gln Ile Lys Lys Glu Asp Leu
    770                 775                 780

Phe Ser Ser Lys Ile Asp Ile Glu His Ile Ile Pro Lys Ala Leu Leu
785                 790                 795                 800

Phe Asp Asp Ser Phe Ser Asn Lys Thr Leu Val Phe Arg Glu Thr Asn
                805                 810                 815

Leu Lys Lys Ala Asp Arg Thr Ala Tyr Asp Phe Ile Glu Ser Asp Tyr
            820                 825                 830

Asn Ala Thr Leu Asp Asp Tyr Ile Gln Arg Val Glu Thr Leu Tyr Asn
        835                 840                 845

Asn Thr Lys Gly Thr Ile Ser Lys Gly Lys Arg Asn Lys Leu Leu Met
    850                 855                 860
```

```
Ala Gln Lys Asn Leu Pro Asp Gly Phe Ile Glu Arg Asp Leu Arg Asn
865                 870                 875                 880


Ser Gln Tyr Ile Ala Lys Lys Ala Lys Ala Met Leu Tyr Gln Val Phe
                885                 890                 895


Lys Asp Val Asn Val Thr Ser Gly Ser Ile Thr Asp Arg Leu Arg Glu
            900                 905                 910


Asp Trp Asp Leu Ile Asn Val Met Lys Glu Leu Asn Phe Pro Lys Tyr
        915                 920                 925


Lys Ala Leu Gly Leu Thr Glu Ile Glu Glu Arg Tyr Asp Ile Gly Gln
    930                 935                 940


Glu Lys Thr Lys Arg Val Glu Val Ile Thr Asp Trp Thr Lys Arg Asn
945                 950                 955                 960


Asp His Arg His His Ala Met Asn Ala Leu Thr Val Ala Phe Thr Thr
                965                 970                 975


Ser Ser His Ile Gln Tyr Leu Asn Tyr Leu Asn Ala Arg Lys Asn Glu
            980                 985                 990


Ser His Lys Glu His Lys Asn Ile  Lys Gly Ile Glu Asn  Lys Ile Thr
        995                 1000                1005


His Lys  Gln Lys Asp Lys Arg  Lys Phe Ile Pro Pro  Met Pro Asn
    1010                1015                1020


Phe Arg  Glu Glu Ala Lys Lys  His Ile Glu Thr Ile  Leu Val Ser
    1025                1030                1035


Ile Lys  Asn Lys Asn Lys Val  Tyr Thr Lys Asn Ile  Asn Lys Thr
    1040                1045                1050


Lys Lys  Lys Ser Gly His Asn  Thr Lys Glu Gln Leu  Thr Pro Arg
```

```
    1055                1060                1065

Gly Gln  Leu His Lys Glu Thr  Val Tyr Gly Lys Ser  Lys Arg Pro
    1070                1075                1080

Met Ser  Lys Pro Thr Lys Ile  Asn Lys Asn Phe Ser  Leu Glu Gln
    1085                1090                1095

Ala Gln  Leu Ile Ile Asn Val  Gln Glu Lys Glu Leu  Val Leu Arg
    1100                1105                1110

His Leu  Ala Gln Phe Asp Asn  Asn Pro Ala Val Ala  Phe Asp Thr
    1115                1120                1125

Lys Thr  Leu Lys Lys Met Pro  Leu Leu Lys Asn Gly  Glu Pro Leu
    1130                1135                1140

Lys Glu  Val Leu Cys Phe Glu  Glu Ile Phe Thr Ile  Arg Lys Asp
    1145                1150                1155

Ile Thr  Pro Asp Leu Lys Ile  Glu Lys Val Val Asp  Glu Lys Ile
    1160                1165                1170

Lys Ala  Ile Leu Glu Gln Arg  Lys Lys Asp Phe Gly  Gly Asn Ala
    1175                1180                1185

Lys Glu  Ala Phe Ser Asp Leu  Asp Lys Asn Pro Ile  Trp Leu Asn
    1190                1195                1200

Lys Lys  Lys Gly Ile Cys Ile  Lys Arg Val Thr Ile  Thr Gly Val
    1205                1210                1215

Ser Asn  Ala Glu Ala Leu His  His Gln Lys Asp His  Leu Gly Arg
    1220                1225                1230

Glu Ile  Leu Asp Asp Asn Gly  Asn Pro Ile Pro Ala  Asp Phe Val
    1235                1240                1245
```

```
Ser Thr  Gly Asn Asn His His  Leu Ala Val Tyr Leu  Asp Ser Glu
    1250                1255                1260


Gly Lys  Leu Gln Asp Asn Ile  Val Ser Phe Tyr Glu  Ala Val Val
    1265                1270                1275


Arg Thr  Ser Gln Gly Leu Pro  Val Val Asp Lys Gly  Leu Asn Lys
    1280                1285                1290


Asp Leu  Gly Trp Lys Phe Leu  Phe Ser Leu Lys Gln  Asn Glu Met
    1295                1300                1305


Phe Val  Phe Pro Asn Asp Asp  Phe Asp Ile Asn Asp  Phe Asp Leu
    1310                1315                1320


Leu Asp  Asp Lys Lys Ala Glu  Leu Ile Ser Lys His  Leu Tyr Arg
    1325                1330                1335


Val Gln  Lys Ile Ser Lys Val  Ser Ala Gly Asn Ser  Phe Val Arg
    1340                1345                1350


Asp Ile  Val Phe Arg His His  Leu Glu Thr Thr Val  Lys Glu Val
    1355                1360                1365


Lys Glu  Leu Lys Asp Ile Ser  Tyr Ile Gln Leu Lys  Ser Leu Glu
    1370                1375                1380


Gly Leu  Arg Asn Ile Lys Lys  Val Arg Ile Asn His  Ile Gly Lys
    1385                1390                1395


Ile Val  Gln Val Gly Glu Tyr
    1400                1405


<210>  629
<211>  1145
<212>  PRT
<213>  Riemerella anatipestifer
```

<400> 629

```
Met Lys Thr Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                  10                  15

Ala Leu Val Lys Glu Thr Glu Asn Ser Asn Glu Lys Ser Glu Ile Ile
            20                  25                  30

Lys Leu Gly Val Arg Val Asn Pro Leu Thr Val Asp Glu Lys Thr Asn
        35                  40                  45

Phe Glu Ala Gly Arg Pro Leu Ser Thr Asn Ala Asp Arg Thr Ala Lys
    50                  55                  60

Arg Ser Ala Arg Arg Asn Leu Gln Arg Tyr Lys Leu Arg Arg Lys Asn
65                  70                  75                  80

Leu Ile Asp Leu Leu Ile Lys His Arg Leu Ile Asp Lys Asp Thr Pro
                85                  90                  95

Leu Thr Glu Ile Gly Lys Asn Thr Thr His Gln Thr Leu Glu Leu Arg
            100                 105                 110

Ala Lys Ala Ala Arg Glu Arg Ile Glu Leu Glu Asp Leu Ala Arg Val
        115                 120                 125

Phe Leu Ala Ile Asn Lys Lys Arg Gly Tyr Arg Ser Ser Arg Lys Val
    130                 135                 140

Asn Asn Glu Glu Glu Gly Gln Val Val Asp Gly Met Ala Val Ala Lys
145                 150                 155                 160

Lys Leu Tyr Asp Glu Asn Leu Thr Pro Gly Gln Tyr Ala Tyr Glu Leu
                165                 170                 175

Leu Ser Lys Gly Lys Lys Tyr Val Pro Asp Phe Tyr Arg Ser Asp Leu
            180                 185                 190
```

```
Gln Ala Glu Phe Asp Ser Ile Trp Glu Tyr Gln Lys Gln Phe Tyr Ala
        195                 200                 205

Asp Ile Leu Asp Asp Glu Leu Tyr Asn Ala Leu Lys Gly Gln Gly Gln
    210                 215                 220

Gln Asn Ser Arg Lys Arg Phe Leu Ala Ile Lys Gly Val Tyr Thr Ala
225                 230                 235                 240

Glu Asn Lys Gly Lys Arg Asp Glu Val Lys Leu Gln His Tyr Lys Trp
                245                 250                 255

Arg Ser Glu Ala Ile Thr Gln Lys Leu Ser Ile Glu Glu Val Ala Tyr
            260                 265                 270

Val Leu Val Glu Ile Asn Asn Asp Leu Asn Lys Ser Ser Gly Tyr Leu
        275                 280                 285

Gly Ala Ile Ser Asp Arg Ser Lys Glu Leu Tyr Phe Asn Lys Glu Thr
    290                 295                 300

Val Gly Glu Asn Leu Trp Lys Gln Ile Gln Lys Asn Pro His Thr Ser
305                 310                 315                 320

Leu Lys Asn Gln Val Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe Glu
                325                 330                 335

Gln Ile Trp Glu Thr Gln Ala Gln Phe His Pro Gln Leu Thr Leu Ala
            340                 345                 350

Leu Lys Glu Gln Ile Arg Asp Val Val Ile Phe Tyr Gln Arg Lys Leu
        355                 360                 365

Lys Ser Gln Lys Gly Leu Leu Ser Phe Cys Gln Phe Glu Ser Trp Glu
    370                 375                 380

Ile Glu Arg Lys Asp Glu Asn Gly Asn Val Ile Leu Asn Lys Thr Thr
385                 390                 395                 400
```

```
Gln Leu Pro Lys Arg Gln Thr Val Gly Arg Arg Val Ala Pro Lys Ser
               405                 410                 415

Ser Pro Leu Phe Gln Glu Phe Lys Ile Trp Gln Asn Ile Asn Asn Leu
            420                 425                 430

Glu Ile Ala Lys Ile Ser Asp Gly Asn Ser Lys Asn Lys Lys Glu Thr
        435                 440                 445

Glu Ala Leu Ser Asp Asp Glu Arg Lys Leu Leu Phe Glu Glu Leu Asn
    450                 455                 460

Leu Arg Gly Asn Leu Ser Gln Lys Glu Val Leu Gln Ile Leu Gly Leu
465                 470                 475                 480

Lys Asp Lys Glu Tyr Lys Thr Asn Phe Pro Glu Gly Leu Glu Gly Asn
               485                 490                 495

Arg Thr Asn Ala Ala Leu Phe Asn Ile Tyr Gln Gln Ile Ala Glu Asn
            500                 505                 510

Glu Gly Tyr Gly Asp Trp Thr Lys Lys Ser Ala Gln Glu Ile Lys Glu
        515                 520                 525

Glu Leu Lys Ala Val Phe Pro Gln Ile Gly Ile Gln Ala Asp Ile Leu
    530                 535                 540

Asp Phe Asn Ala Glu Leu Asp Gly Lys Glu Phe Glu Asn Gln Ala Ser
545                 550                 555                 560

Tyr Gln Leu Trp His Leu Leu Tyr Ser Ala Glu Glu Asp Asp Lys Ile
               565                 570                 575

Asn Glu Glu Asp Gln Ile Ile Tyr Gly Asn Ser Ala Val Ser Leu Lys
            580                 585                 590
```

```
Lys Lys Leu Cys Glu Lys Phe Gly Phe Thr Pro Glu Tyr Ala Lys Trp
        595                 600                 605

Ile Ala Asn Val Ser Leu Gln Asp Asp Tyr Gly Asn Leu Ser Thr Lys
    610                 615                 620

Ala Met Arg Lys Ile Ile Pro Tyr Leu Ile Asp Gly Asn Asp Tyr Ser
625                 630                 635                 640

Glu Ala Cys Ala Leu Ala Gly Tyr Asn His Ser Asn Ser Leu Thr Lys
                645                 650                 655

Glu Glu Asn Asp Asn Arg Glu Arg Leu Asn Lys Leu Glu Leu Leu Pro
            660                 665                 670

Lys Asn Ser Leu Arg Asn Pro Val Val Glu Lys Ile Leu Asn Gln Met
        675                 680                 685

Val Asn Val Val Asn Gln Val Ile Glu Thr Tyr Gly Lys Pro Asp Glu
    690                 695                 700

Val Arg Ile Glu Leu Ala Arg Glu Leu Lys Lys Ser Ala Glu Glu Arg
705                 710                 715                 720

Ala Glu Met Thr Lys Gly Ile Asn Glu Ala Thr Arg Arg Asn Glu Asp
                725                 730                 735

Ile Lys Lys Leu Ile Thr Lys Asn Phe Gly Ile Pro Asn Pro Thr Lys
            740                 745                 750

Asn Asp Val Val Arg Tyr Arg Leu Trp Glu Glu Leu Ala Pro Leu Ala
        755                 760                 765

Tyr Lys Asp Val Phe Thr Gly Arg Gln Ile Lys Lys Glu Asp Leu Phe
    770                 775                 780

Ser Ser Lys Ile Asp Ile Glu His Ile Ile Pro Lys Ala Leu Leu Phe
785                 790                 795                 800
```

```
Asp Asp Ser Phe Ser Asn Lys Thr Leu Ala Phe Arg Glu Thr Asn Leu
                805                 810                 815

Lys Lys Ala Asp Arg Thr Ala Tyr Gly Phe Ile Glu Ser Asp Tyr Asn
            820                 825                 830

Ala Thr Leu Asp Asp Tyr Ile Gln Arg Val Glu Thr Leu Tyr Asn Asn
        835                 840                 845

Ala Lys Gly Thr Ile Ser Lys Gly Lys Arg Asn Lys Leu Leu Met Ala
    850                 855                 860

Gln Lys Asn Leu Pro Asp Gly Phe Ile Glu Arg Asp Leu Arg Asn Ser
865                 870                 875                 880

Gln Tyr Ile Ala Lys Lys Ala Lys Ser Met Ile Glu Lys Val Phe Asn
                885                 890                 895

Asp Val Asn Val Thr Ser Gly Ser Ile Thr Asp Arg Leu Arg Glu Asp
            900                 905                 910

Trp Asp Leu Ile Asn Val Met Lys Glu Leu Asn Phe Pro Lys Tyr Lys
        915                 920                 925

Ala Leu Gly Leu Thr Glu Ile Glu Glu Arg Tyr Asp Ile Gly Gln Glu
    930                 935                 940

Lys Thr Lys Lys Val Glu Val Ile Thr Asp Trp Thr Lys Arg Asn Asp
945                 950                 955                 960

His Arg His His Ala Met Asp Ala Leu Thr Val Ala Phe Thr Thr Lys
                965                 970                 975

Ser His Val Gln Tyr Leu Asn Asn Leu Asn Thr Ile His Ser Leu Lys
            980                 985                 990
```

```
Gly Asp Glu Val Asp Leu Glu Leu  Ser Lys Leu Tyr Gly  Leu Lys Asn
        995                 1000                1005


Thr Ile  Thr Glu Val Val Asn  Lys Lys Arg Lys Phe  Ile Pro Pro
    1010                1015                1020


Met Pro  Asn Phe Arg Glu Glu  Ala Lys Lys His Ile  Glu Thr Ile
    1025                1030                1035


Leu Val  Ser Ile Lys Asn Lys  Asn Lys Val Tyr Thr  Lys Asn Ile
    1040                1045                1050


Asn Lys  Thr Lys Lys Glu Ser  Gly Tyr His Thr Lys  Glu Gln Leu
    1055                1060                1065


Thr Pro  Arg Gly Gln Leu His  Lys Glu Thr Val Tyr  Gly Lys Ser
    1070                1075                1080


Lys Arg  Pro Met Asn Lys Pro  Thr Lys Ile Asn Lys  Asn Phe Ser
    1085                1090                1095


Leu Glu  Gln Ala Gln Leu Ile  Ile Asn Val Gln Glu  Lys Glu Leu
    1100                1105                1110


Val Leu  Arg His Leu Ala Gln  Phe Asp Asn Asn Pro  Ala Val Ala
    1115                1120                1125


Phe Asp  Thr Lys Thr Leu Lys  Lys Cys His Tyr Leu  Lys Met Val
    1130                1135                1140


Asn Leu
    1145


<210>  630
<211>  1400
<212>  PRT
<213>  Riemerella anatipestifer

<400>  630
```

```
Met Lys Thr Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                  10                  15

Ala Leu Val Lys Glu Thr Glu Asn Ser Asn Glu Lys Ser Glu Ile Ile
            20                  25                  30

Lys Leu Gly Val Arg Val Asn Pro Leu Thr Val Asp Glu Lys Thr Asn
        35                  40                  45

Phe Glu Ala Gly Arg Pro Leu Ser Thr Asn Ala Asp Arg Thr Ala Lys
    50                  55                  60

Arg Ser Ala Arg Arg Asn Leu Gln Arg Tyr Lys Leu Arg Arg Lys Asn
65                  70                  75                  80

Leu Ile Asp Leu Leu Ile Lys His Arg Leu Ile Asp Lys Asp Thr Pro
                85                  90                  95

Leu Thr Glu Ile Gly Lys Asn Thr Thr His Gln Thr Leu Glu Leu Arg
            100                 105                 110

Ala Lys Ala Ala Arg Glu Arg Ile Glu Leu Glu Asp Leu Ala Arg Val
        115                 120                 125

Phe Leu Ala Ile Asn Lys Lys Arg Gly Tyr Arg Ser Ser Arg Lys Val
    130                 135                 140

Asn Asn Glu Glu Glu Gly Gln Val Val Asp Gly Met Ala Val Ala Lys
145                 150                 155                 160

Lys Leu Tyr Asp Glu Asn Leu Thr Pro Gly Gln Tyr Ala Tyr Glu Leu
                165                 170                 175

Leu Ser Lys Gly Lys Lys Tyr Val Pro Asp Phe Tyr Arg Ser Asp Leu
            180                 185                 190

Gln Ala Glu Phe Asp Ser Ile Trp Glu Tyr Gln Lys Gln Phe Tyr Ala
```

```
        195                 200                 205

Asp Ile Leu Asp Asp Glu Leu Tyr Asn Ala Leu Lys Gly Gln Gly Gln
    210                 215                 220

Gln Asn Ser Arg Lys Arg Phe Leu Ala Ile Lys Gly Val Tyr Thr Ala
225                 230                 235                 240

Glu Asn Lys Gly Lys Arg Asp Glu Val Lys Leu Gln His Tyr Lys Trp
                245                 250                 255

Arg Ser Glu Ala Ile Thr Gln Lys Leu Ser Ile Glu Glu Val Ala Tyr
            260                 265                 270

Val Leu Val Glu Ile Asn Asn Asp Leu Asn Lys Ser Ser Gly Tyr Leu
        275                 280                 285

Gly Ala Ile Ser Asp Arg Ser Lys Glu Leu Tyr Phe Asn Lys Glu Thr
    290                 295                 300

Val Gly Glu Asn Leu Trp Lys Gln Ile Gln Lys Asn Pro His Thr Ser
305                 310                 315                 320

Leu Lys Asn Gln Val Phe Tyr Arg Gln Asp Tyr Leu Asp Glu Phe Glu
                325                 330                 335

Gln Ile Trp Glu Thr Gln Ala Gln Phe His Pro Gln Leu Thr Leu Ala
            340                 345                 350

Leu Lys Glu Gln Ile Arg Asp Val Val Ile Phe Tyr Gln Arg Lys Leu
        355                 360                 365

Lys Ser Gln Lys Gly Leu Leu Ser Phe Cys Gln Phe Glu Ser Trp Glu
    370                 375                 380

Ile Glu Arg Lys Asp Glu Asn Gly Asn Val Ile Leu Asn Lys Thr Thr
385                 390                 395                 400
```

```
Gln Leu Pro Lys Arg Gln Thr Val Gly Arg Arg Val Ala Pro Lys Ser
               405                 410                 415

Ser Pro Leu Phe Gln Glu Phe Lys Ile Trp Gln Asn Ile Asn Asn Leu
            420                 425                 430

Glu Ile Ala Lys Ile Ser Asp Gly Asn Ser Lys Asn Lys Lys Glu Thr
        435                 440                 445

Glu Ala Leu Ser Asp Asp Glu Arg Lys Leu Leu Phe Glu Glu Leu Asn
    450                 455                 460

Leu Arg Gly Asn Leu Ser Gln Lys Glu Val Leu Gln Ile Leu Gly Leu
465                 470                 475                 480

Lys Asp Lys Glu Tyr Lys Thr Asn Phe Pro Glu Gly Leu Glu Gly Asn
               485                 490                 495

Arg Thr Asn Ala Ala Leu Phe Asn Ile Tyr Gln Gln Ile Ala Glu Asn
            500                 505                 510

Glu Gly Tyr Gly Asp Trp Thr Lys Lys Ser Ala Gln Glu Ile Lys Glu
        515                 520                 525

Glu Leu Lys Ala Val Phe Pro Gln Ile Gly Ile Gln Ala Asp Ile Leu
    530                 535                 540

Asp Phe Asn Ala Glu Leu Asp Gly Lys Glu Phe Glu Asn Gln Ala Ser
545                 550                 555                 560

Tyr Gln Leu Trp His Leu Leu Tyr Ser Ala Glu Glu Asp Asp Lys Ile
               565                 570                 575

Asn Glu Glu Asp Gln Ile Ile Tyr Gly Asn Ser Ala Val Ser Leu Lys
            580                 585                 590

Lys Lys Leu Cys Glu Lys Phe Gly Phe Thr Pro Glu Tyr Ala Lys Trp
```

```
        595                 600                 605

Ile Ala Asn Val Ser Leu Gln Asp Asp Tyr Gly Asn Leu Ser Thr Lys
    610                 615                 620

Ala Met Arg Lys Ile Ile Pro Tyr Leu Ile Asp Gly Asn Asp Tyr Ser
625                 630                 635                 640

Glu Ala Cys Ala Leu Ala Gly Tyr Asn His Ser Asn Ser Leu Thr Lys
                645                 650                 655

Glu Glu Asn Asp Asn Arg Glu Arg Leu Asn Lys Leu Glu Leu Leu Pro
            660                 665                 670

Lys Asn Ser Leu Arg Asn Pro Val Val Glu Lys Ile Leu Asn Gln Met
        675                 680                 685

Val Asn Val Val Asn Gln Val Ile Glu Thr Tyr Gly Lys Pro Asp Glu
    690                 695                 700

Val Arg Ile Glu Leu Ala Arg Glu Leu Lys Lys Ser Ala Glu Glu Arg
705                 710                 715                 720

Ala Glu Met Thr Lys Gly Ile Asn Glu Ala Thr Arg Arg Asn Glu Asp
                725                 730                 735

Ile Lys Lys Leu Ile Thr Lys Asn Phe Gly Ile Pro Asn Pro Thr Lys
            740                 745                 750

Asn Asp Val Val Arg Tyr Arg Leu Trp Glu Glu Leu Ala Pro Leu Ala
        755                 760                 765

Tyr Lys Asp Val Phe Thr Gly Arg Gln Ile Lys Lys Glu Asp Leu Phe
    770                 775                 780

Ser Ser Lys Ile Asp Ile Glu His Ile Ile Pro Lys Ala Leu Leu Phe
785                 790                 795                 800
```

```
Asp Asp Ser Phe Ser Asn Lys Thr Leu Ala Phe Arg Glu Thr Asn Leu
               805                 810                 815

Lys Lys Ala Asp Arg Thr Ala Tyr Gly Phe Ile Glu Ser Asp Tyr Asn
            820                 825                 830

Ala Thr Leu Asp Asp Tyr Ile Gln Arg Val Glu Thr Leu Tyr Asn Asn
        835                 840                 845

Ala Lys Gly Thr Ile Ser Lys Gly Lys Arg Asn Lys Leu Leu Met Ala
    850                 855                 860

Gln Lys Asn Leu Pro Asp Gly Phe Ile Glu Arg Asp Leu Arg Asn Ser
865                 870                 875                 880

Gln Tyr Ile Ala Lys Lys Ala Lys Ser Met Ile Glu Lys Val Phe Asn
               885                 890                 895

Asp Val Asn Val Thr Ser Gly Ser Ile Thr Asp Arg Leu Arg Glu Asp
            900                 905                 910

Trp Asp Leu Ile Asn Val Met Lys Glu Leu Asn Phe Pro Lys Tyr Lys
        915                 920                 925

Ala Leu Gly Leu Thr Glu Ile Glu Glu Arg Tyr Asp Ile Gly Gln Glu
    930                 935                 940

Lys Thr Lys Lys Val Glu Val Ile Thr Asp Trp Thr Lys Arg Asn Asp
945                 950                 955                 960

His Arg His His Ala Met Asp Ala Leu Thr Val Ala Phe Thr Thr Lys
               965                 970                 975

Ser His Val Gln Tyr Leu Asn Asn Leu Asn Thr Ile His Ser Leu Lys
            980                 985                 990

Gly Asp Glu Val Asp Leu Glu Leu  Ser Lys Leu Tyr Gly  Leu Lys Asn
```

995 1000 1005

Thr Ile Thr Glu Val Val Asn Lys Lys Arg Lys Phe Ile Pro Pro
1010 1015 1020

Met Pro Asn Phe Arg Glu Glu Ala Lys Lys His Ile Glu Thr Ile
1025 1030 1035

Leu Val Ser Ile Lys Asn Lys Asn Lys Val Tyr Thr Lys Asn Ile
1040 1045 1050

Asn Lys Thr Lys Lys Glu Ser Gly Tyr His Thr Lys Glu Gln Leu
1055 1060 1065

Thr Pro Arg Gly Gln Leu His Lys Glu Thr Val Tyr Gly Lys Ser
1070 1075 1080

Lys Arg Pro Met Asn Lys Pro Thr Lys Ile Asn Lys Asn Phe Ser
1085 1090 1095

Leu Glu Gln Ala Gln Leu Ile Ile Asn Val Gln Glu Lys Glu Leu
1100 1105 1110

Val Leu Arg His Leu Ala Gln Phe Asp Asn Asn Pro Ala Val Ala
1115 1120 1125

Phe Asp Thr Lys Thr Leu Lys Lys Met Pro Leu Leu Lys Asn Gly
1130 1135 1140

Glu Pro Leu Lys Glu Val Leu Cys Phe Glu Glu Ile Phe Thr Ile
1145 1150 1155

Arg Lys Asp Ile Thr Pro Asp Leu Lys Ile Glu Lys Val Val Asp
1160 1165 1170

Glu Lys Ile Lys Ala Ile Leu Glu Gln Arg Lys Lys Asp Phe Gly
1175 1180 1185

```
Gly Asn  Ala Lys Glu Ala Phe  Ser Asp Leu Asp Lys  Asn Pro Ile
    1190                1195                1200

Trp Leu  Asn Lys Glu Lys Gly  Ile Cys Ile Lys Arg  Val Thr Ile
    1205                1210                1215

Thr Gly  Val Ser Asn Ala Glu  Ala Leu His His Gln  Lys Asp His
    1220                1225                1230

Leu Gly  Arg Glu Ile Leu Asp  Asp Asn Gly Asn Pro  Ile Pro Ala
    1235                1240                1245

Asp Phe  Val Ser Thr Gly Asn  Asn His His Val Ala  Ile Tyr Glu
    1250                1255                1260

Asp Glu  Lys Gly Lys Leu Gln  Glu Lys Val Val Ser  Leu Tyr Glu
    1265                1270                1275

Ala Val  Ala Arg Ala Asn Gln  Gly Leu Pro Val Val  Asp Lys Gly
    1280                1285                1290

Leu Asn  Glu Asp Leu Gly Trp  Lys Phe Leu Phe Thr  Met Lys Gln
    1295                1300                1305

Asn Glu  Met Phe Val Phe Pro  Asn Asp Asp Phe Asp  Val Asn Asp
    1310                1315                1320

Ile Asp  Leu Leu Asp Glu Asn  Asn Ala Lys Ile Ile  Ser Gln His
    1325                1330                1335

Leu Phe  Arg Val Gln Lys Leu  Ala Thr Lys Asn Tyr  Met Phe Arg
    1340                1345                1350

His His  Leu Glu Thr Asn Val  Gln Glu Val Lys Glu  Leu Asn Asp
    1355                1360                1365

Ile Ala  Tyr Lys Ser Ile Arg  Ser Thr Glu Pro Leu  Lys Asn Ile
```

1370 1375 1380

Lys Lys Val Arg Ile Asn His Ile Gly Lys Ile Val Gln Val Gly
1385 1390 1395

Glu Tyr
1400

<210> 631
<211> 1128
<212> PRT
<213> Roseburia intestinalis

<400> 631

Met Asp Glu Lys Met Asp Tyr Arg Ile Gly Leu Asp Ile Gly Ile Ala
1 5 10 15

Ser Val Gly Trp Ala Val Leu Gln Asn Asn Ser Asp Asp Glu Pro Val
20 25 30

Arg Ile Val Asp Leu Gly Val Arg Ile Phe Asp Thr Ala Glu Ile Pro
35 40 45

Lys Thr Gly Glu Ser Leu Ala Gly Pro Arg Arg Ala Ala Arg Thr Thr
50 55 60

Arg Arg Arg Leu Arg Arg Arg Lys His Arg Leu Asp Arg Ile Lys Trp
65 70 75 80

Leu Phe Glu Asn Gln Gly Leu Ile Asn Ile Asp Asp Phe Leu Lys Arg
85 90 95

Tyr Asn Met Ala Gly Leu Pro Asp Val Tyr Gln Leu Arg Tyr Glu Ala
100 105 110

Leu Asp Arg Lys Leu Thr Asp Glu Glu Leu Ala Gln Val Leu Leu His
115 120 125

```
Ile Ala Lys His Arg Gly Phe Arg Ser Thr Arg Lys Ala Glu Thr Ala
    130                 135                 140

Ala Lys Glu Asn Gly Ala Val Leu Lys Ala Thr Asp Glu Asn Gln Lys
145                 150                 155                 160

Arg Met Gln Glu Lys Gly Tyr Arg Thr Val Gly Glu Met Ile Tyr Leu
                165                 170                 175

Asp Glu Ala Phe Arg Ile Gly Cys Ser Trp Ser Glu Lys Gly Tyr Ile
            180                 185                 190

Leu Thr Pro Arg Asn Lys Ala Glu Asn Tyr Gln His Thr Met Leu Arg
        195                 200                 205

Ala Met Leu Val Glu Glu Val Lys Glu Ile Phe Ser Ser Gln Arg Arg
    210                 215                 220

Leu Gly Asn Lys Lys Ala Thr Glu Glu Leu Glu Glu Lys Tyr Leu Glu
225                 230                 235                 240

Ile Met Thr Ser Gln Arg Ser Phe Asp Leu Gly Pro Gly Met Gln Pro
                245                 250                 255

Asp Gly Lys Pro Ser Pro Tyr Ala Met Glu Gly Phe Ser Asp Arg Val
            260                 265                 270

Gly Lys Cys Thr Phe Leu Gly Asp Gln Gly Glu Leu Arg Gly Ala Lys
        275                 280                 285

Gly Thr Tyr Thr Ala Glu Tyr Phe Val Ala Leu Gln Lys Ile Asn His
    290                 295                 300

Thr Lys Leu Val Asn Gln Asp Gly Glu Thr Arg Asn Phe Thr Glu Glu
305                 310                 315                 320

Glu Arg Arg Ala Leu Thr Leu Leu Leu Phe Thr Gln Lys Glu Val Lys
                325                 330                 335
```

```
Tyr Ala Ala Val Arg Lys Lys Leu Gly Leu Pro Glu Asp Ile Leu Phe
            340                 345                 350

Tyr Asn Leu Asn Tyr Lys Lys Ala Ala Thr Lys Glu Glu Gln Gln Lys
        355                 360                 365

Glu Asn Gln Asn Thr Glu Lys Ala Lys Phe Ile Gly Met Pro Tyr Tyr
    370                 375                 380

His Asp Tyr Lys Lys Cys Leu Glu Glu Arg Val Lys Tyr Leu Thr Glu
385                 390                 395                 400

Asn Glu Val Arg Asp Leu Phe Asp Glu Ile Gly Met Ile Leu Thr Cys
                405                 410                 415

Tyr Lys Asn Asp Asp Ser Arg Thr Glu Arg Leu Ala Lys Leu Gly Leu
            420                 425                 430

Val Pro Ile Glu Met Glu Gly Leu Leu Ala Tyr Thr Pro Thr Lys Phe
        435                 440                 445

Gln His Leu Ser Met Lys Ala Met Arg Asn Ile Ile Pro Phe Leu Glu
    450                 455                 460

Lys Gly Met Thr Tyr Asp Lys Ala Cys Glu Glu Ala Gly Tyr Asp Phe
465                 470                 475                 480

Lys Ala Asp Ser Lys Gly Thr Lys Gln Lys Leu Leu Thr Gly Glu Asn
                485                 490                 495

Val Asn Gln Thr Ile Asn Glu Ile Thr Asn Pro Val Val Lys Arg Ser
            500                 505                 510

Val Ser Gln Thr Val Lys Val Ile Asn Ala Ile Ile Arg Thr Tyr Gly
        515                 520                 525
```

```
Ser Pro Gln Ala Ile Asn Ile Glu Leu Ala Arg Glu Met Ser Lys Thr
    530                 535                 540

Phe Glu Glu Arg Arg Lys Ile Lys Gly Asp Met Glu Lys Arg Gln Lys
545                 550                 555                 560

Asn Asn Glu Asp Val Lys Lys Gln Ile Gln Glu Leu Gly Lys Leu Ser
                565                 570                 575

Pro Thr Gly Gln Asp Ile Leu Lys Tyr Arg Leu Trp Gln Glu Gln Gln
            580                 585                 590

Gly Ile Cys Met Tyr Ser Gly Lys Thr Ile Pro Leu Glu Glu Leu Phe
        595                 600                 605

Lys Pro Gly Tyr Asp Ile Asp His Ile Leu Pro Tyr Ser Ile Thr Phe
    610                 615                 620

Asp Asp Ser Phe Arg Asn Lys Val Leu Val Thr Ser Gln Glu Asn Arg
625                 630                 635                 640

Gln Lys Gly Asn Arg Thr Pro Tyr Glu Tyr Met Gly Asn Asp Glu Gln
                645                 650                 655

Arg Trp Asn Glu Phe Glu Thr Arg Val Lys Thr Thr Ile Arg Asp Tyr
            660                 665                 670

Lys Lys Gln Gln Lys Leu Leu Lys Lys His Phe Ser Glu Glu Glu Arg
        675                 680                 685

Ser Glu Phe Lys Glu Arg Asn Leu Thr Asp Thr Lys Tyr Ile Thr Thr
    690                 695                 700

Val Ile Tyr Asn Met Ile Arg Gln Asn Leu Glu Met Ala Pro Leu Asn
705                 710                 715                 720

Arg Pro Glu Lys Lys Lys Gln Val Arg Ala Val Asn Gly Ala Ile Thr
                725                 730                 735
```

```
Ala Tyr Leu Arg Lys Arg Trp Gly Leu Pro Gln Lys Asn Arg Glu Thr
            740                 745                 750

Asp Thr His His Ala Met Asp Ala Val Val Ile Ala Cys Cys Thr Asp
        755                 760                 765

Gly Met Ile Gln Lys Ile Ser Arg Tyr Thr Lys Val Arg Glu Arg Cys
    770                 775                 780

Tyr Ser Lys Gly Thr Glu Phe Val Asp Ala Glu Thr Gly Glu Ile Phe
785                 790                 795                 800

Arg Pro Glu Asp Tyr Ser Arg Ala Glu Trp Asp Glu Ile Phe Gly Val
                805                 810                 815

His Ile Pro Lys Pro Trp Glu Thr Phe Arg Ala Glu Leu Asp Val Arg
            820                 825                 830

Met Gly Asp Asp Pro Lys Gly Phe Leu Asp Thr His Ser Asp Val Ala
        835                 840                 845

Leu Glu Leu Asp Tyr Pro Glu Tyr Ile Tyr Glu Asn Leu Arg Pro Ile
    850                 855                 860

Phe Val Ser Arg Met Pro Asn His Lys Val Thr Gly Ala Ala His Ala
865                 870                 875                 880

Asp Thr Ile Arg Ser Pro Arg His Phe Lys Asp Glu Gly Ile Val Leu
                885                 890                 895

Thr Lys Thr Ala Leu Thr Asp Leu Lys Leu Asp Lys Asp Gly Glu Ile
            900                 905                 910

Asp Gly Tyr Tyr Asn Pro Gln Ser Asp Leu Leu Leu Tyr Glu Ala Leu
        915                 920                 925
```

```
Lys Lys Gln Leu Leu Leu Tyr Gly Asn Asp Ala Lys Lys Ala Phe Ala
    930                 935                 940

Gln Asp Phe His Lys Pro Lys Ala Asp Gly Thr Glu Gly Pro Val Val
945                 950                 955                 960

Arg Lys Val Lys Ile Gln Lys Lys Gln Thr Met Gly Val Phe Val Asp
                965                 970                 975

Ser Gly Asn Gly Ile Ala Glu Asn Gly Gly Met Val Arg Ile Asp Val
            980                 985                 990

Phe Arg Val Asn Gly Lys Tyr Tyr  Phe Val Pro Val Tyr  Thr Ala Asp
        995                 1000                1005

Val Val  Lys Lys Val Leu Pro  Asn Arg Ala Ser Thr  Ala Asn Lys
    1010                1015                1020

Pro Tyr  Ser Glu Trp Arg Thr  Met Glu Asp Lys Asp  Phe Leu Phe
    1025                1030                1035

Ser Leu  Tyr Ser Arg Asp Leu  Val His Ile Lys Ser  Lys Lys Gly
    1040                1045                1050

Ile Pro  Ile Lys Asn Val Asp  Gly Ser Leu Gly Glu  Ser Lys Glu
    1055                1060                1065

Val Tyr  Ala Tyr Tyr Ile Gly  Ala Asp Ile Ser Gly  Ala Lys Ile
    1070                1075                1080

Glu Gly  Lys Ala His Asp Ser  Arg Tyr Thr Phe Arg  Gly Ile Gly
    1085                1090                1095

Val Gln  Lys Leu Glu Leu Ile  Glu Lys Cys Gln Val  Asp Ile Leu
    1100                1105                1110

Gly His  Ile Ser Thr Val Lys  Asn Glu Lys Arg Met  Gly Phe Ser
    1115                1120                1125
```

<210> 632
<211> 1471
<212> PRT
<213> Scardovia wiggsiae

<400> 632

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Met Gly Tyr Lys Ala Pro Arg Asn Asp Lys Gly Glu Ile Asp Tyr Gly
1               5                  10                  15


Val Gly Leu Asp Leu Gly Asn Gly Ser Val Gly Trp Val Ala Met Asp
            20                  25                  30


Lys Asp Tyr His Leu Ile Arg Ala Arg Gly His Glu Leu Ile Gly Ala
        35                  40                  45


Arg Leu Phe Asp Pro Ala Asn Ser Ala Glu Asn Arg Arg Glu Ser Arg
    50                  55                  60


Thr Thr Arg Arg Arg Leu Ser Arg Arg Arg Trp Arg Leu Arg Met Leu
65                  70                  75                  80


Asp Ser Leu Phe Ala Ser Glu Leu Ala Lys Ile Asp Pro Asn Phe Leu
                85                  90                  95


Ala Arg Arg Lys Tyr Ser Trp Val His Pro Lys Asp Glu Gln Asn His
            100                 105                 110


Glu Asn Trp Tyr Gly Ser Ile Ile Phe Gly Ser Lys Glu Gln Asp Lys
        115                 120                 125


Gln Phe Tyr Lys Asp Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu
    130                 135                 140


Thr Glu Asp Thr Glu Arg His Asp Ile Arg Glu Ile Tyr Val Ala Ile
145                 150                 155                 160


His His Ile Val Lys Tyr Arg Gly His Phe Leu Arg Glu Gly Glu Ile
```

```
                165                 170                 175

Asn Ser Glu Asn Leu Phe Asp Pro Glu Gly Phe Val Glu Leu Ile Lys
            180                 185                 190

Asp Val Ile Lys Leu Asn Asn Ser Tyr Asp Glu Ser Thr Pro Ile Phe
        195                 200                 205

Glu Ala Ser Pro Ala Asp Val Ser Glu Ala Leu Leu Asn Glu His Thr
    210                 215                 220

Ser Arg Ser Gly Arg Ile Glu Asp Thr Leu Asp Lys Leu Asp Phe Ser
225                 230                 235                 240

Val Ser Arg Val Asp Lys His Glu Leu Lys Gly Met Arg Asp Ala Ala
                245                 250                 255

Lys Ala Val Ile Gly Ala Ile Val Gly Asn Thr Ala Asp Phe Ser Lys
            260                 265                 270

Ile Phe Asn Leu Asp Asn Leu Asp Lys Asp Ser Lys Asp Asn Leu Lys
        275                 280                 285

Leu Lys Phe Ala Asp Ser Asn Phe Asp Glu Lys Tyr Gly Gly Val Val
    290                 295                 300

Gly Ser Gly Leu Leu Asp Glu Thr Gln Ile Glu Leu Val Asp Arg Ile
305                 310                 315                 320

His Ala Val Tyr Asp Ala Val Ala Leu Lys Gly Ile Leu Gly Asp Ala
                325                 330                 335

His Thr Ile Ser Glu Ala Lys Val Glu Ser Tyr Glu Lys His Arg Lys
            340                 345                 350

Asn Trp Lys Leu Ile Lys Glu Glu Leu Arg Thr Lys Glu Asn Lys Asp
        355                 360                 365
```

```
Glu Val Asp Leu Trp Tyr Gly Asp Leu Ser Gly Arg Gln Tyr Lys Asn
    370                 375                 380

Pro Pro Asp Pro Glu Lys Gly Pro Asp Glu Gly Ser Lys Lys Asp Ser
385                 390                 395                 400

Pro Ile Arg Asp Ser Asp Gln Lys Gln Asn Leu Ile Lys Lys Ala Asn
                405                 410                 415

Asp Tyr Phe Thr Glu Leu Ile Asp Asp Ser Gln Leu Ser Glu Glu Gln
            420                 425                 430

Lys Asn Cys Leu Lys Asn Asp Ile Asn Asn Gly Gln Leu Phe Pro Val
        435                 440                 445

Gln Arg Ser Ser Asp Asn Gly Val Ile Pro Tyr Gln Ile His Leu Asn
    450                 455                 460

Glu Leu Arg Arg Ile Ile Glu Asn Gln Lys Gln Tyr Tyr Pro Phe Leu
465                 470                 475                 480

Ala Glu Thr Phe Ile Arg Lys Thr Ala Glu Gly Lys Ser Tyr Glu Glu
                485                 490                 495

Asn Lys Ile Val Ala Leu Leu Lys Phe Arg Val Pro Tyr Tyr Val Gly
            500                 505                 510

Pro Leu Val Ser Lys Glu Asp Met Glu Glu His Ser Ser Gly Asn Ser
        515                 520                 525

Ala Tyr His Trp Met Ala Arg Asn Pro Gly Arg Gly Glu Ala Ile Thr
    530                 535                 540

Pro Trp Asn Phe Asp Glu Val Val Asp Lys Asp Glu Ser Gly Ala Arg
545                 550                 555                 560

Phe Ile Ser Arg Leu Thr Gly Thr Asp Thr Tyr Leu Leu Gly Glu Pro
```

```
                565                 570                 575

Thr Leu Pro Gln His Ser Leu Leu Tyr Glu Glu Tyr Met Val Leu Ser
            580                 585                 590

Glu Leu Asn Asn Val Arg Leu Asn Val Arg Gln Gly Asn His Trp Ser
        595                 600                 605

Asp Lys Asn Arg Gln Arg Leu Ser Tyr Lys Gln Lys Glu Phe Leu Ile
    610                 615                 620

Glu Asn Leu Phe Lys Glu His Lys Thr Val Thr Arg Lys Arg Ala Glu
625                 630                 635                 640

Asp Cys Leu Ser Ser Met Gly Cys Gly Glu Val Gln Leu Phe Gly Leu
                645                 650                 655

Ser Asp Glu Lys Lys Phe Ala Ser Ser Leu Ser Ser Tyr Ile Thr Leu
            660                 665                 670

Lys Lys Ile Leu Gly Lys Ala Phe Val Asp Asp Ser Gly Asn Ser Ala
        675                 680                 685

Ile Leu Glu Arg Ile Ile Glu Val Gln Thr Val Phe Glu Asp Arg Glu
    690                 695                 700

Pro Leu Thr His Gln Leu Ser Leu Ile Asp Ser Leu Thr Val Glu Gln
705                 710                 715                 720

Arg Lys Gln Leu Ala Lys Ile His Tyr Thr Gly Trp Gly Lys Leu Ser
                725                 730                 735

Arg Lys Leu Leu Thr Ser Lys Lys Gly Ser Tyr Lys Ile His Ser Gln
            740                 745                 750

Asn Glu Ile Met Arg Thr Gln His Ser Ile Ile Asp Ile Met Arg Gly
        755                 760                 765
```

```
Asp Ser Leu Asn Leu Ile Glu Ile Ile Arg Asp Lys Lys Ile Gly Ile
    770                 775                 780

Gly Glu Trp Ile Asp Asn Glu Asn Leu Asp Arg Glu Thr Gly Glu Ser
785                 790                 795                 800

Asp Val Ser Arg Leu Glu Ser Val Phe Glu Gly Ile Val Met Ser Pro
                805                 810                 815

Arg Val Lys Arg Gly Val Val Gln Ala Val Arg Val Ile Asp Asp Leu
            820                 825                 830

Ala Lys Ala Ile Gly Asn Pro Pro Gln Arg Ile Phe Ile Glu Met Ala
        835                 840                 845

Asp Glu Val Gln Ala Ser Gln Arg Thr Val Ser Arg Leu Ser Arg Leu
    850                 855                 860

Lys Ala Leu Tyr Gly Ser Pro Ser Leu Gln Lys Glu Phe Asn Asp Leu
865                 870                 875                 880

Lys Asp Leu Arg Lys Ser Leu Asn Glu Thr Lys Asp Ala Asp Leu Gln
                885                 890                 895

Glu Asp Arg Leu Tyr Leu Tyr Tyr Ile Gln Leu Gly Lys Asp Leu Tyr
            900                 905                 910

Thr Gly Lys Glu Ile Ser Ile Asp Ser Leu Ser Ser Ala Tyr Asp Ile
        915                 920                 925

Asp His Ile Val Pro Gln Ala Leu Thr Gln Asp Asp Ser Ile Asp Asn
    930                 935                 940

Arg Val Leu Val Ser Arg Lys Glu Asn Ala Arg Lys Thr Asp Ser Tyr
945                 950                 955                 960

Leu Tyr Thr Pro Asp Leu Ile Lys Asn Met Arg Pro Leu Trp Gly Lys
```

```
               965                 970                 975

Leu Leu Ala Ala Gly Leu Met Ser Gln Lys Lys Tyr Asp Ala Leu Thr
            980                 985                 990

Arg Val Asp Asp Phe Lys Asp Arg  Glu Lys Gln Arg Phe  Val Gln Arg
        995                 1000                1005

Ser Leu  Val Glu Thr Arg Gln  Ile Met Lys Asn Val  Ser Thr Ile
    1010                1015                1020

Leu Arg  Thr Tyr Tyr Gly Glu  Asp Thr Asn Val Val  Thr Leu Lys
    1025                1030                1035

Ser Ser  Ile Thr His Asp Met  Arg Lys Tyr Leu Gly  Phe Pro Tyr
    1040                1045                1050

Lys Asn  Arg Asp Ile Asn Asp  Tyr His His Ala Gln  Asp Ala Leu
    1055                1060                1065

Cys Ile  Ser Ala Ala Gly Gln  Phe Met Leu Asn Arg  His Phe Val
    1070                1075                1080

Ser Gly  Gly Glu Val Thr Asp  Gly Ala Ser Asn Ala  Tyr Asn Met
    1085                1090                1095

Tyr Leu  Ala Glu Tyr Leu Gln  Glu Phe Arg Asp Ala  Lys Ala Arg
    1100                1105                1110

Gly Glu  Arg Lys Arg Ser Thr  Ala Phe Gly Phe Val  Val Gly Ser
    1115                1120                1125

Met Ser  Ser Lys Asp Asp Glu  Lys Arg Thr Asp His  Arg Thr Gly
    1130                1135                1140

Glu Ile  Val Trp Ser Glu Thr  Asn Ala Glu Tyr Leu  Arg Lys Val
    1145                1150                1155
```

```
Met Asn  Tyr Lys Lys Met Leu  Ile Thr Gln Lys Val  Gly Asp Val
    1160                1165                1170

Lys Thr  Arg Ala Leu Tyr Asp  Glu Thr Arg Tyr Gly  His Lys Glu
    1175                1180                1185

Ser Ser  Ala Lys Ser Ile Lys  Phe Asp Asn Leu Arg  Arg Asp Thr
    1190                1195                1200

Ser Leu  Tyr Gly Gly Phe Ser  Gly Ala Ser Thr Ala  Tyr Met Met
    1205                1210                1215

Leu Val  Glu Tyr Lys Lys Lys  Asn Lys Leu Val Ser  Ile Thr Ala
    1220                1225                1230

Gln Glu  Ala Ser Leu Leu Ala  Val Ala Asp Gln Lys  Asn Asp Thr
    1235                1240                1245

Val Ser  Val Met Asp Gly Ile  Leu Ala Ser His Gly  Leu Ser Gly
    1250                1255                1260

Ala Lys  Ile Leu Leu Pro Lys  Ile Val Thr Gly Gln  Leu Leu Asp
    1265                1270                1275

Tyr Ser  Asp Ala Leu Val Thr  Leu Gln Ser Ala Ser  Glu Leu Asn
    1280                1285                1290

Thr Ala  Arg Gln Met Trp Leu  Pro Arg Asn Asp Tyr  Asn Asp Ile
    1295                1300                1305

Asp Ile  Ile Leu Lys Ser Lys  Asp Ile Glu Asp Ala  Ala His Lys
    1310                1315                1320

Leu Gly  Tyr Asp Ser Asp Thr  Val His Val Leu Arg  Arg Ile Gln
    1325                1330                1335

Lys Leu  Phe Glu Ala Val Phe  Arg Val Ala Glu Ser  Gln Phe Pro
```

```
    1340                1345                1350

Leu His  Gln Leu Ser Lys Asp  Gln Gln Glu Glu Ile  Leu Arg Asp
    1355                1360                1365

Pro Gln  Asn Tyr Gly Phe Gly  Ser Ala Val Lys Leu  Leu Gly Gly
    1370                1375                1380

Leu Leu  Lys Ala Leu His Ala  Asn Ala Glu Asn Thr  Asn Leu Ala
    1385                1390                1395

Gly Leu  Val Lys Val Leu His  Gly Asp Lys Glu Tyr  Ser Asp Asp
    1400                1405                1410

Gly Lys  Ala Lys Glu Phe Lys  Lys Phe Gly Phe Ser  Pro Arg Trp
    1415                1420                1425

Arg Arg  Ile Ser Asn Pro Thr  Gly Phe Thr Leu Ser  Asp Ser Asp
    1430                1435                1440

Thr Phe  Ile Tyr Gln Ser Pro  Ser Gly Ile Phe Glu  Gln Arg Val
    1445                1450                1455

Thr Val  Lys Glu Leu Lys Glu  Lys Ala Asp Lys Gln  Lys
    1460                1465                1470
```

<210> 633
<211> 116
<212> PRT
<213> Sphingobacterium spiritivorum

<400> 633

```
Met Phe Arg Lys Tyr Phe Glu Glu Lys Asn Ser Ala Arg Leu Leu Phe
1               5                   10                  15

Thr Leu Lys Gln Gly Asp Phe Val Tyr Val Pro Asp Asp Asn Glu Glu
            20                  25                  30
```

```
Val Ile Leu Asp Glu Ser Ser Pro Leu Phe Ile Asp Tyr Trp Lys Asn
        35                  40                  45

Ile Ser Glu Arg Ser Asn Asn Ile His Val Val Gln Lys Phe Ser Gly
    50                  55                  60

Lys Glu Ile Tyr Phe Leu Lys His Thr Ile Ala Asp Thr Ile Ala Lys
65                  70                  75                  80

Lys Ile Glu Phe Gly Ser Gln Asp Cys Tyr Gln Ser Leu Asn Gly Lys
                85                  90                  95

Ser Ile Lys Glu Phe Cys Ile Lys Ile Asp Ser Asp Arg Leu Gly Asn
            100                 105                 110

Ile Ser Lys Val
        115
```

<210> 634
<211> 1306
<212> PRT
<213> Sphingobacterium spiritivorum

<400> 634

```
Met Lys His Ile Leu Gly Leu Asp Leu Gly Thr Asn Ser Ile Gly Trp
1               5                   10                  15

Ala Leu Ile Lys Gln Asn Phe Glu Asn Lys Gln Gly Glu Ile Leu Gly
            20                  25                  30

Met Gly Ser Arg Ile Ile Pro Met Gly Ala Glu Leu Ser Lys Phe Glu
        35                  40                  45

Gln Gly Gln Ala Gln Thr Lys Asn Ala Asn Arg Arg Ile Ala Arg Gly
    50                  55                  60

Thr Arg Lys Leu Asn Lys Arg Tyr Lys Gln Arg Arg Asn Lys Leu Ile
65                  70                  75                  80
```

```
Tyr Ile Leu Gln Gly Leu Gly Met Leu Pro Asp Gln Ile Lys Leu Val
                85                  90                  95

Asn Gln Phe Ser Asp Pro Asn Lys Leu Asp Lys Ile Ser Ile Leu Pro
            100                 105                 110

Ile Ser Lys Asn Gln Gln Gln Leu Thr Ala Phe Asp Leu Leu Glu Leu
        115                 120                 125

Arg Val Lys Ala Leu Thr Glu Lys Ile Glu Leu Glu Glu Leu Gly Lys
    130                 135                 140

Val Ile Tyr Lys Tyr Asn Gln Leu Arg Gly Tyr Ser Gly Gly Asn Ser
145                 150                 155                 160

Glu Pro Glu Lys Glu Glu Asn Asn Glu Asp Glu Ser Glu Glu Asn Glu
                165                 170                 175

Lys Thr Asn Asp Ser Phe Val Val Phe Ser Lys Val Leu Ser Leu Gly
            180                 185                 190

Leu Pro Glu Glu Ile Thr Phe Lys Gly Lys Lys Leu Ser Lys Arg Lys
        195                 200                 205

Ile Ala Ile Glu Thr Glu Asp Gly Ile Ile Glu Ala Glu Thr Phe Leu
    210                 215                 220

Asp Ser Leu Lys Glu Asn Asp Ser Leu Glu Leu His Val Asn Ile Arg
225                 230                 235                 240

Arg Ala Lys Ser Gly Asp Thr Ile Thr Ile Lys Leu Pro Ser Lys Thr
                245                 250                 255

Ser Trp Arg Lys Lys Met Glu Asn Ile Glu Lys Gln Leu Ala Asp Lys
            260                 265                 270

Ser Lys Glu Leu Gly Arg Glu Tyr Phe Ile Ser Glu Leu Leu Phe Asp
```

```
        275                 280                 285

Ile Leu Lys Glu Asn Lys Trp Ala Lys Ile Arg Asn Asn Val Ile Leu
    290                 295                 300

Arg Ser Arg Tyr Glu Ser Glu Phe Asp Ala Val Trp Ser Glu Gln Ser
305                 310                 315                 320

Lys Tyr Tyr Pro Ile Leu Asn His Leu Glu Thr Asp Arg Leu Gln Lys
                325                 330                 335

Ile Leu Glu Phe Ile Phe Pro Gly Gln Lys Glu Ser Gln Glu Lys Leu
            340                 345                 350

Arg Gln Thr Gly Leu Lys Glu Gly Leu Lys Tyr Val Ile Lys Asn Gln
        355                 360                 365

Val Val Phe Tyr Gln Arg Glu Leu Lys Asp Gln Ser Asp Leu Ile Ser
    370                 375                 380

Asn Cys Arg Tyr Glu Pro Thr Glu Lys Val Val Ala Lys Ser His Pro
385                 390                 395                 400

Val Phe Gln Glu Tyr Lys Ile Trp Glu Gln Ile Asn Lys Leu Val Ile
                405                 410                 415

Asn Thr Lys Ile Glu Asn Gly Val Asn Arg Lys Gly Glu Ile Arg Tyr
            420                 425                 430

Lys Tyr Ile Asp Lys Pro Ile Pro Val Ala Leu Lys Glu Trp Leu Tyr
        435                 440                 445

Glu Glu Leu Gln Ser Lys Lys Glu Val Ser Phe Asn Pro Ile Leu Thr
    450                 455                 460

Lys Leu Lys Lys Glu Phe Lys Leu Arg Glu Asn Val Asp Phe Leu Asn
465                 470                 475                 480
```

```
Gly Met Asn Ala Lys Asp Lys Leu Lys Gly Asn Glu Thr Lys Val Ile
                485                 490                 495

Leu Gln Lys Ala Leu Gly Glu Leu Trp Asn Ile Phe Gly Leu Asp Asp
            500                 505                 510

Ser Glu Arg Gln Val Glu Leu Trp Glu Ile Leu Tyr Asn Gly Lys Gly
        515                 520                 525

Asn Glu Tyr Asp Leu Thr Ser Glu Arg Thr Ser Asn Ile Leu Ala Phe
    530                 535                 540

Ile Glu Lys Tyr Ser Pro Asp Leu Glu Asn Lys Asn Asp Val Ala Ile
545                 550                 555                 560

Lys Ile Ser Lys Ile Lys Phe Ser Arg Asn Tyr Ser Asn Leu Ser Leu
                565                 570                 575

Lys Ala Ile Asp Asn Ile Leu Pro Leu Val Arg Ala Gly Lys Phe Phe
            580                 585                 590

Asp Gln Asn Phe Ser Glu Ala Leu Ser His Lys Ile Val Lys Leu Leu
        595                 600                 605

Asn Glu Asn Val Glu Asp Pro Phe Glu Lys Ser Ala Gln Glu Phe Leu
    610                 615                 620

Asp Lys Asn Gln Asp Val Leu Ser Asp Gly Gly Ile Val Asn Ala Ile
625                 630                 635                 640

Ala Thr Ile Leu Val Tyr Asp Lys His Thr Ala Lys Glu Tyr Ser Gly
                645                 650                 655

Asp Glu Leu Ile Lys Glu Phe Thr Gln Ile Ser Arg Leu Lys Gln Gly
            660                 665                 670

Glu Leu Arg Asn Pro Leu Ala Glu Gln Ile Ile Asn Glu Ala Leu Val
```

```
        675                 680                 685

Ile Val Arg Asp Ile Trp Arg Lys Tyr Gly Phe Lys Pro Asp Glu Ile
    690                 695                 700

Arg Val Glu Leu Ala Arg Glu Leu Lys Asn Asn Ala Val Glu Arg Gly
705                 710                 715                 720

Lys Met Tyr Ser Ala Asn Leu Lys Ser Gln Lys His Asn Ala Glu Ile
                725                 730                 735

Arg Asn Lys Leu Ile Glu Leu Lys Gln Glu Ile Ser Ile Ala Asn Ile
            740                 745                 750

Glu Lys Tyr Lys Leu Trp Val Ser Gln Glu Asn Leu Gln Glu Val Tyr
        755                 760                 765

Leu Lys Asn Tyr Asn Asp Pro Ser Lys Ser Glu Ile Glu Lys Leu Lys
    770                 775                 780

Leu Trp Glu Ser Gln Gly His Ile Ser Pro Tyr Thr Gly Gln Pro Ile
785                 790                 795                 800

Ser Leu Ser Glu Leu Phe Asn Arg Glu Arg Tyr Asp Val Asp His Ile
                805                 810                 815

Ile Pro Gln Ser Arg Tyr Phe Asp Asp Ser Leu Ser Asn Lys Val Ile
            820                 825                 830

Cys Glu Lys Ser Ile Asn Asn Glu Lys Gly Asn Arg Thr Ser Met Glu
        835                 840                 845

Tyr Phe Glu Val Gly Ser Val Asn Tyr Arg Ile Phe Thr Lys Asp Gln
    850                 855                 860

Phe Ile Asp His Ala Asn Lys Tyr Phe Ser Gly Lys Lys Arg Lys Asn
865                 870                 875                 880
```

```
Leu Leu Ala Thr Ser Ile Pro Glu Asp Pro Ile Gln Arg Gln Ile Lys
               885                 890                 895

Asp Thr Gln Tyr Ile Ser Ile Arg Ile Arg Glu Glu Leu Asn Lys Ile
            900                 905                 910

Val Gly Asn Glu Asn Val Lys Thr Thr Thr Gly Gly Ile Thr Asp Tyr
        915                 920                 925

Leu Arg Asn His Trp Gly Leu Thr Asp Lys Phe Lys Val Leu Leu Lys
    930                 935                 940

Glu Arg Tyr Glu Ala Val Leu Pro Lys Ile Ala Gln Leu Glu Tyr Asp
945                 950                 955                 960

Asn Tyr Lys Lys Glu Thr Glu Lys Lys Phe Thr Glu Tyr Lys Asn Ala
               965                 970                 975

Asp Val Glu Phe Asn Glu Pro Ile Leu Asp Glu Glu Ile Phe Ile Glu
            980                 985                 990

Lys Phe Arg Ser Glu Phe Ile Arg  Lys Lys Asn Asn Lys  Leu Ile Ile
        995                 1000                1005

Lys Gly  Trp Ser Lys Arg Ile  Asp His Arg His His  Ala Met Asp
    1010                1015                1020

Ala Leu  Val Ile Ala Cys Thr  Gln Pro Ala His Ile  Lys Arg Leu
    1025                1030                1035

Asn Asp  Leu Asn Gln Val Leu  Lys Glu Trp Leu Asp  Lys Asn Lys
    1040                1045                1050

Glu Lys  Phe Phe Pro Gly Phe  Ser Gly Thr Lys Thr  Glu Leu Leu
    1055                1060                1065

Asp Glu  Val Leu Asn Leu Glu  Glu Glu Lys Arg Arg  Glu Ile Phe
```

```
    1070                1075                1080

Asn Gln  Leu Glu Lys Phe Arg  Ala Ile Glu Met Pro  Trp Lys Gly
    1085                1090                1095

Phe Pro  Glu Glu Ala Glu Gln  Lys Leu Lys Glu Val  Ile Val Ser
    1100                1105                1110

His Lys  Pro Lys Asp Lys Leu  Leu Leu Gln Tyr Asp  Ile Gln Gly
    1115                1120                1125

Asn Lys  Gln Ile Lys Leu Arg  Gly Gln Leu His Glu  Gly Thr Leu
    1130                1135                1140

Tyr Gly  Leu Ser Asn Gly Lys  Glu Ile Tyr Arg Ile  Pro Ile Asn
    1145                1150                1155

Lys Leu  Ala Gly Lys Gln Phe  Ala Thr Glu Lys Thr  Ile Glu Lys
    1160                1165                1170

Ile Val  Asn Pro Phe Leu Lys  Asn Val Ile Glu Glu  His Leu Lys
    1175                1180                1185

Ser Phe  Gly Lys Lys Glu Glu  Ala Phe Ser Ala Glu  Gly Ile Leu
    1190                1195                1200

Asp Leu  Asn Lys Lys Leu Ala  Glu Arg Lys Asp Glu  Gln Gln Asn
    1205                1210                1215

Pro Lys  Pro His Pro Pro Ile  Ser Thr Ile Lys Ile  Tyr Tyr Lys
    1220                1225                1230

Asp Pro  Ser Lys Ser Lys Lys  Lys Lys Thr Asp Asp  Glu Asp Asp
    1235                1240                1245

Ile Ser  Leu Gln Lys Leu Asn  Arg Lys Lys Ser Phe  Asn Asp Ser
    1250                1255                1260
```

```
Leu Tyr  Val Lys Thr Gly Asp  Asn Tyr Leu Phe Ala  Val Met Glu
    1265                1270                1275


Lys Glu  Val Phe Asn Lys Lys  Leu Asn Lys Asp Lys  Thr Glu Arg
    1280                1285                1290


His Tyr  Asp Leu Lys Leu Phe  Leu Thr Leu Leu Ile  Phe
    1295                1300                1305


<210>  635
<211>  1110
<212>  PRT
<213>  Sphingobium sp.

<400>  635

Met Ala Glu Gly Lys Lys Arg Ile Trp Arg Leu Gly Ala Asp Leu Gly
1               5                   10                  15


Ala Asn Ser Leu Gly Trp Ala Ala Ile Glu Leu Ser Ala Pro Val Asn
            20                  25                  30


Gly Lys Pro Ile Ala Ile Leu Ala Ala Gly Ser Arg Ile Phe Ser Asp
        35                  40                  45


Gly Arg Asp Pro Lys Ser Gly Ala Ser Leu Ala Val Asp Arg Arg Asp
    50                  55                  60


Ala Arg Ala Met Arg Arg Arg Arg Asp Arg Phe Lys Gln Arg Gln Lys
65                  70                  75                  80


Ala Leu Ile Lys Tyr Leu Ile Ala Asp Gly Leu Phe Pro Ala Asp Glu
                85                  90                  95


Ala Ala Arg Asn Ala Met Ala Ala Ile Asp Pro Tyr Ala Val Arg Ala
            100                 105                 110


Arg Ala Leu Asp Glu Ala Leu Ser Leu Pro Glu Leu Gly Arg Ala Leu
        115                 120                 125
```

```
Phe His Leu Asn Gln Arg Arg Gly Phe Lys Ser Asn Arg Lys Ala Asp
    130                 135                 140

Arg Lys Ala Asp Asp Asp Ala Gly Lys Ile Ala Ile Gly Ile Asp Arg
145                 150                 155                 160

Thr Arg Asp Ala Ile Ala Glu Asp Glu Ala Asp Ala Gly Ala Glu Pro
                165                 170                 175

Gly Ser Trp Thr Phe Gly Lys Trp Leu His Glu Arg Arg Leu Lys Gly
            180                 185                 190

Gln Ser Val Arg Thr Arg Leu Arg Pro Glu Ser Gly Glu Asp Ala Lys
        195                 200                 205

Gly Asp Gly Tyr Asp Phe Tyr Pro Asp Arg Ala Leu Met Glu Glu Glu
    210                 215                 220

Phe Asp Ala Ile Trp Ala Ala Gln Ala Pro His His Pro Asp Val Leu
225                 230                 235                 240

Thr Asn Asp Val His Asp Arg Leu His Glu Ile Ile Phe Tyr Gln Arg
                245                 250                 255

Pro Leu Lys Ala Pro Gln Val Gly Met Cys Ser Leu Ile Pro Gly Asp
            260                 265                 270

Arg Arg Leu Pro Lys Ala His Pro Leu Phe Gln Arg Arg Arg Leu Leu
        275                 280                 285

Glu Glu Leu Asn Ala Leu Met Ile Val Arg Pro Gly Glu Val Ala Gln
    290                 295                 300

Arg Leu Thr Arg Glu Glu Arg Asp Ile Leu Leu Leu Lys Leu Lys Asp
305                 310                 315                 320
```

```
Lys Asn Lys Val Ser Phe Ala Thr Leu Arg Lys Ala Leu Lys Leu Asp
                325                 330                 335

Pro Asp Ala Arg Phe Asn Lys Glu Ser Glu Asp Arg Thr Asp Leu Lys
            340                 345                 350

Gly Asp Glu Val Ala Ala Val Met Gly Ser Lys Thr Arg Phe Gly Asn
        355                 360                 365

Leu Trp Val His Leu Ser Ile Glu Ala Gln Trp Asp Val Leu Ala Arg
    370                 375                 380

Leu Asp Ala Val Glu Ser Asp Ala Glu Asp Ala Ala Phe Cys Ala Trp
385                 390                 395                 400

Leu Val Glu Thr Tyr Ala Leu Thr Pro Glu Gln Ala Arg Ala Val Ala
                405                 410                 415

Asn Ala Pro Leu Pro Pro Gly Tyr Gly Arg Phe Gly Glu Thr Ala Thr
            420                 425                 430

Arg Lys Leu Ile Glu Ala Leu Arg Asp Gly Lys Lys Asp Asp Arg Val
        435                 440                 445

Leu Val Tyr Ser Glu Ala Val Thr Glu Ala Gly Leu Gly His His Ser
    450                 455                 460

Asp Arg Arg Thr Gly Glu Val Phe Glu Asp Ala Lys Gly Arg Pro Gln
465                 470                 475                 480

Leu Pro Tyr Tyr Gly Val Ala Leu Glu Arg His Ile Met Pro Gly Thr
                485                 490                 495

Gly Asp Pro Ser Asp Pro Glu Glu Met Arg Val Gly Arg Leu Thr Asn
            500                 505                 510

Pro Thr Val His Ile Gly Leu Asn Gln Leu Arg Arg Ile Leu Asn Val
        515                 520                 525
```

```
Leu Ile Arg Ala Tyr Gly Pro Pro Ala Glu Ile Ala Ile Glu Leu Ala
    530                 535                 540

Arg Glu Leu Lys Leu Thr Asp Glu Asp Lys Lys Arg Ile Asn Arg Glu
545                 550                 555                 560

Asn Asn Asp Asn Arg Ile Ala Ala Glu Arg Arg Ser Glu Lys Leu Leu
                565                 570                 575

Ala Ile Gly Gln Ala Asp Ser Gly Ala Asn Arg Ala Leu Leu Lys Leu
            580                 585                 590

Trp Glu Glu Leu Asn Pro Ala Asn Val Leu Asp Arg Arg Cys Ile Tyr
        595                 600                 605

Ser Gly Arg Gln Ile Ser Ile Asp Met Leu Phe Ser Ala Ala Val Glu
    610                 615                 620

Val Asp His Ile Leu Pro Phe Ala Ala Thr Leu Asp Asp Ser Asn Gly
625                 630                 635                 640

Asn Lys Ile Val Cys Leu Arg Glu Ala Asn Arg Glu Lys Arg Lys Arg
                645                 650                 655

Ser Pro His Asp Ala Trp Gly His Ser Ala Arg Trp Asp Glu Ile Ala
            660                 665                 670

Ala Arg Ala Ala Gln Leu Pro Arg Asn Lys Arg Trp Arg Phe Glu Pro
        675                 680                 685

Asp Ala Met Asp Lys Phe Arg Asp Glu Gly Gly Phe Gln Ala Arg His
    690                 695                 700

Leu Val Asp Thr Gln Tyr Leu Ala Arg Leu Ser Arg Glu Tyr Leu Ala
705                 710                 715                 720
```

```
Thr Leu Tyr Pro Glu Lys Gly Glu Gly Ser Gly His Ile Trp Val Ser
                725                 730                 735

Pro Gly Arg Leu Thr Glu Met Val Arg Arg Lys Leu Gly Leu Asn Asp
            740                 745                 750

Leu Leu Pro Asp His Asn Phe Gly Gly Gly Ala Asp Gln Ala Lys Asn
        755                 760                 765

Arg Leu Asp His Arg His His Ala Ile Asp Ala Val Val Val Ala Ile
    770                 775                 780

Val Asp Arg Gly Met Leu Asn Ala Ile Ala Arg Ala Ser Gly Gln Glu
785                 790                 795                 800

Gly Ala Glu Gly Arg Glu Arg Ile Ile Ile Pro Glu Pro Trp Asp Gly
                805                 810                 815

Phe Arg Asp Ala Leu Arg Glu Thr Val Asn Arg Ile Thr Val Ser His
            820                 825                 830

Arg Thr Asp His Gly Thr Ala Ser Lys Ala Gly Leu Pro Lys Gly Lys
        835                 840                 845

Asp Ala Thr Ala Gly Arg Leu His Asn Asp Thr Ala Tyr Gly Phe Thr
    850                 855                 860

Gly Asp Thr Asp Ala Lys Gly Asn Ser Ile Val Val Arg Arg Val Pro
865                 870                 875                 880

Leu Ser Ser Phe Lys Lys Leu Ala Asp Leu Asp Arg Ile Arg Asp Ala
                885                 890                 895

Asp Leu Lys Ala Ala Leu Tyr Gln His Leu Asn Gly Leu Glu Gly Lys
            900                 905                 910

Ala Phe Glu Lys Ala Leu Ala Glu Phe His Lys Leu Glu Trp His Asn
        915                 920                 925
```

```
Phe Gly Gly Val Arg Arg Val Arg Val Thr Glu Pro Leu Thr Val Ile
    930                 935                 940

Pro Ile Lys Asp Arg Asn Gly Arg Ile Tyr Lys Gly Tyr Lys Gly Asp
945                 950                 955                 960

Ser Asn Tyr Arg Tyr Asp Val Trp Glu Leu Pro Asp Gly Lys Trp Val
                965                 970                 975

Thr Asn Trp Lys Asn Glu Ala Gly Glu Ala Met Ser Ser Val Ile Ser
            980                 985                 990

Met Phe Asp Ala His Gln Ser Ser  Glu Pro Pro Arg Pro  His Pro Ala
        995                 1000                1005

Ala Arg  Lys Ile Leu Ser Leu  His Gln Asn Asp Leu  Leu Ala Ile
    1010                1015                1020

Glu Arg  Glu Gly Glu Asp Arg  Lys Leu Met Arg Val  Val Lys Phe
    1025                1030                1035

Gly Gln  Ser Gly Gln Ile Thr  Leu Ala Glu His Gln  Gln Ala Gly
    1040                1045                1050

Asp Leu  Lys Lys Arg Asp Ala  Val Ser Asn Asp Asp  Asp Pro Phe
    1055                1060                1065

Lys Tyr  Phe Ala Pro Thr Ser  Gly Gly Leu Lys Lys  Val Lys Ala
    1070                1075                1080

Arg Gln  Val Arg Ile Asp Glu  Ile Gly Arg Val Leu  Asp Pro Gly
    1085                1090                1095

Phe Pro  Ala Arg Thr Ala Arg  Arg Lys Thr Arg Gly
    1100                1105                1110
```

<210> 636
<211> 1084
<212> PRT
<213> Sporolactobacillus vineae

<400> 636

Met Lys Tyr Ser Ile Gly Leu Asp Ile Gly Ile Ser Ser Val Gly Trp
1 5 10 15

Ser Val Ile Asn Leu Asp Arg Glu Arg Ile Glu Leu Met Gly Ala Arg
20 25 30

Leu Phe Asp Ala Ala Glu Asn Pro Lys Asn Gly Ser Ser Leu Ala Ala
35 40 45

Pro Arg Arg Asp Ala Arg Ser Ala Arg Arg Arg Leu Arg Arg Arg Arg
50 55 60

Tyr Arg Val Gly Arg Val Arg His Phe Ile Ile Asp Arg Gly Leu Val
65 70 75 80

Thr Arg Gly Gln Ala Asp Gln Leu Phe Asp Trp Lys Asp Gly Asp Leu
85 90 95

Asp Ile Trp Leu Val Arg Val Asn Ala Leu Glu Arg Leu Leu Thr Asp
100 105 110

Arg Glu Phe Ala Arg Val Leu Ile His Ile Ala Lys Asn Arg Gly Tyr
115 120 125

Arg Ser Asn Arg Lys Ser Glu Ala Lys Ser Gly Glu Asn Gly Gln Val
130 135 140

Leu Ser Ala Ile Lys Ala Asn Lys Glu Leu Met Glu Glu Lys Gly Tyr
145 150 155 160

Gln Thr Val Ala Glu Met Leu Val Asn Glu Pro Glu Thr Phe Ala Gly
165 170 175

```
Arg Lys Arg Asn Arg Gly Gly Glu Tyr Thr His Val Ile Ala Arg Ser
            180                 185                 190

Glu Leu Glu His Glu Ile Arg Leu Ile Phe Thr Lys Gln Arg Ala Phe
        195                 200                 205

Gly Asn Arg Phe Ala Thr Glu Glu Asn Glu Asn Thr Tyr Val Lys Ile
    210                 215                 220

Trp Ala Ala Gln Arg Pro Val Ala Thr Lys Asp Asp Ile Leu Lys Lys
225                 230                 235                 240

Ile Gly Asp Cys Thr Phe Glu Lys Gly Glu Lys Arg Ala Pro Lys Ala
                245                 250                 255

Ser Tyr Ala Phe Gln Tyr Phe Arg Ala Leu Asp Lys Leu Asn Arg Leu
            260                 265                 270

Arg Ile Leu Ser Val Arg Glu Pro Ser Arg Asn Leu Thr Asp Asp Glu
        275                 280                 285

Arg Asn Leu Ile Val Pro Ala Leu Phe Asn His Asp Lys Gln Lys Tyr
    290                 295                 300

Ser Asp Leu Arg Lys Ile Leu Gln Leu Arg Asp Asp Gln Lys Phe Asn
305                 310                 315                 320

Glu Leu Phe Tyr Asp Pro Gly Lys Ser Leu Lys Glu Asn Glu Asn Lys
                325                 330                 335

Thr Phe Leu Ser Leu Ala Glu Gln Tyr Lys Ile Arg Lys Val Ile Arg
            340                 345                 350

Asp Val Gln Gly Lys Asp Gly Leu Leu Gln Tyr Arg Pro Leu Asp Ile
        355                 360                 365

Asp Thr Ile Ala Tyr Ala Leu Thr Val Phe Lys Asp Asp Gln Asp Thr
```

```
    370                 375                 380

Arg Asp Tyr Leu Ser Asn Thr Phe Val Asn Gly Asn Gly Lys Gln Val
385                 390                 395                 400

Leu Asn Leu Ala Asn Arg Ala Phe Asp Ala Glu Leu Ile Asp Gly Leu
                405                 410                 415

Leu Ser Leu Ser Phe Ala Lys Phe Gly His Leu Ser Leu Lys Ala Leu
            420                 425                 430

His Lys Leu Ile Pro His Met Glu Gln Gly Leu Ser Tyr Tyr Asp Ala
        435                 440                 445

Cys Lys Lys Val Gly Tyr His Asp Asn Glu Gln Val Gly Lys Ser Lys
    450                 455                 460

Gln His Leu Leu Pro Val Ile Pro Ala Asp Glu Ile Arg Asn Pro Val
465                 470                 475                 480

Val Val Arg Ser Leu Ser Gln Thr Arg Lys Val Ile Asn Ala Ile Ile
                485                 490                 495

Lys Arg Tyr Gly Ser Pro Thr Phe Met Tyr Ile Glu Leu Ala Arg Glu
            500                 505                 510

Met Gly Arg Pro Tyr Asn Glu Arg Arg Asp Leu Glu Lys Gln Tyr Asn
        515                 520                 525

Lys Asn Arg Thr Val Asn Asp Ser Ala Ile Glu Gln Ile His Glu Leu
    530                 535                 540

Tyr Pro Glu Ile Gly Ala Pro Arg Gly His Asp Ile Leu Lys Tyr Lys
545                 550                 555                 560

Leu Trp Gln Gln Gln Asp Cys Lys Cys Ala Tyr Ser Leu Glu Lys Ile
                565                 570                 575
```

```
Pro Ala Glu Lys Ile Phe Glu Pro Gly Tyr Ala Glu Val Asp His Ile
            580                 585                 590

Ile Pro Tyr Ser Arg Ser Phe Asp Asp Ser Asn Ser Asn Lys Val Leu
        595                 600                 605

Val Leu Ser Arg Met Asn Gln Glu Lys Lys Asn Arg Thr Pro Tyr Glu
    610                 615                 620

Trp Phe Gly Gly Asp Glu His Arg Trp Asn Lys Phe Glu Ser Tyr Val
625                 630                 635                 640

Asn Ala Leu Lys Val Asn Arg Lys Lys Lys Ser Leu Leu Thr Lys Lys
                645                 650                 655

Asn Met Asp Thr Glu Glu Glu Asp Thr Phe Lys Ser Arg His Leu Asn
            660                 665                 670

Asp Thr Arg Tyr Ile Thr Arg Phe Ile Lys Ser Phe Val Glu Asp Asn
        675                 680                 685

Leu Leu Phe Arg Glu Ile Glu Gly Ala Lys Gln His Val Phe Thr Val
    690                 695                 700

Asn Gly Ala Tyr Thr Ser Leu Met Arg Lys Arg Trp Gly Phe Asn Lys
705                 710                 715                 720

Asn Arg Glu Glu Ser Asp Leu His His Ser Val Asp Ala Val Ile Ile
                725                 730                 735

Ala Val Ser Gln Pro Phe Arg Asn Glu Val Ser Arg Tyr Phe Lys His
            740                 745                 750

Arg Glu Ile Ser Leu Pro Gln Leu Leu Lys Arg Thr Trp Asp Tyr Phe
        755                 760                 765

Pro Glu Pro Trp Glu Gly Phe Val Lys Glu Leu Arg Ala Arg Thr Leu
```

```
    770                 775                 780

Gln Asp Pro Glu Lys Leu Lys Leu Ala Leu Glu Ser Leu Asp Leu Asp
785                 790                 795                 800

Ser Tyr Asp Pro Glu Phe Ile Asp Glu Val Lys Pro Ile Phe Ile Ser
                805                 810                 815

Arg Met Pro Lys Arg Ser Ile Lys Gly Gln Ile His Asp Glu Thr Leu
            820                 825                 830

Arg Arg Asn Arg Gly Lys Thr Lys Asp Gly Phe Val Lys Ile Val Thr
        835                 840                 845

Arg Thr Arg Leu Glu Asn Ile Lys Phe Asp Lys Asn Gly Asp Phe Pro
    850                 855                 860

Met Tyr Gly Arg Glu Ser Asp Pro Lys Thr Tyr Gln Ala Ile Lys Gln
865                 870                 875                 880

Arg Tyr Leu Glu Asn Asn Lys Asp Lys Lys Lys Ala Phe Ile Glu Pro
                885                 890                 895

Leu Tyr Lys Pro Ala Lys Asn Pro Asn Asn Ala Ser Leu Ile Arg Ser
            900                 905                 910

Val Lys Ile Glu Asp Lys Ala Asn Gln Ile Val Pro Leu Arg Asp Glu
        915                 920                 925

Ala Val Ala Tyr Asn Ala Ser Ile Val Arg Thr Glu Val Tyr Arg Asn
    930                 935                 940

Lys Glu Thr Gly Lys Phe Tyr Leu Ala Pro Val Tyr Val Ser Asp Val
945                 950                 955                 960

Phe Ala Gly Arg Glu Pro Arg Arg Phe Ile Arg Ala Asn Val Pro Tyr
                965                 970                 975
```

```
Glu Gln Trp Val Asn Ile Thr Asp Lys Phe Thr Phe Leu Phe Asn Leu
            980                 985                 990


Tyr Pro Asn Asp Val Ile Tyr Ile  Lys Met Lys Lys Val  Lys Thr Thr
        995                 1000                1005


Lys Ser  Asn Ile Asn Lys Thr  Ile Ser Trp Gln Glu  Ser Tyr Phe
    1010                1015                1020


Tyr Phe  Lys Gly Thr Asp Ile  His Thr Gly Ala Ile  Thr Ile Ile
    1025                1030                1035


Asp His  Met Asn Ser Phe Thr  Asp Arg Val Gly Thr  Gln Gly Leu
    1040                1045                1050


Gln Leu  Phe Glu Lys Tyr Gln  Val Asp Pro Leu Gly  Asn Leu Ser
    1055                1060                1065


Arg Val  His Gly Glu Thr Gln  Tyr Gly Val Pro Ala  Leu Ser His
    1070                1075                1080


Ser
```

<210> 637
<211> 475
<212> PRT
<213> Staphylococcus massiliensis

<400> 637

```
Met Gly Gln Asp Tyr Ile Leu Gly Leu Asp Ile Gly Ile Thr Ser Val
1               5                   10                  15


Gly Tyr Gly Leu Ile Asp Tyr His Asp Lys Ser Val Ile Asp Ala Gly
            20                  25                  30


Val Arg Leu Phe Lys Glu Ala Asn Val Glu Asn Asn Glu Gly Arg Arg
        35                  40                  45
```

```
Ser Lys Arg Gly Ser Arg Arg Leu Gln Arg Arg Arg Lys His Arg Leu
    50                  55                  60

Ala Arg Thr Arg Asn Leu Leu Glu Ser Tyr Gln Leu Asn Pro Phe Pro
65                  70                  75                  80

Lys Cys Glu Lys Asn Pro Tyr Glu Ile Arg Val Lys Gly Phe Lys Glu
                85                  90                  95

Val Leu Thr Ser Asp Glu Leu Ser Ala Ala Leu Leu His Leu Ala Lys
            100                 105                 110

Arg Arg Gly Ile Asp Asn Val His Val Thr Asp Thr Glu Ser Asp Ser
        115                 120                 125

Ser Asp Asn Gly Leu Ser Thr Lys Glu Gln Leu Ala Lys Asn Gln Lys
    130                 135                 140

Ala Leu Glu Ser Arg Tyr Val Cys Glu Leu Gln Leu Glu Arg Leu Leu
145                 150                 155                 160

Asn Asp Asn Lys Val Arg Gly Ala Asn Asn Arg Phe Lys Thr Gln Asp
                165                 170                 175

Phe Val Arg Glu Ala Lys Gln Ile Leu Ser Ile Gln Lys Asp His His
            180                 185                 190

Asn Leu Asp Gln Val Phe Ile Asp Lys Tyr Ile Ser Leu Leu Glu Thr
        195                 200                 205

Arg Arg Glu Tyr Tyr Glu Gly Pro Gly Lys Gly Ser Pro Tyr Gly Trp
    210                 215                 220

Asp Gly Asp Ile Lys Lys Trp Tyr Glu Leu Leu Met Gly Arg Cys Thr
225                 230                 235                 240
```

```
Tyr Phe Pro Glu Ser Leu Arg Ser Val Lys Tyr Ala Tyr Ser Ala Asp
                245                 250                 255

Leu Phe Asn Ala Leu Asn Asp Leu Asn Asn Leu Val Ile Val Arg Asp
            260                 265                 270

Glu Asn Asp Lys Leu Thr Tyr Pro Glu Lys Tyr His Ile Val Glu Asn
        275                 280                 285

Val Phe Lys Gln Arg Lys Lys Pro Thr Leu Lys Gln Ile Ala Lys Glu
    290                 295                 300

Ile Asp Val Ala Pro Glu Asp Ile Arg Gly Tyr Arg Val Thr Ala Ser
305                 310                 315                 320

Gly Thr Pro Val Phe Thr Ser Phe Lys Leu Tyr His Asp Ile Lys Ser
                325                 330                 335

Val Thr Ser Asn Asp Lys Val Leu Glu Asp Thr Glu Leu Leu Asp Ala
            340                 345                 350

Ile Ala Glu Val Leu Thr Ile Tyr Gln Ser Pro Ile Glu Val Gln Glu
        355                 360                 365

Lys Leu Glu Ser Leu Asn Val Ile Leu Thr Lys Glu Glu Ile Glu Gly
    370                 375                 380

Ile Ser Lys Leu Thr Gly Tyr Thr Gly Thr His Ala Leu Ser Leu Lys
385                 390                 395                 400

Ala Ile Gln Ile Val Ile Asp Glu Leu Trp Glu Thr Asn Asp Asn Gln
                405                 410                 415

Met Thr Ile Phe Thr Arg Leu Asn Met Lys Pro Gln Lys Val Asp Leu
            420                 425                 430

Ala Lys Ala Asn Lys Ile Pro Thr Ser Leu Val Glu Asp Phe Ile Ile
        435                 440                 445
```

Ser Pro Val Ala Lys Arg Ala Phe Ile Gln Ser Ile Lys Val Ile Asn
    450   455   460

Ala Val Ile Lys Asn Met Val Cys Leu Lys Ile
465   470   475

<210> 638
<211> 581
<212> PRT
<213> Staphylococcus massiliensis

<400> 638

Met Pro Lys Asp Ile Ile Ile Glu Leu Ala Arg Glu Lys Asn Ser Asp
1   5   10   15

Glu Glu Arg Lys Ile Ile Arg Asp Val Gln Lys Arg Asn Gln Gln Thr
            20   25   30

Arg Asp Leu Val Asp Lys Val Ile Lys Glu Thr Gly Lys Thr Lys Ala
        35   40   45

Lys Gly Met Val Glu Lys Leu Ile Leu His Asp Lys Gln Glu Gly Lys
    50   55   60

Cys Leu Tyr Ser Leu Lys Ser Ile Pro Leu Glu Asp Leu Leu Asn Asn
65   70   75   80

Pro His His Tyr Glu Val Asp His Ile Ile Pro Arg Ser Val Ser Tyr
                85   90   95

Asp Asn Ser Met Asn Asn Lys Val Leu Val Leu Gln Glu Glu Asn Ser
            100   105   110

Lys Lys Ser Asn Gln Thr Pro Phe Gln Tyr Phe Asn Ser Ser Asn Thr
        115   120   125

His Ile Thr Phe Lys Gln Phe Lys Gln His Val Leu Asn Leu Ser Lys

```
    130                 135                 140

Thr Lys Asp Arg Ile Thr Lys Lys Lys Lys Glu Tyr Leu Leu Glu Glu
145                 150                 155                 160

Arg Asp Ile Asn Lys Phe Ser Val Gln Lys Glu Phe Ile Asn Arg Asn
                165                 170                 175

Leu Val Asp Thr Arg Tyr Ala Thr Arg Glu Leu Met Thr Leu Leu Arg
            180                 185                 190

Ala Tyr Phe Ser Ala Asn Glu Leu Asp Val Lys Val Lys Ala Ile Asn
        195                 200                 205

Gly Gly Phe Thr Ser Tyr Leu Arg Lys Arg Trp Asp Phe Lys Lys Asp
    210                 215                 220

Arg Asn Ala Gly Tyr Lys His His Ala Glu Asp Ala Leu Ile Ile Ala
225                 230                 235                 240

Asn Val Asp Phe Ile Phe Lys Gln Leu Lys Ala Leu Asp Asn Ala Lys
                245                 250                 255

Lys Val Met Glu Gly Arg Lys Val Gln Val Glu Lys Asp Asn Val Glu
            260                 265                 270

Asp Asn Glu His Tyr Glu Ser Leu Phe Arg Glu Pro Asp Gln Ile Lys
        275                 280                 285

Glu Ile Lys Leu Tyr Asp Asn Tyr Lys Phe Ser His Arg Val Asp Lys
    290                 295                 300

Lys Pro Asn Arg Glu Leu Ile Asn Asp Thr Ile Tyr Ser Thr Arg Lys
305                 310                 315                 320

Val Asp Asn Lys Thr Tyr Thr Ile Gln Thr Val Asn Asn Ile Tyr Asp
                325                 330                 335
```

```
Lys Gln Asn Asp Gln Leu Lys Lys Leu Phe Asn Lys Ser Pro Glu Lys
            340                 345                 350

Phe Leu Met Tyr Lys His Asp Pro Lys Thr Phe Asp Lys Leu Ala Thr
        355                 360                 365

Ile Met Arg Gln Tyr Lys Asn Glu Lys Asn Pro Leu Tyr Lys Phe His
    370                 375                 380

Asp Glu Thr Gly Glu Tyr Leu Thr Lys Tyr Ala Lys Lys Asp Asn Gly
385                 390                 395                 400

Pro Ile Val Lys Ser Leu Lys Tyr Ile Gly Lys Gln Val Asn Ala His
                405                 410                 415

Leu Asp Ile Thr Asn Asp Tyr Glu Asn Ser Asn Asn Lys Val Val Lys
            420                 425                 430

Leu Ser Leu Lys Pro Phe Arg Phe Asp Val Tyr Leu Asp Asp Gly Lys
        435                 440                 445

Tyr Lys Phe Val Thr Val Lys Tyr Leu Asp Ile Ile Lys Lys Asp Thr
    450                 455                 460

Tyr Tyr Val Ile Asp Glu Glu Lys Tyr Lys Leu Ala Leu Gln Gln Lys
465                 470                 475                 480

Lys Ile Ser Glu Asn Ala Lys Phe Ile Gly Ser Phe Tyr Asn Asn Asp
                485                 490                 495

Leu Ile Lys Ile Asn Gly Glu Leu Leu Arg Val Ile Gly Val Asn Asp
            500                 505                 510

Asp Ala Lys Asn Thr Leu Glu Leu Asn Met Ile Asp Ile Ser Tyr Arg
        515                 520                 525

Asp Tyr Val Glu Asn Met Asn Leu Ala Thr Thr Pro Arg Ile Arg Lys
```

```
    530                 535                 540

Asn Ile Gly Lys Ser Ile Thr Ile Leu Glu Lys Tyr Thr Thr Asp Ile
545                 550                 555                 560

Leu Gly Asn Thr Phe Lys Ile Ser Ser Pro Glu Lys Pro Gln Phe Ile
                565                 570                 575

Phe Lys Val Arg Asp
            580
```

<210> 639
<211> 1334
<212> PRT
<213> Staphylococcus pseudintermedius

<400> 639

```
Met Gly Arg Lys Pro Tyr Ile Leu Ser Leu Asp Ile Gly Thr Gly Ser
1               5                   10                  15

Val Gly Tyr Ala Cys Met Asp Lys Gly Phe Asn Val Leu Lys Tyr His
            20                  25                  30

Asp Lys Asp Ala Leu Gly Val Tyr Leu Phe Asp Gly Ala Leu Thr Ala
        35                  40                  45

Gln Glu Arg Arg Gln Phe Arg Thr Ser Arg Arg Arg Lys Asn Arg Arg
    50                  55                  60

Ile Lys Arg Leu Gly Leu Leu Gln Glu Leu Leu Ala Pro Leu Val Gln
65                  70                  75                  80

Asn Pro Asn Phe Tyr Gln Phe Gln Arg Gln Phe Ala Trp Lys Asn Asp
                85                  90                  95

Asn Met Asp Phe Lys Asn Lys Ser Leu Ser Glu Val Leu Ser Phe Leu
            100                 105                 110
```

```
Gly Tyr Glu Ser Lys Lys Tyr Pro Thr Ile Tyr His Leu Gln Glu Ala
        115                 120                 125

Leu Leu Leu Lys Asp Glu Lys Phe Asp Pro Glu Leu Ile Tyr Met Ala
    130                 135                 140

Leu Tyr His Leu Val Lys Tyr Arg Gly His Phe Leu Phe Asp His Leu
145                 150                 155                 160

Lys Ile Glu Asn Leu Thr Asn Asn Asp Asn Met His Asp Phe Val Glu
                165                 170                 175

Leu Ile Glu Thr Tyr Glu Asn Leu Asn Asn Ile Lys Leu Asn Leu Asp
            180                 185                 190

Tyr Glu Lys Thr Lys Val Ile Tyr Glu Ile Leu Lys Asp Asn Glu Met
        195                 200                 205

Thr Lys Asn Asp Arg Ala Lys Arg Val Lys Asn Met Glu Lys Lys Leu
    210                 215                 220

Glu Gln Phe Ser Ile Met Leu Leu Gly Leu Lys Phe Asn Glu Gly Lys
225                 230                 235                 240

Leu Phe Asn His Ala Asp Asn Ala Glu Glu Leu Lys Gly Ala Asn Gln
                245                 250                 255

Ser His Thr Phe Ala Asp Asn Tyr Glu Glu Asn Leu Thr Pro Phe Leu
            260                 265                 270

Thr Val Glu Gln Ser Glu Phe Ile Glu Arg Ala Asn Lys Ile Tyr Leu
        275                 280                 285

Ser Leu Thr Leu Gln Asp Ile Leu Lys Gly Lys Lys Ser Met Ala Met
    290                 295                 300

Ser Lys Val Ala Ala Tyr Asp Lys Phe Arg Asn Glu Leu Lys Gln Val
305                 310                 315                 320
```

```
Lys Asp Ile Val Tyr Lys Ala Asp Ser Thr Arg Thr Gln Phe Lys Lys
               325                 330                 335

Ile Phe Val Ser Ser Lys Lys Ser Leu Lys Gln Tyr Asp Ala Thr Pro
            340                 345                 350

Asn Asp Gln Thr Phe Ser Ser Leu Cys Leu Phe Asp Gln Tyr Leu Ile
        355                 360                 365

Arg Pro Lys Lys Gln Tyr Ser Leu Leu Ile Lys Glu Leu Lys Lys Ile
    370                 375                 380

Ile Pro Gln Asp Ser Glu Leu Tyr Phe Glu Ala Glu Asn Asp Thr Leu
385                 390                 395                 400

Leu Lys Val Leu Asn Thr Thr Asp Asn Ala Ser Ile Pro Met Gln Ile
               405                 410                 415

Asn Leu Tyr Glu Ala Glu Thr Ile Leu Arg Asn Gln Gln Lys Tyr His
            420                 425                 430

Ala Glu Ile Thr Asp Glu Met Ile Glu Lys Val Leu Ser Leu Ile Gln
        435                 440                 445

Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Val Asn Asp His Thr Ala
    450                 455                 460

Ser Lys Phe Gly Trp Met Glu Arg Lys Ser Asn Glu Ser Ile Lys Pro
465                 470                 475                 480

Trp Asn Phe Asp Glu Val Val Asp Arg Ser Lys Ser Ala Thr Gln Phe
               485                 490                 495

Ile Arg Arg Met Thr Asn Lys Cys Ser Tyr Leu Ile Asn Glu Asp Val
            500                 505                 510
```

```
Leu Pro Lys Asn Ser Leu Leu Tyr Gln Glu Met Glu Val Leu Asn Glu
        515                 520                 525

Leu Asn Ala Thr Gln Ile Arg Leu Gln Thr Asp Pro Lys Asn Arg Lys
    530                 535                 540

Tyr Arg Met Met Pro Gln Ile Lys Leu Phe Ala Val Glu His Ile Phe
545                 550                 555                 560

Lys Lys Tyr Lys Thr Val Ser His Ser Lys Phe Leu Glu Ile Met Leu
                565                 570                 575

Asn Ser Asn His Arg Glu Asn Phe Met Asn His Gly Glu Lys Leu Ser
            580                 585                 590

Ile Phe Gly Thr Gln Asp Asp Lys Lys Phe Ala Ser Lys Leu Ser Ser
        595                 600                 605

Tyr Gln Asp Met Thr Lys Ile Phe Gly Asp Ile Glu Gly Lys Arg Ala
    610                 615                 620

Gln Ile Glu Glu Ile Ile Gln Trp Ile Thr Ile Phe Glu Asp Lys Lys
625                 630                 635                 640

Ile Leu Val Gln Lys Leu Lys Glu Cys Tyr Pro Glu Leu Thr Ser Lys
                645                 650                 655

Gln Ile Asn Gln Leu Lys Lys Leu Asn Tyr Ser Gly Trp Gly Arg Leu
            660                 665                 670

Ser Glu Lys Leu Leu Thr His Ala Tyr Gln Gly His Ser Ile Ile Glu
        675                 680                 685

Leu Leu Arg His Ser Asp Glu Asn Phe Met Glu Ile Leu Thr Asn Asp
    690                 695                 700

Val Tyr Gly Phe Gln Asn Phe Ile Lys Glu Glu Asn Gln Val Gln Ser
705                 710                 715                 720
```

```
Asn Lys Ile Gln His Gln Asp Ile Ala Asn Leu Thr Thr Ser Pro Ala
                725                 730                 735

Leu Lys Lys Gly Ile Trp Ser Thr Ile Lys Leu Val Arg Glu Leu Thr
            740                 745                 750

Ser Ile Phe Gly Glu Pro Glu Lys Ile Ile Met Glu Phe Ala Thr Glu
        755                 760                 765

Asp Gln Gln Lys Gly Lys Lys Gln Lys Ser Arg Lys Gln Leu Trp Asp
    770                 775                 780

Asp Asn Ile Lys Lys Asn Lys Leu Lys Ser Val Asp Glu Tyr Lys Tyr
785                 790                 795                 800

Ile Ile Asp Val Ala Asn Lys Leu Asn Asn Glu Gln Leu Gln Gln Glu
                805                 810                 815

Lys Leu Trp Leu Tyr Leu Ser Gln Asn Gly Lys Cys Met Tyr Ser Gly
            820                 825                 830

Gln Ser Ile Asp Leu Asp Ala Leu Leu Ser Pro Asn Ala Thr Lys His
        835                 840                 845

Tyr Glu Val Asp His Ile Phe Pro Arg Ser Phe Ile Lys Asp Asp Ser
    850                 855                 860

Ile Asp Asn Lys Val Leu Val Ile Lys Lys Met Asn Gln Thr Lys Gly
865                 870                 875                 880

Asp Gln Val Pro Leu Gln Phe Ile Gln Gln Pro Tyr Glu Arg Ile Ala
                885                 890                 895

Tyr Trp Lys Ser Leu Asn Lys Ala Gly Leu Ile Ser Asp Ser Lys Leu
            900                 905                 910
```

```
His Lys Leu Met Lys Pro Glu Phe Thr Ala Met Asp Lys Glu Gly Phe
        915                 920                 925


Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Ser Val His Val Arg
    930                 935                 940


Asp Phe Leu Lys Glu Glu Tyr Pro Asn Thr Lys Val Ile Pro Met Lys
945                 950                 955                 960


Ala Lys Met Val Ser Glu Phe Arg Lys Lys Phe Asp Ile Pro Lys Ile
                965                 970                 975


Arg Gln Met Asn Asp Ala His His Ala Ile Asp Ala Tyr Leu Asn Gly
            980                 985                 990


Val Val Tyr His Gly Ala Gln Leu  Ala Tyr Pro Asn Val  Asp Leu Phe
        995                 1000                1005


Asp Phe  Asn Phe Lys Trp Glu  Lys Val Arg Glu Lys  Trp Lys Ala
    1010                1015                1020


Leu Gly  Glu Phe Asn Thr Lys  Gln Lys Ser Arg Glu  Leu Phe Phe
    1025                1030                1035


Phe Lys  Lys Leu Glu Lys Met  Glu Val Ser Gln Gly  Glu Arg Leu
    1040                1045                1050


Ile Ser  Lys Ile Lys Leu Asp  Met Asn His Phe Lys  Ile Asn Tyr
    1055                1060                1065


Ser Arg  Lys Leu Ala Asn Ile  Pro Gln Gln Phe Tyr  Asn Gln Thr
    1070                1075                1080


Ala Val  Ser Pro Lys Thr Ala  Glu Leu Lys Tyr Glu  Ser Asn Lys
    1085                1090                1095


Ser Asn  Glu Val Val Tyr Lys  Gly Leu Thr Pro Tyr  Gln Thr Tyr
    1100                1105                1110
```

```
Val Val  Ala Ile Lys Ser Val  Asn Lys Lys Gly Lys  Glu Lys Met
    1115                1120                1125

Glu Tyr  Gln Met Ile Asp His  Tyr Val Phe Asp Phe  Tyr Lys Phe
    1130                1135                1140

Gln Asn  Gly Asn Glu Lys Glu  Leu Ala Leu Tyr Leu  Ala Gln Arg
    1145                1150                1155

Glu Asn  Lys Asp Glu Val Leu  Asp Ala Gln Ile Val  Tyr Ser Leu
    1160                1165                1170

Asn Lys  Gly Asp Leu Leu Tyr  Ile Asn Asn His Pro  Cys Tyr Phe
    1175                1180                1185

Val Ser  Arg Lys Glu Val Ile  Asn Ala Lys Gln Phe  Glu Leu Thr
    1190                1195                1200

Val Glu  Gln Gln Leu Ser Leu  Tyr Asn Val Met Asn  Asn Lys Glu
    1205                1210                1215

Thr Asn  Val Glu Lys Leu Leu  Ile Glu Tyr Asp Phe  Ile Ala Glu
    1220                1225                1230

Lys Val  Ile Asn Glu Tyr His  His Tyr Leu Asn Ser  Lys Leu Lys
    1235                1240                1245

Glu Lys  Arg Val Arg Thr Phe  Phe Ser Glu Ser Asn  Gln Thr His
    1250                1255                1260

Glu Asp  Phe Ile Lys Ala Leu  Asp Glu Leu Phe Lys  Val Val Thr
    1265                1270                1275

Ala Ser  Ala Thr Arg Ser Asp  Lys Ile Gly Ser Arg  Lys Asn Ser
    1280                1285                1290
```

```
Met Thr  His Arg Ala Phe Leu  Gly Lys Gly Lys Asp  Val Lys Ile
    1295                1300                1305


Ala Tyr  Thr Ser Ile Ser Gly  Leu Lys Thr Thr Lys  Pro Lys Ser
    1310                1315                1320


Leu Phe  Lys Leu Ala Glu Ser  Arg Asn Glu Leu
    1325                1330
```

<210> 640
<211> 1112
<212> PRT
<213> Staphylococcus simulans

<400> 640

```
Met Leu Val Gly Leu Lys Phe Lys Gln Ser Ile Leu Phe Glu Asn Met
1               5                   10                  15


Glu Asn Ala Glu Asp Ile Lys Glu Ser Ala Thr Gly Ser Asp Ala Ile
            20                  25                  30


Ser Leu Ser Asp Asp Tyr Tyr Glu Asn Leu Ser Glu Phe Leu Thr Asp
        35                  40                  45


Glu Gln Leu Asn Phe Ile Glu Ser Ala Asn Thr Phe Phe Met Gly Ile
    50                  55                  60


Met Leu Asp Arg Ile Leu Lys Gly Ala Thr Ser Ile Ser Ala Ala Lys
65                  70                  75                  80


Val Arg Asp Tyr Lys Ile Phe Lys Ser Gln Leu Lys Leu Ile Lys Asp
                85                  90                  95


Ile Val Tyr Gln Asn Lys Tyr Asp Lys Tyr His Glu Phe Phe Val Thr
            100                 105                 110


Ser Lys Glu Asp Met Arg Ala Tyr Gln Glu Asn Pro Asp Ala Lys Asn
        115                 120                 125
```

```
Phe Gly Lys Leu Ser Lys Phe Asp Gln Tyr Leu Ile His Ser Lys Asp
    130                 135                 140

Gln Tyr Ala Lys Leu Met Lys Asp Leu Lys Gly Leu Val Pro Lys Glu
145                 150                 155                 160

Tyr Thr Glu Val Leu Asn Leu Ile Asp Glu Gln Lys Phe Leu Val Val
                165                 170                 175

Gln Asn Thr Thr Asp Asn Ala Ser Ile Pro Tyr Gln Asn Asn Val Phe
            180                 185                 190

Glu Ala Glu Asn Ile Leu Arg Asn Gln Gln Lys Tyr Tyr Pro Glu Ile
        195                 200                 205

Thr Glu Glu Met Ile Gly Lys Val Ile Asn Leu Ile Ser Phe Arg Ile
    210                 215                 220

Pro Tyr Tyr Val Gly Pro Leu Thr Asn Lys Asn Gly Gln Ser Asp Phe
225                 230                 235                 240

Ala Trp Met Ile Arg Lys Ser Asp Glu Gln Thr Leu Pro Trp Asn Phe
                245                 250                 255

Asp Lys Val Ile Asp Lys Ser Lys Ser Ala Glu Lys Phe Ile Arg Arg
            260                 265                 270

Met Thr Ser Lys Cys Thr Tyr Leu Leu Glu Glu Asp Val Leu Pro Lys
        275                 280                 285

His Ser Leu Leu Tyr Gln Glu Met Glu Val Leu Asn Glu Leu Asn Asn
    290                 295                 300

Val Gln Leu Arg Gly Glu Asn Glu Pro Lys His Arg Ile His Arg Leu
305                 310                 315                 320

Asp Pro Lys Val Lys Gln Phe Ile Tyr His Asn Leu Phe Gln Lys Lys
```

```
                325                 330                 335

Lys Asn Val Thr His Lys Asp Leu Ile Thr Leu Leu Gln Asn Ser Glu
            340                 345                 350

His Arg Asn Thr Leu Asn Lys Thr Ser Gly Gln Lys Leu Lys Val Phe
        355                 360                 365

Gly Thr Gln Asn Asp Ser Lys Phe Ala Ser Lys Leu Ser Thr Tyr Asn
    370                 375                 380

Asp Met Lys Ala Ile Leu Gly Ser Val Glu Asn Lys Arg Gln Met Ile
385                 390                 395                 400

Glu Glu Leu Val Leu Trp Ile Thr Ile Phe Glu Asp Lys Ala Ile Leu
                405                 410                 415

Lys Gln Lys Ile Gly Glu Lys Tyr Pro Asn Ile Thr Glu Lys Gln Leu
            420                 425                 430

Asn Gln Ile Val Lys Leu Asn Tyr Ser Gly Trp Gly Arg Leu Ser Glu
        435                 440                 445

Lys Leu Leu Thr Lys Glu Val Asn Gly Arg Ser Leu Ile Asp Leu Met
    450                 455                 460

Tyr Ser Thr Glu Asn Asn Phe Met Glu Ile Ile Thr Asp Lys Thr Leu
465                 470                 475                 480

Gly Phe Asp Cys Phe Ile Lys Asn Ser Asn Lys Val Lys Asn Ala Lys
                485                 490                 495

Ile Ser Tyr Lys Asp Val Ala Glu Leu Arg Thr Ser Pro Ala Leu Lys
            500                 505                 510

Lys Gly Ile Trp Asn Ala Ile Lys Met Val Arg Glu Ile Ser Asn Leu
        515                 520                 525
```

```
Phe Gly Ala Pro Glu Lys Ile Ile Ile Glu Phe Ala Thr Glu Asp Gln
    530                 535                 540

Ala Lys Gly Lys Arg Gln Lys Ser Arg Ser Glu Leu Trp Asp Asp Leu
545                 550                 555                 560

Val Lys Lys Asn Asn Leu Lys Arg Asn Lys Glu Phe Glu Gly Leu Phe
                565                 570                 575

Glu Glu Leu Lys Ala Tyr Pro Asp Leu Asp Phe Ser Asn Pro Lys Leu
            580                 585                 590

Trp Leu Tyr Ile His Gln Asn Gly Lys Cys Met Tyr Thr Lys Lys Pro
        595                 600                 605

Ile Asp Leu Glu Arg Leu Met Ser Asp Thr Asn Asn Gln Leu Tyr Glu
    610                 615                 620

Ile Asp His Ile Leu Pro Arg Thr Phe Val Lys Asp Asp Ser Ile Asn
625                 630                 635                 640

Asn Lys Val Leu Val Ile Gln Ser Ala Asn Gln Lys Lys Ser Gly Asp
                645                 650                 655

Lys Met Pro Leu Glu Ile Phe Asp Asn His Val Leu Val Pro Phe Trp
            660                 665                 670

Lys Met Leu Tyr Glu Asn Asp Leu Ile Ser Ser Ser Lys Leu Ser Lys
        675                 680                 685

Leu Met Lys Lys Glu Phe Asn Asp Leu Asp Lys Glu Gly Phe Ile Gln
    690                 695                 700

Arg Gln Leu Val Glu Thr Arg Gln Ile Ile Ser His Val Ser Asp Phe
705                 710                 715                 720

Leu Thr Glu Glu Tyr Pro Ser Thr Thr Val Val Pro Met Lys Ala Asn
```

```
                725                 730                 735

Val Val Ser Glu Leu Arg Arg Lys Phe Asp Ile Pro Lys Ile Arg Gln
            740                 745                 750

Leu Asn Asp Trp His His Ala Val Asp Ala Tyr Leu Asn Gly Phe Val
        755                 760                 765

Tyr Gln Ala Ala Arg Val Phe Tyr Pro Lys Val Asn Leu Phe Glu Phe
    770                 775                 780

Asn Phe Lys Trp Glu Lys Val Arg Glu Lys Trp Arg Gln Leu Gly Glu
785                 790                 795                 800

Phe Thr Glu Asn Asn Lys Lys Arg Glu Phe Phe Leu Phe Lys Arg Met
                805                 810                 815

Glu Asn Tyr Val Asn Glu Tyr Gly Glu Gly Met Ile Ser Lys Leu Ile
            820                 825                 830

Phe Asp Leu Asp Asn Phe Lys Phe Asn Tyr Ser Arg Lys Val Glu Ser
        835                 840                 845

Thr Glu Ser Ala Phe Tyr Lys Gln Ser Ala Phe Ser Pro Lys Asn Thr
    850                 855                 860

Thr Ala Gln Tyr Asp Ser Asp Lys Asn Lys Thr Ala Ile Tyr Lys Glu
865                 870                 875                 880

Met Lys Asn Lys Arg Gly Ile Val Val Ser Tyr Thr Tyr Val Lys Lys
                885                 890                 895

Asp Gln Glu Leu Ile Gly Tyr Gly Val Phe Asn Glu Thr Val Phe Glu
            900                 905                 910

Tyr Val Asn Asn Ala Asp Val Asp Met Asn Thr Arg Ala Leu Lys Ile
        915                 920                 925
```

```
Val Arg Lys Ala Phe Pro Lys Leu Asp Ile Lys Lys Ala Gln Tyr Leu
    930                 935                 940

Phe Ser Ile Asn Lys Gly Asp Ala Leu Leu Val Asn Gly His Pro Phe
945                 950                 955                 960

Leu Phe Val Ser Ala Tyr Glu Arg Ile Asn Gly Lys Gln Leu Glu Phe
                965                 970                 975

Asp Ile Ala Met Gln Arg Lys Ile Lys Gln Ala Leu Ser Pro Tyr Asn
            980                 985                 990

Asn Met Thr Glu Gln Glu Lys Val  Glu Phe Tyr Asn Gln  Phe Ala Glu
        995                 1000                1005

Lys Val  Ile Glu Glu Phe Arg  Asn Ser Ile Gly Leu  Gln Ser Arg
    1010                1015                1020

Asp Arg  Lys Val Asn Leu Ile  Lys Asn Leu Phe Asn  Asn Thr Glu
    1025                1030                1035

Lys Ser  Asn Asp Ser Met Thr  Gln Ser Ile Leu Glu  Val Leu Lys
    1040                1045                1050

Met Thr  Lys Val Ser Ala Glu  Arg Ser Lys Glu Leu  Lys Ile Arg
    1055                1060                1065

Trp Asn  Gly Gln Thr Pro Asn  Thr Phe Ile Asp Thr  Lys Asn Asn
    1070                1075                1080

Ala Glu  Ile Gln Tyr Lys Ser  Ile Thr Gly Leu Lys  Thr Thr Lys
    1085                1090                1095

Pro Lys  Ser Ile Phe Lys Leu  Ala Glu Ser Lys Asn  Glu Leu
    1100                1105                1110
```

<210> 641

<211> 773
<212> PRT
<213> Streptococcus agalactiae

<400> 641

```
Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110


Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125


His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140


Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175
```

```
Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380
```

```
Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575
```

```
Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln
    770
```

<210> 642
<211> 1370
<212> PRT
<213> Streptococcus agalactiae

<400> 642

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
85 90 95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
100 105 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Asp Tyr
115 120 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
130 135 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145 150 155 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Arg Phe Asp

```
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Ser Phe Glu Asn Asn His Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365
```

```
Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Tyr Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Val
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Gln Leu Leu Asp Phe Leu Ala Lys Glu Phe Glu Glu Phe Arg
```

```
                565                 570                 575

Ile Val Asp Val Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Ile Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Arg Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Ser Asp
        675                 680                 685

Gly Arg Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ser Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765
```

```
Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Glu Asp Gly Val Lys Asn Leu Ala Ser Asp Leu Asn Gly Asp Ile
785                 790                 795                 800

Leu Lys Glu Tyr Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu
                805                 810                 815

Phe Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala
            820                 825                 830

Leu Asp Ile Asp Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Val Pro
        835                 840                 845

Gln Ala Phe Ile Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser
    850                 855                 860

Ser Ala Lys Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Ile Asp Ile
865                 870                 875                 880

Val Lys Ala Arg Lys Ala Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu
                885                 890                 895

Ile Ser Gln Arg Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly
            900                 905                 910

Leu Thr Pro Asp Asp Lys Ala Gly Phe Ile Gln Arg Gln Leu Val Glu
        915                 920                 925

Thr Arg Gln Ile Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe
    930                 935                 940

Asn Asn Lys Val Asp Asp Asn Asn Lys Pro Ile Arg Lys Val Lys Ile
945                 950                 955                 960

Val Thr Leu Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly
```

```
               965                 970                 975

Phe Tyr Lys Ile Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala
            980                 985                 990

Tyr Leu Asn Ala Val Val Ala Lys  Ala Ile Leu Thr Lys  Tyr Pro Gln
        995                 1000                1005

Leu Glu  Pro Glu Phe Val Tyr  Gly Asp Tyr Pro Lys  Tyr Asn Ser
    1010                1015                1020

Tyr Lys  Thr Arg Lys Ser Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser
    1025                1030                1035

Asn Ile  Met Asn Phe Phe Lys  Thr Lys Val Thr Leu  Ala Asp Glu
    1040                1045                1050

Thr Val  Val Val Lys Asp Asp  Ile Glu Val Asn Asn  Glu Thr Gly
    1055                1060                1065

Glu Ile  Ala Trp Asp Lys Lys  Lys His Phe Ala Thr  Val Arg Lys
    1070                1075                1080

Val Leu  Ser Tyr Pro Gln Val  Asn Ile Val Lys Lys  Thr Glu Val
    1085                1090                1095

Gln Thr  Gly Gly Phe Ser Lys  Glu Ser Ile Leu Ala  His Ser Asn
    1100                1105                1110

Ser Asp  Lys Leu Ile Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp
    1115                1120                1125

Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser
    1130                1135                1140

Val Leu  Val Leu Ala Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu
    1145                1150                1155
```

```
Lys Thr  Val Lys Glu Leu Ile  Gly Ile Thr Ile Met  Glu Arg Glu
    1160                1165                1170

Arg Phe  Glu Lys Asn Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr
    1175                1180                1185

Leu Asn  Ile Arg Thr Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser
    1190                1195                1200

Leu Phe  Glu Leu Glu Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala
    1205                1210                1215

Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Tyr
    1220                1225                1230

Met Lys  Phe Leu Tyr Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly
    1235                1240                1245

Lys Pro  Glu Glu Ile Glu Lys  Lys Gln Glu Phe Val  Asn Gln His
    1250                1255                1260

Val Ser  Tyr Phe Asp Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser
    1265                1270                1275

Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys
    1280                1285                1290

Leu Tyr  Ser Asp Asn Lys Asp  Asn Thr Pro Val Asp  Glu Leu Ala
    1295                1300                1305

Lys Asn  Ile Ile Asn Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro
    1310                1315                1320

Ala Ala  Phe Lys Phe Phe Asp  Lys Ser Val Asp Arg  Lys Arg Tyr
    1325                1330                1335

Thr Ser  Thr Lys Glu Val Leu  Asp Ser Thr Leu Ile  His Gln Ser
```

```
    1340                1345                1350

Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly
    1355                1360                1365

Glu Asp
    1370
```

<210> 643
<211> 1370
<212> PRT
<213> Streptococcus agalactiae

<400> 643

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Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Asp Tyr
        115                 120                 125
```

```
His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Arg Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Ser Phe Glu Asn Asn His Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Tyr Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335
```

```
Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Tyr Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525
```

```
Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Val
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Gln Leu Leu Asp Phe Leu Ala Lys Glu Phe Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Ile Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Arg Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Ser Asp
        675                 680                 685

Gly Arg Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ser Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735
```

```
Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Glu Asp Gly Val Lys Asn Leu Ala Ser Asp Leu Asn Gly Asp Ile
785                 790                 795                 800

Leu Lys Glu Tyr Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu
                805                 810                 815

Phe Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala
            820                 825                 830

Leu Asp Ile Asp Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Val Pro
        835                 840                 845

Gln Ala Phe Ile Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser
    850                 855                 860

Ser Ala Lys Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Ile Asp Ile
865                 870                 875                 880

Val Lys Ala Arg Lys Ala Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu
                885                 890                 895

Ile Ser Gln Arg Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly
            900                 905                 910

Leu Thr Pro Asp Asp Lys Ala Gly Phe Ile Gln Arg Gln Leu Val Glu
        915                 920                 925
```

```
Thr Arg Gln Ile Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe
    930                 935                 940

Asn Asn Lys Val Asp Asp Asn Asn Lys Pro Ile Arg Lys Val Lys Ile
945                 950                 955                 960

Val Thr Leu Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly
                965                 970                 975

Phe Tyr Lys Ile Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala
            980                 985                 990

Tyr Leu Asn Ala Val Val Ala Lys  Ala Ile Leu Thr Lys  Tyr Pro Gln
        995                 1000                1005

Leu Glu  Pro Glu Phe Val Tyr  Gly Asp Tyr Pro Lys  Tyr Asn Ser
    1010                1015                1020

Tyr Lys  Thr Arg Lys Ser Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser
    1025                1030                1035

Asn Ile  Met Asn Phe Phe Lys  Thr Lys Val Thr Leu  Ala Asp Glu
    1040                1045                1050

Thr Val  Val Val Lys Asp Asp  Ile Glu Val Asn Asn  Glu Thr Gly
    1055                1060                1065

Glu Ile  Ala Trp Asp Lys Lys  Lys His Phe Ala Thr  Val Arg Lys
    1070                1075                1080

Val Leu  Ser Tyr Pro Gln Val  Asn Ile Val Lys Lys  Thr Glu Val
    1085                1090                1095

Gln Thr  Gly Gly Phe Ser Lys  Glu Ser Ile Leu Ala  His Ser Asn
    1100                1105                1110

Ser Asp  Lys Leu Ile Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp
    1115                1120                1125
```

```
Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser
    1130                1135                1140

Val Leu  Val Leu Ala Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu
    1145                1150                1155

Lys Thr  Val Lys Glu Leu Ile  Gly Ile Thr Ile Met  Glu Arg Glu
    1160                1165                1170

Arg Phe  Glu Lys Asn Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr
    1175                1180                1185

Leu Asn  Ile Arg Thr Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser
    1190                1195                1200

Leu Phe  Glu Leu Glu Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala
    1205                1210                1215

Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Tyr
    1220                1225                1230

Met Lys  Phe Leu Tyr Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly
    1235                1240                1245

Lys Pro  Glu Glu Ile Glu Lys  Lys Gln Glu Phe Val  Asn Gln His
    1250                1255                1260

Ile Ser  Tyr Phe Asp Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser
    1265                1270                1275

Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys
    1280                1285                1290

Leu Tyr  Ser Asp Asn Lys Asp  Asn Thr Pro Val Asp  Glu Leu Ala
    1295                1300                1305
```

```
Lys Asn  Ile Ile Asn Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro
    1310                1315                1320


Ala Ala  Phe Lys Phe Phe Asp  Lys Ser Val Asp Arg  Lys Arg Tyr
    1325                1330                1335


Thr Ser  Thr Lys Glu Val Leu  Asp Ser Thr Leu Ile  His Gln Ser
    1340                1345                1350


Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly
    1355                1360                1365


Glu Asp
    1370
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<213> Streptococcus agalactiae

<400> 644

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Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95
```

```
Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Tyr Tyr
        115                 120                 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Arg Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Arg Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
```

```
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His His Glu Asp Leu Lys His Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Asn Tyr Arg Glu Val Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Ser Gln Glu Ala Phe Tyr Lys Tyr Leu Leu Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Leu Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Arg Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495
```

```
Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Phe Leu Ala Glu Gly Phe Lys Asp Phe Gln Phe Leu Asn Arg Lys
    530                 535                 540

Gln Lys Glu Thr Ile Phe Asn Ser Leu Phe Lys Glu Lys Arg Lys Val
545                 550                 555                 560

Thr Glu Lys Asp Ile Ile Ser Phe Leu Asn Lys Val Asp Gly Tyr Glu
                565                 570                 575

Gly Ile Ala Ile Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser
            580                 585                 590

Thr Tyr His Asp Leu Lys Lys Ile Leu Gly Lys Asp Phe Leu Asp Asn
        595                 600                 605

Thr Asp Asn Glu Leu Ile Leu Glu Asp Ile Ile Gln Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Asp Ile Tyr Lys Asp
625                 630                 635                 640

Phe Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asn Lys
            660                 665                 670

Glu Asn Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Ser Ala
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile Lys Asp Ala Gly Leu Ser Phe Lys
```

```
    690                 695                 700

Pro Ile Ile Asp Lys Ala Arg Thr Gly Ser His Ser Asp Asn Leu Lys
705                 710                 715                 720

Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val Met Gly Tyr
            740                 745                 750

Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Ala Lys Gly Leu Ser Arg Ser Arg Gln Arg Leu Thr Thr Leu Arg Glu
    770                 775                 780

Ser Leu Gly Asn Leu Lys Ser Asn Ile Leu Glu Glu Lys Lys Pro Lys
785                 790                 795                 800

Tyr Val Lys Asp Gln Val Glu Asn His His Leu Ser Asp Asp Arg Leu
                805                 810                 815

Phe Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Asp Asp Glu
            820                 825                 830

Leu Asp Ile Asp Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro
        835                 840                 845

Gln Ala Phe Ile Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser
    850                 855                 860

Ser Ala Lys Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Ile Glu Ile
865                 870                 875                 880

Val Lys Ala Arg Lys Met Phe Trp Lys Asn Leu Leu Asp Ala Lys Leu
                885                 890                 895
```

```
Met Ser Gln Arg Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly
            900                 905                 910

Leu Thr Ser Asp Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu
        915                 920                 925

Thr Arg Gln Ile Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe
    930                 935                 940

Asn Asn Glu Leu Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile
945                 950                 955                 960

Val Thr Leu Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly
                965                 970                 975

Phe Tyr Lys Ile Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala
            980                 985                 990

Tyr Leu Asn Ala Val Val Ala Lys  Ala Ile Leu Thr Lys  Tyr Pro Gln
        995                 1000                1005

Leu Glu  Pro Glu Phe Val Tyr  Gly Leu Tyr Arg Arg  Lys Lys Leu
    1010                1015                1020

Ser Lys  Ile Val Arg Glu Asp  Lys Glu Glu Lys Tyr  Ser Glu Ala
    1025                1030                1035

Thr Arg  Lys Met Phe Phe Tyr  Ser Asn Leu Met Asn  Met Phe Lys
    1040                1045                1050

Arg Val  Val Arg Leu Ala Asp  Gly Ser Ile Val Val  Arg Pro Val
    1055                1060                1065

Ile Glu  Thr Gly Arg Tyr Met  Gly Lys Thr Ala Trp  Asp Lys Lys
    1070                1075                1080

Lys His  Phe Ala Thr Val Arg  Lys Val Leu Ser Tyr  Pro Gln Asn
```

```
    1085                1090                1095

Asn Ile  Val Lys Lys Thr Glu  Ile Gln Thr Gly Gly  Phe Ser Lys
    1100                1105                1110

Glu Ser  Ile Leu Ala His Gly  Asn Ser Asp Lys Leu  Ile Pro Arg
    1115                1120                1125

Lys Thr  Lys Asp Ile Tyr Leu  Asp Pro Lys Lys Tyr  Gly Gly Phe
    1130                1135                1140

Asp Ser  Pro Ile Val Ala Tyr  Ser Val Leu Val Val  Ala Asp Ile
    1145                1150                1155

Lys Lys  Gly Lys Ala Gln Lys  Leu Lys Thr Val Thr  Glu Leu Leu
    1160                1165                1170

Gly Ile  Thr Ile Met Glu Arg  Ser Arg Phe Glu Lys  Asn Thr Ser
    1175                1180                1185

Ala Phe  Leu Glu Ser Lys Gly  Tyr Leu Asn Ile Arg  Asp Asp Lys
    1190                1195                1200

Leu Met  Ile Leu Pro Lys Tyr  Ser Leu Phe Glu Leu  Glu Asn Gly
    1205                1210                1215

Arg Arg  Arg Leu Leu Ala Ser  Ala Gly Glu Leu Gln  Lys Gly Asn
    1220                1225                1230

Glu Leu  Ala Leu Pro Thr Gln  Phe Met Lys Phe Leu  Tyr Leu Ala
    1235                1240                1245

Ser Arg  Tyr Asn Glu Ser Lys  Gly Lys Pro Glu Glu  Ile Glu Lys
    1250                1255                1260

Lys Gln  Glu Phe Val Asn Gln  His Val Ser Tyr Phe  Asp Asp Ile
    1265                1270                1275
```

```
Leu Gln  Leu Ile Asn Asp Phe  Ser Asn Arg Val Ile  Leu Ala Asp
    1280                1285                1290


Ala Asn  Leu Glu Lys Ile Asn  Lys Leu Tyr Gln Asp  Asn Lys Glu
    1295                1300                1305


Asn Ile  Pro Val Asp Glu Leu  Ala Asn Asn Ile Ile  Asn Leu Phe
    1310                1315                1320


Thr Phe  Thr Ser Leu Gly Ala  Pro Ala Ala Phe Lys  Phe Phe Asp
    1325                1330                1335


Lys Ile  Val Asp Arg Lys Arg  Tyr Thr Ser Thr Lys  Glu Val Leu
    1340                1345                1350


Asn Ser  Thr Leu Ile His Gln  Ser Ile Thr Gly Leu  Tyr Glu Thr
    1355                1360                1365


Arg Ile  Asp Leu Gly Lys Leu  Gly Glu Gly
    1370                1375


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<213>  Streptococcus agalactiae

<400>  645

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60
```

```
Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Tyr Tyr
        115                 120                 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Arg Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Arg Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255
```

```
Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Leu Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Arg Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460
```

```
Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Phe Leu Ala Glu Gly Phe Lys Asp Phe Gln Phe Leu Asn Arg Lys
    530                 535                 540

Gln Lys Glu Thr Ile Phe Asn Ser Leu Phe Lys Glu Lys Arg Lys Val
545                 550                 555                 560

Thr Glu Lys Asp Ile Ile Ser Phe Leu Asn Lys Val Asp Gly Tyr Glu
                565                 570                 575

Gly Ile Ala Ile Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser
            580                 585                 590

Thr Tyr His Asp Leu Lys Lys Ile Leu Gly Lys Asp Phe Leu Asp Asn
        595                 600                 605

Thr Asp Asn Glu Leu Ile Leu Glu Asp Ile Val Gln Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Asp Ile Tyr Lys Asp
625                 630                 635                 640

Phe Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg His Tyr Thr
                645                 650                 655
```

```
Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asn Lys
            660                 665                 670

Glu Asn Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Ser Ala
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile Lys Asp Ala Gly Leu Ser Phe Lys
    690                 695                 700

Pro Ile Ile Asp Lys Ala Arg Thr Gly Ser His Ser Asp Asn Leu Lys
705                 710                 715                 720

Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val Met Gly Tyr
            740                 745                 750

Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Ala Lys Gly Leu Ser Arg Leu Arg Gln Arg Leu Thr Thr Leu Arg Glu
    770                 775                 780

Ser Leu Ala Asn Leu Lys Ser Asn Ile Leu Glu Glu Lys Lys Pro Lys
785                 790                 795                 800

Tyr Val Lys Asp Gln Val Glu Asn His His Leu Ser Asp Asp Arg Leu
                805                 810                 815

Phe Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Asp Asp Glu
            820                 825                 830

Leu Asp Ile Asp Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro
        835                 840                 845

Gln Ala Phe Ile Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser
    850                 855                 860
```

```
Ser Ala Lys Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Val Glu Ile
865                 870                 875                 880

Val Lys Asp Cys Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu
                885                 890                 895

Met Ser Gln Arg Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly
            900                 905                 910

Leu Thr Ser Asp Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu
        915                 920                 925

Thr Arg Gln Ile Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe
    930                 935                 940

Asn Asn Glu Leu Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile
945                 950                 955                 960

Val Thr Leu Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly
                965                 970                 975

Phe Tyr Lys Ile Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala
            980                 985                 990

Tyr Leu Asn Ala Val Val Ala Lys  Ala Ile Leu Thr Lys  Tyr Pro Gln
        995                 1000                1005

Leu Glu  Pro Glu Phe Val Tyr  Gly Asp Tyr Pro Lys  Tyr Asn Ser
    1010                1015                1020

Tyr Lys  Thr Arg Lys Ser Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser
    1025                1030                1035

Asn Ile  Met Asn Phe Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly
    1040                1045                1050
```

```
Thr Val  Val Val Lys Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly
    1055                1060                1065

Glu Ile  Val Trp Asp Lys Lys  Lys His Phe Ala Thr  Val Arg Lys
    1070                1075                1080

Val Leu  Ser Tyr Pro Gln Val  Asn Ile Val Lys Lys  Thr Glu Ile
    1085                1090                1095

Gln Thr  Gly Gly Phe Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn
    1100                1105                1110

Ser Asp  Lys Leu Ile Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp
    1115                1120                1125

Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser
    1130                1135                1140

Val Leu  Val Val Ala Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu
    1145                1150                1155

Lys Thr  Val Thr Glu Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser
    1160                1165                1170

Arg Phe  Glu Lys Asn Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr
    1175                1180                1185

Leu Asn  Ile Arg Asp Asp Lys  Leu Met Ile Leu Pro  Lys Tyr Ser
    1190                1195                1200

Leu Phe  Glu Leu Glu Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala
    1205                1210                1215

Asp Glu  Leu Gln Lys Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe
    1220                1225                1230

Met Lys  Phe Leu Tyr Leu Ala  Ser Arg Tyr Asn Glu  Leu Lys Gly
    1235                1240                1245
```

```
Lys Pro  Glu Glu Ile Glu Gln  Lys Gln Glu Phe Val  Val Gln His
    1250                1255                1260


Val Ser  Tyr Phe Asp Asp Ile  Leu Gln Ile Ile Asn  Asp Phe Ser
    1265                1270                1275


Asn Arg  Val Ile Leu Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys
    1280                1285                1290


Leu Tyr  Gln Asp Asn Lys Glu  Asn Ile Pro Val Asp  Glu Leu Ala
    1295                1300                1305


Asn Asn  Ile Ile Asn Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro
    1310                1315                1320


Ala Ala  Phe Lys Phe Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr
    1325                1330                1335


Thr Ser  Thr Lys Glu Val Leu  Asn Ser Thr Leu Ile  His Gln Ser
    1340                1345                1350


Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly
    1355                1360                1365


Glu Asp
    1370


<210>  646
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<212>  PRT
<213>  Streptococcus agalactiae

<400>  646

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
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```
            20                  25                  30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Tyr Tyr
        115                 120                 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Arg Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn His Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220
```

```
Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Val Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His His Glu Asp Leu Lys His Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Asn Tyr Arg Glu Val Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Leu Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Arg Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
```

```
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Phe Leu Ala Glu Gly Phe Lys Asp Phe Gln Phe Leu Asn Arg Lys
    530                 535                 540

Gln Lys Glu Thr Ile Phe Asn Ser Leu Phe Lys Glu Lys Arg Lys Val
545                 550                 555                 560

Thr Glu Lys Asp Ile Ile Ser Phe Leu Asn Lys Val Asp Gly Tyr Glu
                565                 570                 575

Gly Ile Ala Ile Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser
            580                 585                 590

Thr Tyr His Asp Leu Lys Lys Ile Leu Gly Lys Asp Phe Leu Asp Asn
        595                 600                 605

Thr Asp Asn Glu Leu Ile Leu Glu Asp Ile Val Gln Thr Leu Thr Leu
    610                 615                 620
```

```
Phe Glu Asp Arg Glu Met Ile Lys Lys Cys Leu Asp Ile Tyr Lys Asp
625                 630                 635                 640

Phe Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asn Lys
            660                 665                 670

Glu Asn Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Ser Ala
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Asp Leu Ser Phe Lys
    690                 695                 700

Pro Ile Ile Asp Lys Ala Arg Thr Gly Ser His Ser Asp Asn Leu Lys
705                 710                 715                 720

Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val Met Gly Tyr
            740                 745                 750

Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Ala Lys Gly Leu Ser Arg Ser Arg Gln Arg Leu Thr Thr Leu Arg Glu
    770                 775                 780

Ser Leu Ala Asn Leu Lys Ser Asn Ile Leu Glu Glu Lys Lys Pro Lys
785                 790                 795                 800

Tyr Val Lys Asp Gln Val Glu Asn His His Leu Ser Asp Asp Arg Leu
                805                 810                 815

Phe Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Lys Lys Ala
```

```
            820                 825                 830

Leu Asp Ile Asp Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro
        835                 840                 845

Gln Ala Phe Ile Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser
    850                 855                 860

Ser Ala Lys Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Ile Glu Ile
865                 870                 875                 880

Val Lys Ala Arg Lys Met Phe Trp Lys Asn Leu Leu Asp Ala Lys Leu
                885                 890                 895

Met Ser Gln Arg Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly
            900                 905                 910

Leu Thr Ser Asp Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu
        915                 920                 925

Thr Arg Gln Ile Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe
    930                 935                 940

Asn Asn Glu Val Asp Asn Gly Lys Lys Ile Cys Lys Val Lys Ile Val
945                 950                 955                 960

Thr Leu Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe
                965                 970                 975

Tyr Lys Ile Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala Tyr
            980                 985                 990

Leu Asn Ala Val Val Ala Lys Ala  Ile Leu Thr Lys Tyr  Pro Gln Leu
        995                 1000                1005

Glu Pro  Glu Phe Val Tyr Gly  Met Tyr Arg Gln Lys  Lys Leu Ser
    1010                1015                1020
```

```
Lys Ile  Val His Glu Asp Lys  Glu Glu Lys Tyr Ser  Glu Ala Thr
    1025                1030                1035

Arg Lys  Met Phe Phe Tyr Ser  Asn Leu Met Asn Met  Phe Lys Arg
    1040                1045                1050

Val Val  Arg Leu Ala Asp Gly  Ser Ile Val Val Arg  Pro Val Ile
    1055                1060                1065

Glu Thr  Gly Arg Tyr Met Gly  Lys Thr Ala Trp Asp  Lys Lys Lys
    1070                1075                1080

His Phe  Ala Thr Val Arg Lys  Val Leu Ser Tyr Pro  Gln Asn Asn
    1085                1090                1095

Ile Val  Lys Lys Thr Glu Ile  Gln Thr Gly Gly Phe  Ser Lys Glu
    1100                1105                1110

Ser Ile  Leu Ala His Gly Asn  Ser Asp Lys Leu Ile  Pro Arg Lys
    1115                1120                1125

Thr Lys  Asp Ile Tyr Leu Asp  Pro Lys Lys Tyr Gly  Gly Phe Asp
    1130                1135                1140

Ser Pro  Ile Val Ala Tyr Ser  Val Leu Val Val Ala  Asp Ile Lys
    1145                1150                1155

Lys Gly  Lys Ala Gln Lys Leu  Lys Thr Val Thr Glu  Leu Leu Gly
    1160                1165                1170

Ile Thr  Ile Met Glu Arg Ser  Arg Phe Glu Lys Asn  Pro Ser Ala
    1175                1180                1185

Phe Leu  Glu Ser Lys Gly Tyr  Leu Asn Ile Arg Asp  Asp Lys Leu
    1190                1195                1200

Met Ile  Leu Pro Lys Tyr Ser  Leu Phe Glu Leu Glu  Asn Gly Arg
```

```
    1205                1210                1215

Arg Arg  Leu Leu Ala Ser Ala  Gly Glu Leu Gln Lys  Gly Asn Glu
    1220                1225                1230

Leu Ala  Leu Pro Thr Gln Phe  Met Lys Phe Leu Tyr  Leu Ala Ser
    1235                1240                1245

Arg Tyr  Asn Glu Ser Lys Gly  Lys Pro Glu Glu Ile  Glu Lys Lys
    1250                1255                1260

Gln Glu  Phe Val Asn Gln His  Val Ser Tyr Phe Asp  Asp Ile Leu
    1265                1270                1275

Gln Leu  Ile Asn Asp Phe Ser  Lys Arg Val Ile Leu  Ala Asp Ala
    1280                1285                1290

Asn Leu  Glu Lys Ile Asn Lys  Leu Tyr Gln Asp Asn  Lys Glu Asn
    1295                1300                1305

Ile Pro  Val Asp Glu Leu Ala  Asn Asn Ile Ile Asn  Leu Phe Thr
    1310                1315                1320

Phe Thr  Ser Leu Gly Ala Pro  Ala Ala Phe Lys Phe  Phe Asp Lys
    1325                1330                1335

Ile Val  Asp Arg Lys Arg Tyr  Thr Ser Thr Lys Glu  Val Leu Asn
    1340                1345                1350

Ser Thr  Leu Ile His Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg
    1355                1360                1365

Ile Asp  Leu Gly Lys Leu Gly  Glu Asp
    1370                1375
```

<210> 647
<211> 1370
<212> PRT

<213> Streptococcus agalactiae

<220>
<221> misc_feature
<222> (117)..(117)
<223> Xaa can be any naturally occurring amino acid

<400> 647

```
Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Xaa Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160
```

```
Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365
```

```
Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560
```

```
Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765
```

```
Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asp Leu Asn Gly Asn Ile
785                 790                 795                 800

Leu Lys Glu Tyr Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu
                805                 810                 815

Phe Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala
            820                 825                 830

Leu Asp Ile Asp Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro
        835                 840                 845

Gln Ala Phe Ile Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser
    850                 855                 860

Ser Ala Lys Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile
865                 870                 875                 880

Val Lys Asp Cys Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu
                885                 890                 895

Met Ser Gln Arg Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly
            900                 905                 910

Leu Thr Ser Asp Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu
        915                 920                 925

Thr Arg Gln Ile Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe
    930                 935                 940

Asn Asn Glu Leu Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile
945                 950                 955                 960
```

```
Val Thr Leu Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly
                965                 970                 975


Phe Tyr Lys Ile Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala
            980                 985                 990


Tyr Leu Asn Ala Val Val Ala Lys  Ala Ile Leu Thr Lys  Tyr Pro Gln
        995                 1000                1005


Leu Glu  Pro Glu Phe Val Tyr  Gly Asp Tyr Pro Lys  Tyr Asn Ser
    1010                1015                1020


Tyr Lys  Thr Arg Lys Ser Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser
    1025                1030                1035


Asn Ile  Met Asn Phe Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly
    1040                1045                1050


Thr Val  Val Val Lys Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly
    1055                1060                1065


Glu Ile  Val Trp Asp Lys Lys  Lys His Phe Ala Thr  Val Arg Lys
    1070                1075                1080


Val Leu  Ser Tyr Pro Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile
    1085                1090                1095


Gln Thr  Gly Gly Phe Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn
    1100                1105                1110


Ser Asp  Lys Leu Ile Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp
    1115                1120                1125


Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser
    1130                1135                1140


Val Leu  Val Val Ala Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu
    1145                1150                1155
```

```
Lys Thr  Val Thr Glu Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser
    1160                1165                1170

Arg Phe  Glu Lys Asn Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr
    1175                1180                1185

Leu Asn  Ile Arg Ala Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser
    1190                1195                1200

Leu Phe  Glu Leu Glu Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala
    1205                1210                1215

Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe
    1220                1225                1230

Met Lys  Phe Leu Tyr Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly
    1235                1240                1245

Lys Pro  Glu Glu Ile Glu Lys  Lys Gln Glu Phe Val  Asn Gln His
    1250                1255                1260

Val Ser  Tyr Phe Asp Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser
    1265                1270                1275

Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys
    1280                1285                1290

Leu Tyr  Gln Asp Asn Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala
    1295                1300                1305

Asn Asn  Ile Ile Asn Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro
    1310                1315                1320

Ala Ala  Phe Lys Phe Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr
    1325                1330                1335
```

```
Thr Ser  Thr Lys Glu Val Leu  Asn Ser Thr Leu Ile  His Gln Ser
    1340                1345                1350


Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly
    1355                1360                1365


Glu Asp
    1370
```

<210> 648
<211> 1370
<212> PRT
<213> Streptococcus agalactiae

<400> 648

```
Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Tyr Ser Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ser Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Asp Asp Lys Arg
            100                 105                 110


Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Asp Tyr
        115                 120                 125
```

```
His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Arg Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn His Leu Leu Ser Gln Asn Ile Asp
        195                 200                 205

Val Glu Gly Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Val Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
```

```
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Thr Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Gly Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Glu Leu Val Asp Lys Glu Ala Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525
```

```
Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Ser Asp
        675                 680                 685

Gly Arg Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Pro Ile Ile Asp Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
```

```
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Val Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Thr Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Glu Glu Gly Val Lys Asn Leu Ala Ser Asp Leu Asn Gly Asn Ile
785                 790                 795                 800

Leu Lys Glu Tyr Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu
                805                 810                 815

Phe Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala
            820                 825                 830

Leu Asp Ile Asp Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Val Pro
        835                 840                 845

Gln Ala Phe Ile Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser
    850                 855                 860

Ser Ala Lys Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Ile Asp Ile
865                 870                 875                 880

Val Lys Ala Arg Lys Ala Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu
                885                 890                 895

Met Ser Gln Arg Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly
            900                 905                 910

Leu Thr Ser Asp Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu
        915                 920                 925
```

```
Thr Arg Gln Ile Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe
    930                 935                 940

Asn Asn Glu Leu Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile
945                 950                 955                 960

Val Thr Leu Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly
                965                 970                 975

Phe Tyr Lys Ile Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala
            980                 985                 990

Tyr Leu Asn Ala Val Val Ala Lys  Ala Ile Leu Thr Lys  Tyr Pro Gln
        995                 1000                1005

Leu Glu  Pro Glu Phe Val Tyr  Gly Asp Tyr Pro Lys  Tyr Asn Ser
    1010                1015                1020

Tyr Lys  Thr Arg Lys Ser Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser
    1025                1030                1035

Asn Ile  Met Asn Phe Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly
    1040                1045                1050

Thr Val  Val Val Lys Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly
    1055                1060                1065

Glu Ile  Val Trp Asp Lys Lys  Lys His Phe Ala Thr  Val Arg Lys
    1070                1075                1080

Val Leu  Ser Tyr Pro Gln Val  Asn Ile Val Lys Lys  Thr Glu Ile
    1085                1090                1095

Gln Thr  Gly Gly Phe Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn
    1100                1105                1110

Ser Asp  Lys Leu Ile Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp
```

```
    1115                1120                1125

Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser
    1130                1135                1140

Val Leu  Val Val Ala Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu
    1145                1150                1155

Lys Thr  Val Thr Glu Leu Leu  Gly Ile Thr Ile Met  Glu Arg Phe
    1160                1165                1170

Arg Phe  Glu Lys Asn Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr
    1175                1180                1185

Leu Asn  Ile Arg Asp Asp Lys  Leu Met Ile Leu Pro  Lys Tyr Ser
    1190                1195                1200

Leu Phe  Glu Leu Glu Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala
    1205                1210                1215

Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Tyr
    1220                1225                1230

Met Lys  Phe Leu Tyr Leu Ala  Ser Arg Tyr Asn Glu  Leu Lys Gly
    1235                1240                1245

Lys Pro  Glu Glu Ile Glu Gln  Lys Gln Glu Phe Val  Val Gln His
    1250                1255                1260

Val Ser  Tyr Phe Asp Asp Ile  Leu Gln Ile Ile Asn  Asp Phe Ser
    1265                1270                1275

Asn Arg  Val Ile Leu Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys
    1280                1285                1290

Leu Tyr  Gln Asp Asn Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala
    1295                1300                1305
```

```
Asn Asn  Ile Ile Asn Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro
    1310                1315                1320


Ala Ala  Phe Lys Phe Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr
    1325                1330                1335


Thr Ser  Thr Lys Glu Val Leu  Asn Ser Thr Leu Ile  His Gln Ser
    1340                1345                1350


Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly
    1355                1360                1365


Glu Asp
    1370
```

<210> 649
<211> 1370
<212> PRT
<213> Streptococcus agalactiae

<400> 649

```
Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Tyr Ser Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ser Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95
```

```
Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Asp Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asn Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Arg Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn His Leu Leu Ser Gln Asn Ile Asp
        195                 200                 205

Val Glu Gly Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285
```

```
Asp Leu Phe Ser Val Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Thr Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Gly Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Glu Leu Val Asp Lys Glu Ala Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495
```

```
Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Ser Asp
        675                 680                 685
```

```
Gly Arg Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Pro Ile Ile Asp Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Val Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Thr Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Glu Glu Gly Val Lys Asn Leu Ala Ser Asp Leu Asn Gly Asn Ile
785                 790                 795                 800

Leu Lys Glu Tyr Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu
                805                 810                 815

Phe Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala
            820                 825                 830

Leu Asp Ile Asp Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Val Pro
        835                 840                 845

Gln Ala Phe Ile Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser
    850                 855                 860

Ser Ala Lys Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Ile Asp Ile
865                 870                 875                 880

Val Lys Ala Arg Lys Ala Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu
                885                 890                 895
```

```
Met Ser Gln Arg Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly
            900                 905                 910

Leu Thr Ser Asp Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu
        915                 920                 925

Thr Arg Gln Ile Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe
    930                 935                 940

Asn Asn Glu Leu Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile
945                 950                 955                 960

Val Thr Leu Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly
                965                 970                 975

Phe Tyr Lys Ile Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala
            980                 985                 990

Tyr Leu Asn Ala Val Val Ala Lys  Ala Ile Leu Thr Lys  Tyr Pro Gln
        995                 1000                1005

Leu Glu  Pro Glu Phe Val Tyr  Gly Asp Tyr Pro Lys  Tyr Asn Ser
    1010                1015                1020

Tyr Lys  Thr Arg Lys Ser Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser
    1025                1030                1035

Asn Ile  Met Asn Phe Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly
    1040                1045                1050

Thr Val  Val Val Lys Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly
    1055                1060                1065

Glu Ile  Val Trp Asp Lys Lys  Lys His Phe Ala Thr  Val Arg Lys
    1070                1075                1080
```

```
Val Leu  Ser Tyr Pro Gln Val  Asn Ile Val Lys Lys  Thr Glu Ile
    1085                1090                1095

Gln Thr  Gly Gly Phe Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn
    1100                1105                1110

Ser Asp  Lys Leu Ile Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp
    1115                1120                1125

Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser
    1130                1135                1140

Val Leu  Val Val Ala Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu
    1145                1150                1155

Lys Thr  Val Thr Glu Leu Leu  Gly Ile Thr Ile Met  Glu Arg Phe
    1160                1165                1170

Arg Phe  Glu Lys Asn Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr
    1175                1180                1185

Leu Asn  Ile Arg Asp Asp Lys  Leu Met Ile Leu Pro  Lys Tyr Ser
    1190                1195                1200

Leu Phe  Glu Leu Glu Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala
    1205                1210                1215

Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Tyr
    1220                1225                1230

Met Lys  Phe Leu Tyr Leu Ala  Ser Arg Tyr Asn Glu  Leu Lys Gly
    1235                1240                1245

Lys Pro  Glu Glu Ile Glu Gln  Lys Gln Glu Phe Val  Val Gln His
    1250                1255                1260

Val Ser  Tyr Phe Asp Asp Ile  Leu Gln Ile Ile Asn  Asp Phe Ser
    1265                1270                1275
```

```
Asn Arg  Val Ile Leu Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys
    1280                1285                1290


Leu Tyr  Gln Asp Asn Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala
    1295                1300                1305


Asn Asn  Ile Ile Asn Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro
    1310                1315                1320


Ala Ala  Phe Lys Phe Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr
    1325                1330                1335


Thr Ser  Thr Lys Glu Val Leu  Asn Ser Thr Leu Ile  His Gln Ser
    1340                1345                1350


Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly
    1355                1360                1365


Glu Asp
    1370


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<223>  Xaa can be any naturally occurring amino acid

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Met Asn Lys Pro Tyr Ser Ile Gly Xaa Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30
```

```
Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
```

```
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430
```

```
Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
```

625 630 635 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
645 650 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
660 665 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
675 680 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
690 695 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705 710 715 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
725 730 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
740 745 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
755 760 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
770 775 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asp Leu Asn Gly Asn Ile
785 790 795 800

Leu Lys Glu Tyr Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu
805 810 815

Phe Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala
820 825 830

```
Leu Asp Ile Asp Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro
        835                 840                 845

Gln Ala Phe Ile Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser
    850                 855                 860

Ser Ala Lys Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile
865                 870                 875                 880

Val Lys Asp Cys Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu
                885                 890                 895

Met Ser Gln Arg Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly
            900                 905                 910

Leu Thr Ser Asp Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu
        915                 920                 925

Thr Arg Gln Ile Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe
    930                 935                 940

Asn Asn Glu Leu Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile
945                 950                 955                 960

Val Thr Leu Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly
                965                 970                 975

Phe Tyr Lys Ile Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala
            980                 985                 990

Tyr Leu Asn Ala Val Val Ala Lys  Ala Ile Leu Thr Lys  Tyr Pro Gln
        995                 1000                1005

Leu Glu  Pro Glu Phe Val Tyr  Gly Asp Tyr Pro Lys  Tyr Asn Ser
    1010                1015                1020

Tyr Lys  Thr Arg Lys Ser Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser
```

```
    1025                1030                1035

Asn Ile  Met Asn Phe Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly
    1040                1045                1050

Thr Val  Val Val Lys Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly
    1055                1060                1065

Glu Ile  Val Trp Asp Lys Lys  Lys His Phe Ala Thr  Val Arg Lys
    1070                1075                1080

Val Leu  Ser Tyr Pro Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile
    1085                1090                1095

Gln Thr  Gly Gly Phe Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn
    1100                1105                1110

Ser Asp  Lys Leu Ile Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp
    1115                1120                1125

Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser
    1130                1135                1140

Val Leu  Val Val Ala Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu
    1145                1150                1155

Lys Thr  Val Thr Glu Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser
    1160                1165                1170

Arg Phe  Glu Lys Asn Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr
    1175                1180                1185

Leu Asn  Ile Arg Ala Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser
    1190                1195                1200

Leu Phe  Glu Leu Glu Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala
    1205                1210                1215
```

```
Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe
    1220                1225                1230

Met Lys  Phe Leu Tyr Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly
    1235                1240                1245

Lys Pro  Glu Glu Ile Glu Lys  Lys Gln Glu Phe Val  Asn Gln His
    1250                1255                1260

Val Ser  Tyr Phe Asp Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser
    1265                1270                1275

Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys
    1280                1285                1290

Leu Tyr  Gln Asp Asn Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala
    1295                1300                1305

Asn Asn  Ile Ile Asn Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro
    1310                1315                1320

Ala Ala  Phe Lys Phe Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr
    1325                1330                1335

Thr Ser  Thr Lys Glu Val Leu  Asn Ser Thr Leu Ile  His Gln Ser
    1340                1345                1350

Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly
    1355                1360                1365

Glu Asp
    1370
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<212> PRT
<213> Streptococcus anginosus

<400> 651

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Met Asn Gly Leu Val Leu Gly Leu Asp Ile Gly Ile Ala Ser Val Gly
1               5                  10                  15

Val Gly Ile Leu Asn Lys Glu Thr Gly Glu Ile Ile His Ala Asn Ser
            20                  25                  30

Arg Ile Phe Pro Ala Ala Thr Ala Asp Ser Asn Val Glu Arg Arg Gly
        35                  40                  45

Phe Arg Gln Gly Arg Arg Leu Gly Arg Arg Lys Lys His Arg Ser Ala
    50                  55                  60

Arg Leu Asn Asn Leu Phe Glu Glu Phe Gly Phe Ile Thr Asp Phe Ser
65                  70                  75                  80

Ala Ile Pro Leu Asn Leu Asn Pro Tyr Ala Leu Arg Val Lys Gly Leu
                85                  90                  95

Ser Glu Glu Leu Thr Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Ile
            100                 105                 110

Ile Lys Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Glu Asp Gly
        115                 120                 125

Glu Thr Ala Ser Asn Glu Tyr Gly Lys Ala Val Glu Glu Asn Arg Lys
    130                 135                 140

Leu Leu Ala Asp Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Phe Glu
145                 150                 155                 160

Lys Tyr Gly Gln Val Arg Gly Asp Phe Thr Val Val Glu Asn Gly Glu
                165                 170                 175

Asn His Arg Leu Ile Asn Val Phe Ser Thr Ser Ala Tyr Lys Lys Glu
            180                 185                 190
```

```
Ala Glu Arg Ile Leu Arg Arg Gln Gln Glu Phe Asn Val Arg Ile Ser
        195                 200                 205

Asp Glu Phe Ile Glu Ala Tyr Leu Thr Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240

Phe Arg Thr Asp Gly Thr Thr Leu Asp Asn Ile Phe Gly Ile Leu Ile
                245                 250                 255

Gly Lys Cys Thr Phe Tyr Pro Asp Glu Tyr Arg Ala Ala Lys Ala Ser
            260                 265                 270

Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285

Val Pro Thr Glu Thr Lys Lys Leu Ser Pro Glu Gln Lys Arg Gln Ile
    290                 295                 300

Val Glu Tyr Ala Arg Thr Ala Lys Thr Leu Gly Thr Pro Thr Leu Leu
305                 310                 315                 320

Lys Tyr Ile Ala Lys Leu Val Asp Gly Ser Ile Asp Asp Ile Lys Gly
                325                 330                 335

Tyr Arg Ile Asp Lys Ser Asp Lys Pro Glu Met His Thr Phe Asp Ala
            340                 345                 350

Tyr Arg Lys Met Arg Thr Leu Asp Leu Val Asn Ile Asp Ala Leu Ser
        355                 360                 365

Arg Glu Thr Leu Asp Asp Leu Ala His Ile Leu Thr Leu Asn Thr Glu
    370                 375                 380

Ser Glu Gly Ile Leu Glu Ala Leu Asn Ser Lys Met Pro Ser Thr Phe
385                 390                 395                 400
```

```
Thr Lys Glu Gln Ile Asp Glu Leu Ile Gln Phe Arg Lys Lys Asn Ser
                405                 410                 415

Ala Val Phe Gly Lys Gly Trp His Asn Phe Ser Leu Lys Leu Met Asn
            420                 425                 430

Glu Leu Ile Ser Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr Ile
        435                 440                 445

Leu Thr Arg Leu Gly Lys Gln Arg Ser Arg Glu Ile Ser Lys Arg Thr
    450                 455                 460

Lys Tyr Ile Asp Glu Lys Glu Leu Thr Glu Glu Ile Tyr Asn Pro Val
465                 470                 475                 480

Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Ile Asn Glu Ala Thr
                485                 490                 495

Lys Arg Tyr Gly Ile Phe Asp Asn Ile Val Ile Glu Met Ala Arg Glu
            500                 505                 510

Asn Asn Glu Glu Asp Ala Lys Lys Asp Tyr Ile Lys Arg Gln Lys Ala
        515                 520                 525

Asn Gln Asp Glu Lys Asn Ala Ser Met Glu Lys Ala Ala Phe Gln Tyr
    530                 535                 540

Asn Gly Lys Lys Glu Leu Pro Asp Ser Ile Phe His Gly His Lys Glu
545                 550                 555                 560

Leu Ala Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Arg Cys Leu
                565                 570                 575

Tyr Thr Gly Lys Asn Ile Ser Ile Arg Asp Leu Ile His Asn Pro His
            580                 585                 590
```

```
Gln Tyr Glu Ile Asp His Ile Leu Pro Leu Ser Leu Ser Phe Asp Asp
        595                 600                 605

Gly Leu Ala Asn Lys Val Leu Val Leu Ala Thr Ala Asn Gln Glu Lys
    610                 615                 620

Gly Gln Arg Thr Pro Phe Gln Ala Ile Asp Ser Met Asp Asp Ala Trp
625                 630                 635                 640

Ser Tyr Arg Glu Phe Lys Gln Tyr Val Arg Asn Ser Lys Ser Leu Ser
                645                 650                 655

Asn Lys Lys Lys Asp Tyr Leu Leu Thr Glu Glu Asp Ile Ser Lys Ile
            660                 665                 670

Glu Val Lys Gln Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg Tyr
        675                 680                 685

Ser Ser Arg Val Val Leu Asn Thr Leu Gln Glu Phe Tyr Lys Thr Asn
    690                 695                 700

Asp Phe Asp Thr Lys Ile Ser Val Val Arg Gly Gln Phe Thr Ser Gln
705                 710                 715                 720

Leu Arg Arg Lys Trp Lys Ile Glu Lys Ser Arg Asp Thr Tyr His His
                725                 730                 735

His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Arg Leu
            740                 745                 750

Trp Lys Lys Gln Asn Asn Pro Leu Ile Ser Tyr Lys Glu Gly Gln Phe
        755                 760                 765

Val Asp Pro Glu Thr Gly Glu Ile Leu Ser Leu Thr Asp Asp Glu Tyr
    770                 775                 780

Lys Glu Leu Val Phe Arg Pro Pro Tyr Asp Tyr Phe Val Asp Thr Leu
785                 790                 795                 800
```

```
Lys Ser Lys Ser Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln Val Asp
                805                 810                 815

Ser Lys Tyr Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Gly Thr Arg
            820                 825                 830

Lys Ala Gln Leu Gly Lys Asp Lys Gln Glu Glu Thr Tyr Val Leu Gly
        835                 840                 845

Lys Ile Lys Asp Ile Tyr Ser Gln Lys Gly Tyr Glu Asp Phe Ile Lys
    850                 855                 860

Arg Tyr Asn Lys Asp Glu Thr Gln Phe Leu Ile Tyr His Lys Asp Pro
865                 870                 875                 880

Gln Thr Phe Glu Lys Val Ile Glu Glu Ile Leu Lys Thr Tyr Pro Asp
                885                 890                 895

Lys Glu Leu Asn Glu Lys Gly Lys Glu Ile Pro Cys Asn Pro Phe Glu
            900                 905                 910

Lys Tyr Arg Gln Glu Asn Gly Pro Ile Arg Lys Tyr Ser Lys Lys Gly
        915                 920                 925

Lys Gly Pro Glu Ile Lys Ser Leu Lys Tyr Tyr Asp Asn Lys Leu Gly
    930                 935                 940

Asn His Ile Asp Ile Thr Pro Val Asn Ser Gln Asn Gln Val Val Leu
945                 950                 955                 960

Gln Ser Leu Lys Pro Trp Arg Thr Asp Val Tyr Phe Asn Pro Arg Thr
                965                 970                 975

Ser Lys Tyr Glu Leu Met Gly Leu Lys Tyr Ser Asp Leu Arg Phe Glu
            980                 985                 990
```

```
Lys Gly Ser Gly Ser Tyr Gly Ile  Ser Pro Glu Lys Tyr  Asn Lys Val
        995                 1000                1005


Lys Ala  Lys Glu Gly Val Asn  Glu Asp Ser Glu Phe  Lys Phe Thr
    1010                1015                1020


Leu Tyr  Lys Asn Asp Leu Ile  Leu Ile Lys Asp Thr  Glu Thr Gly
    1025                1030                1035


Glu Gln  Gln Leu Phe Arg Tyr  Gly Ser Arg Asn Asp  Thr Ser Lys
    1040                1045                1050


His Tyr  Val Glu Leu Lys Pro  Tyr Glu Lys Ala Lys  Phe Glu Gly
    1055                1060                1065


Asn Gln  Gln Leu Met Asn Leu  Leu Gly Thr Val Ala  Lys Gly Gly
    1070                1075                1080


Gln Cys  Leu Lys Gly Ile Asn  Lys Pro Asn Leu Ser  Ile Tyr Lys
    1085                1090                1095


Val Lys  Thr Asp Val Leu Gly  Asn Lys Tyr Phe Ile  Lys Lys Glu
    1100                1105                1110


Gly Asp  Gln Pro Gln Leu Asn  Phe Lys Lys Lys Phe
    1115                1120                1125


<210>  652
<211>  1386
<212>  PRT
<213>  Streptococcus anginosus

<400>  652

Met Asn Gln Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30
```

```
Lys Val Leu Gly Asn Thr Asp Lys Gln Ser Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Met Gln Val Asp Glu Ser
                85                  90                  95

Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Asp Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Ile Ala Ala Glu Val Lys Tyr
        115                 120                 125

His Asp Glu Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140

Ile Ser Gln Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Gln Leu Lys Ala
                165                 170                 175

Glu Asn Thr Asn Val Gln Ala Leu Phe Lys Asp Phe Val Glu Val Tyr
            180                 185                 190

Asp Lys Thr Val Glu Glu Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205

Leu Ser Ile Leu Thr Glu Lys Val Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala His Tyr Pro Ala Glu Lys Lys Asn Thr Leu Phe Gly Asn
```

```
225                 230                 235                 240

Leu Ile Ala Leu Phe Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Gln Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Gly Leu Leu Gly Glu Val Gly Asp Glu Tyr Ala Asp
        275                 280                 285

Leu Phe Ala Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Asp Asp Asn Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Val Lys Arg Tyr Glu Glu His Gln Lys Asp Leu Lys Lys Phe Glu
                325                 330                 335

Asp Phe Ile Lys Val Asn Ala Leu Asp Gln Tyr Asn Ala Ile Phe Lys
            340                 345                 350

Asp Lys Asn Lys Lys Gly Tyr Ala Gly Tyr Ile Glu Ser Gly Val Lys
        355                 360                 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Gly Ile Leu Leu Gln Ile Asn
    370                 375                 380

Gly Ser Gly Asp Phe Leu Asp Lys Ile Asp Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro Phe
            420                 425                 430
```

```
Leu Lys Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Gly Ser Arg Phe Ala Trp
    450                 455                 460

Ala Glu Tyr Lys Ala Asp Glu Lys Ile Thr Pro Trp Asn Phe Asp Asp
465                 470                 475                 480

Ile Leu Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met Thr
                485                 490                 495

Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Thr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Asn Glu Gln Gly Glu Ala Lys Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Leu Asn Tyr Leu Asn Lys Glu Phe Glu Glu Phe Arg Ile
                565                 570                 575

Val Asn Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ser Ser
            580                 585                 590

Leu Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asn Lys Ser Phe Leu
        595                 600                 605

Asp Asn Lys Glu Asn Ala Gln Ile Ile Glu Asp Ile Ile Gln Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Gln Arg Leu Gln Lys Tyr
```

625 630 635 640

Ser Asp Ile Phe Thr Lys Ala Gln Leu Lys Lys Leu Glu Arg Arg His
645 650 655

Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile Arg
660 665 670

Asn Lys Glu Asn Lys Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
675 680 685

Tyr Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
690 695 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Ile Ile Gly Asp Val Asp Asp
705 710 715 720

Ile Ala Asn Val Val His Asp Leu Pro Gly Ser Pro Ala Ile Lys Lys
725 730 735

Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val Lys Val Met
740 745 750

Gly His Asn Pro Ala Asn Ile Ile Ile Glu Met Ala Arg Glu Asn Gln
755 760 765

Thr Thr Asp Arg Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Leu Leu
770 775 780

Gln Asp Ser Leu Lys Asn Leu Asp Asn Pro Val Asn Ile Lys Asn Val
785 790 795 800

Glu Asn Gln Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Ile Gln
805 810 815

Asn Gly Lys Asp Met Tyr Thr Gly Glu Thr Leu Asp Ile Asn Asn Leu
820 825 830

```
Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Tyr Ile Lys Asp
        835                 840                 845

Asp Ser Phe Asp Asn Arg Val Leu Thr Ser Ser Ser Glu Asn Arg Gly
    850                 855                 860

Lys Ser Asp Asn Val Pro Ser Ile Glu Val Val Cys Ala Arg Lys Ala
865                 870                 875                 880

Asp Trp Met Arg Leu Arg Lys Ala Gly Leu Ile Ser Gln Arg Lys Phe
                885                 890                 895

Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Asn Asp Lys
            900                 905                 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925

His Val Ala Gln Val Leu Asp Ala Arg Phe Asn Ala Lys His Asp Glu
    930                 935                 940

Asn Lys Lys Val Ile Arg Asp Val Lys Ile Ile Thr Leu Lys Ser Asn
945                 950                 955                 960

Leu Val Ser Gln Phe Arg Lys Asp Phe Lys Phe Tyr Lys Val Arg Glu
                965                 970                 975

Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Ile
            980                 985                 990

Gly Thr Ala Leu Leu Lys Lys Tyr  Pro Lys Leu Ala Ser  Glu Phe Val
        995                 1000                1005

Tyr Gly  Glu Phe Lys Lys Tyr  Asp Val Arg Lys Phe  Ile Ala Lys
    1010                1015                1020

Ser Asp  Lys Glu Ile Gly Lys  Ala Thr Ala Lys Tyr  Phe Phe Tyr
```

```
    1025                1030                1035

Ser Asn  Leu Met Asn Phe Phe  Lys Lys Glu Val Lys  Phe Ala Asp
    1040                1045                1050

Gly Thr  Val Val Glu Arg Pro  Asp Ile Glu Thr Ser  Glu Asp Gly
    1055                1060                1065

Glu Ile  Ala Trp Asn Lys Gln  Thr Asp Phe Lys Ile  Val Arg Lys
    1070                1075                1080

Val Leu  Ser Tyr Pro Gln Val  Asn Ile Val Lys Lys  Thr Glu Val
    1085                1090                1095

Gln Thr  His Gly Leu Asp Arg  Gly Lys Pro Arg Gly  Leu Phe Asn
    1100                1105                1110

Ala Asn  Pro Ser Pro Lys Pro  Lys Pro Asp Ser Ser  Glu Asn Leu
    1115                1120                1125

Val Gly  Val Lys Arg Asn Leu  Asp Pro Lys Lys Tyr  Gly Gly Tyr
    1130                1135                1140

Ala Gly  Ile Ser Asn Ser Tyr  Ala Val Leu Val Lys  Ala Ile Ile
    1145                1150                1155

Glu Lys  Gly Val Lys Lys Lys  Glu Thr Met Val Leu  Glu Phe Gln
    1160                1165                1170

Gly Ile  Ser Ile Leu Asp Arg  Ile Thr Phe Glu Lys  Asp Lys Arg
    1175                1180                1185

Ala Phe  Leu Leu Gly Lys Gly  Tyr Lys Asp Ile Lys  Lys Ile Ile
    1190                1195                1200

Glu Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Lys Asp  Gly Ser Arg
    1205                1210                1215
```

```
Arg Met  Leu Ala Ser Ile Leu  Ser Thr Asn Asn Lys  Arg Gly Glu
    1220                1225                1230

Ile His  Lys Gly Asn Glu Leu  Phe Val Pro Gln Lys  Phe Thr Thr
    1235                1240                1245

Leu Leu  Tyr His Ala Lys Arg  Ile Asn Asn Pro Ile  Asn Lys Asp
    1250                1255                1260

His Ile  Glu Tyr Val Lys Lys  His Arg Asp Asp Phe  Lys Glu Leu
    1265                1270                1275

Leu Asn  Tyr Val Leu Glu Phe  Asn Glu Lys Tyr Val  Gly Ala Thr
    1280                1285                1290

Lys Asn  Gly Glu Arg Leu Lys  Glu Ala Val Ala Asp  Phe Asp Ser
    1295                1300                1305

Lys Ser  Asn Glu Glu Ile Cys  Thr Ser Phe Leu Gly  Ala Val Asn
    1310                1315                1320

Ser Lys  Asn Ala Gly Leu Phe  Glu Leu Thr Ser Leu  Gly Ser Ala
    1325                1330                1335

Ser Asp  Phe Glu Phe Leu Gly  Val Lys Ile Pro Arg  Tyr Arg Asp
    1340                1345                1350

Tyr Thr  Pro Ser Ser Leu Leu  Lys Asp Ser Thr Leu  Ile His Gln
    1355                1360                1365

Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile Asp Leu  Ser Lys Leu
    1370                1375                1380

Gly Glu  Asp
    1385
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<400> 653

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Met Thr Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asn Arg Asp Tyr Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Glu Thr Ala Glu Gly Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Met Gln Val Asp Glu Ser
                85                  90                  95


Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Glu Glu Asp Lys Gln
            100                 105                 110


Gly Ser Lys Tyr Pro Ile Phe Gly Thr Leu Lys Glu Glu Lys Glu Tyr
        115                 120                 125


His Lys Lys Phe Lys Thr Ile Tyr His Leu Arg Glu Glu Leu Ala Asn
    130                 135                 140


Ser Lys Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Met Ile Lys Phe Arg Gly His Phe Leu Tyr Glu Gly Asp Leu Lys Ala
                165                 170                 175
```

```
Glu Asn Thr Asp Val Gln Ala Leu Phe Lys Asp Phe Val Glu Glu Tyr
            180                 185                 190

Asp Lys Thr Ile Glu Glu Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205

Leu Ser Ile Leu Thr Glu Lys Val Ser Lys Ser Ser Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala His Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Gln Ala Asn Phe Lys Thr Asn Phe
                245                 250                 255

Gln Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Gly Leu Leu Gly Glu Val Gly Asp Glu Tyr Ala Asp
        275                 280                 285

Leu Phe Val Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Asp Asp Asn Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Val Lys Arg Tyr Lys Glu His Lys Glu Glu Leu Ala Ala Phe Lys
                325                 330                 335

Arg Phe Ile Lys Glu Lys Leu Pro Lys Lys Tyr Glu Glu Ile Phe Lys
            340                 345                 350

Asp Asp Thr Lys Asn Gly Tyr Ala Gly Tyr Val Gly Ala Asp Lys Lys
        355                 360                 365

Leu Arg Lys Arg Ser Gly Lys Leu Ala Thr Glu Glu Glu Phe Tyr Lys
    370                 375                 380
```

```
Tyr Val Lys Gly Ile Leu Asn Lys Val Glu Gly Ala Asp Tyr Phe Leu
385                 390                 395                 400

Asp Lys Ile Asp Arg Glu Asp Phe Leu Arg Lys Gln Arg Thr Phe Asp
                405                 410                 415

Asn Gly Ser Ile Pro His Gln Ile His Leu Gln Glu Met His Ala Ile
            420                 425                 430

Leu Arg Arg Gln Gly Glu His Tyr Pro Phe Leu Lys Glu Asn Gln Asp
        435                 440                 445

Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro
    450                 455                 460

Leu Ala Arg Lys Gly Ser Arg Phe Ala Trp Ala Glu Tyr Lys Ala Asp
465                 470                 475                 480

Glu Lys Ile Thr Pro Trp Asn Phe Asp Asp Ile Leu Asp Lys Glu Lys
                485                 490                 495

Ser Ala Glu Lys Phe Ile Thr Arg Met Thr Leu Asn Asp Leu Tyr Leu
            500                 505                 510

Pro Glu Glu Lys Val Leu Pro Lys His Ser Pro Leu Tyr Glu Thr Phe
        515                 520                 525

Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Asn Glu Gln Gly
    530                 535                 540

Glu Ala Lys Phe Phe Asp Thr Asn Met Lys Gln Glu Ile Phe Asp His
545                 550                 555                 560

Val Phe Lys Glu Asn Arg Lys Val Thr Lys Asp Lys Leu Leu Asn Tyr
                565                 570                 575
```

```
Leu Asn Lys Glu Phe Glu Glu Phe Arg Ile Val Asn Leu Thr Gly Leu
            580                 585                 590

Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser Leu Gly Thr Tyr His Asp
        595                 600                 605

Leu Arg Lys Ile Leu Asp Lys Ser Phe Leu Asp Asp Lys Val Asn Glu
    610                 615                 620

Lys Ile Ile Glu Asp Ile Ile Gln Thr Leu Thr Leu Phe Glu Asp Arg
625                 630                 635                 640

Glu Met Ile Arg Gln Arg Leu Gln Lys Tyr Ser Asp Ile Phe Thr Thr
                645                 650                 655

Gln Gln Leu Lys Glu Leu Glu Arg Arg His Tyr Thr Gly Trp Gly Arg
            660                 665                 670

Leu Ser Tyr Lys Leu Ile Asn Gly Ile Arg Asn Lys Glu Asn Lys Lys
        675                 680                 685

Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Tyr Ala Asn Arg Asn Phe
    690                 695                 700

Met Gln Leu Ile Asn Asp Asp Ala Leu Ser Phe Lys Glu Glu Ile Ala
705                 710                 715                 720

Arg Ala Gln Ile Ile Gly Asp Val Asp Asp Ile Ala Asn Val Val His
                725                 730                 735

Asp Leu Pro Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Ser Val
            740                 745                 750

Lys Ile Val Asp Glu Leu Val Lys Val Met Gly His Asn Pro Thr Asn
        755                 760                 765

Ile Ile Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Asp Lys Gly Arg
    770                 775                 780
```

```
Arg Asn Ser Gln Gln Arg Leu Lys Leu Leu Gln Asp Ser Leu Lys Asn
785                 790                 795                 800


Leu Asp Asn Pro Val Asn Ile Lys Asn Val Glu Asn Gln Gln Leu Gln
                805                 810                 815


Asn Asp Arg Leu Phe Leu Tyr Tyr Ile Gln Asn Gly Lys Asp Met Tyr
            820                 825                 830


Thr Gly Glu Thr Leu Asp Ile Asn Asn Leu Ser Gln Tyr Asp Ile Asp
        835                 840                 845


His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asn Ser Leu Asp Asn Arg
    850                 855                 860


Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys Ser Asp Asp Val Pro
865                 870                 875                 880


Ser Ile Glu Val Val His Glu Met Lys Ser Phe Trp Ser Lys Leu Leu
                885                 890                 895


Ser Val Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn Leu Thr Lys Ala
            900                 905                 910


Glu Arg Gly Gly Leu Thr Glu Asn Asp Lys Ala Gly Phe Ile Lys Arg
        915                 920                 925


Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln Val Leu
    930                 935                 940


Asp Ala Arg Phe Asn Ala Lys His Asp Glu Asn Lys Lys Val Ile Arg
945                 950                 955                 960


Asp Val Lys Ile Ile Thr Leu Lys Ser Asn Leu Val Ser Gln Phe Arg
                965                 970                 975
```

```
Lys Asp Phe Lys Phe Tyr Lys Val Arg Glu Ile Asn Asp Tyr His His
            980                 985                 990

Ala His Asp Ala Tyr Leu Asn Ala  Val Ile Gly Thr Ala  Leu Leu Lys
        995                 1000                1005

Lys Tyr  Pro Lys Leu Ala Ser  Glu Phe Val Tyr Gly  Glu Phe Lys
    1010                1015                1020

Lys Tyr  Asp Val Arg Lys Phe  Ile Ala Lys Ser Asp  Lys Glu Ile
    1025                1030                1035

Gly Lys  Ala Thr Ala Lys Tyr  Phe Phe Tyr Ser Asn  Leu Met Asn
    1040                1045                1050

Phe Phe  Lys Lys Glu Val Lys  Phe Ala Asp Gly Thr  Val Val Glu
    1055                1060                1065

Arg Pro  Asp Ile Glu Thr Ser  Glu Asp Gly Glu Ile  Ala Trp Asn
    1070                1075                1080

Lys Gln  Thr Asp Phe Lys Ile  Val Arg Lys Val Leu  Ser Tyr Pro
    1085                1090                1095

Gln Val  Asn Ile Val Lys Lys  Thr Glu Val Gln Thr  His Gly Leu
    1100                1105                1110

Asp Arg  Gly Lys Pro Arg Gly  Leu Phe Asn Ala Asn  Pro Ser Pro
    1115                1120                1125

Lys Pro  Lys Pro Asp Ser Ser  Glu Asn Leu Val Gly  Ile Lys Arg
    1130                1135                1140

Asn Leu  Asp Pro Lys Lys Tyr  Gly Gly Tyr Ala Gly  Ile Ser Asn
    1145                1150                1155

Ser Tyr  Ala Val Leu Val Lys  Ala Ile Ile Glu Lys  Gly Val Lys
    1160                1165                1170
```

```
Lys Lys  Glu Thr Met Val Leu  Glu Phe Gln Gly Ile  Ser Ile Leu
    1175                1180                1185

Asp Arg  Ile Thr Phe Glu Lys  Asp Lys Arg Ala Phe  Leu Leu Gly
    1190                1195                1200

Lys Gly  Tyr Lys Asp Ile Lys  Lys Ile Ile Glu Leu  Pro Lys Tyr
    1205                1210                1215

Ser Leu  Phe Glu Leu Lys Asp  Gly Ser Arg Arg Met  Leu Ala Ser
    1220                1225                1230

Ile Leu  Ser Thr Asn Asn Lys  Arg Gly Glu Ile His  Lys Gly Asn
    1235                1240                1245

Glu Leu  Phe Val Pro Gln Lys  Phe Thr Thr Leu Leu  Tyr His Ala
    1250                1255                1260

Lys Arg  Ile Asn Asn Pro Ile  Asn Lys Asp His Ile  Glu Tyr Val
    1265                1270                1275

Lys Lys  His Arg Asp Asp Phe  Lys Glu Leu Leu Asn  Tyr Val Leu
    1280                1285                1290

Glu Phe  Asn Glu Lys Tyr Val  Gly Ala Thr Lys Asn  Gly Glu Arg
    1295                1300                1305

Leu Lys  Glu Ala Val Ala Asp  Phe Asp Ser Lys Ser  Asn Glu Glu
    1310                1315                1320

Ile Cys  Thr Ser Phe Leu Gly  Ala Val Asn Ser Lys  Asn Ala Gly
    1325                1330                1335

Leu Phe  Glu Leu Thr Ser Leu  Gly Ser Ala Ser Asp  Phe Glu Phe
    1340                1345                1350
```

```
Leu Gly  Val Lys Ile Pro Arg  Tyr Arg Asp Tyr Thr  Pro Ser Ser
    1355                1360                1365


Leu Leu  Lys Asp Ser Ile Leu  Ile His Gln Ser Ile  Thr Gly Leu
    1370                1375                1380


Tyr Glu  Thr Arg Ile Asp Leu  Ser Lys Leu Gly Glu  Asp
    1385                1390                1395


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Met Glu Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asn Arg Lys Ser Ile Lys Lys Asn Leu Met
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Arg
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Asn Glu Met Ala Lys Leu Asp Asp Ser
                85                  90                  95


Phe Phe Gln Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110


Asn Glu Arg His Pro Ile Phe Gly Asn Leu Ala Asp Glu Val Ala Tyr
        115                 120                 125
```

```
His Arg Asn Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Pro Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Leu Asn Ala
                165                 170                 175

Glu Asn Ser Asp Val Ala Lys Leu Phe Tyr Gln Leu Ile Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Ser Pro Leu Asp Glu Ile Glu Val Asp Ala
        195                 200                 205

Lys Gly Ile Leu Ser Ala Arg Leu Ser Lys Ser Lys Arg Leu Glu Lys
    210                 215                 220

Leu Ile Ala Val Phe Pro Asn Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Ile Ile Ala Leu Ala Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Thr Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Glu Leu Leu Gly Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Ser Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Ser Asn Ser Glu Val Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Val Lys Arg Tyr Asp Glu His His Gln Asp Leu Ala Leu Leu Lys
```

```
                325                 330                 335

Thr Leu Val Arg Gln Gln Phe Pro Glu Lys Tyr Ala Glu Ile Phe Lys
            340                 345                 350

Asp Asp Thr Lys Asn Gly Tyr Ala Gly Tyr Val Gly Ile Gly Ile Lys
        355                 360                 365

His Arg Lys Arg Thr Thr Lys Leu Ala Thr Gln Glu Glu Phe Tyr Lys
    370                 375                 380

Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly Ala Glu Glu Leu Leu
385                 390                 395                 400

Ala Lys Leu Asn Arg Asp Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp
                405                 410                 415

Asn Gly Ser Ile Pro His Gln Ile His Leu Lys Glu Leu His Ala Ile
            420                 425                 430

Leu Arg Arg Gln Glu Glu Phe Tyr Pro Phe Leu Lys Glu Asn Arg Glu
        435                 440                 445

Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro
    450                 455                 460

Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Leu Thr Arg Lys Ser Glu
465                 470                 475                 480

Glu Ala Ile Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala
                485                 490                 495

Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Glu Gln Leu
            500                 505                 510

Pro Asn Lys Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe
        515                 520                 525
```

```
Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Arg Met
    530                 535                 540

Arg Lys Pro Glu Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp
545                 550                 555                 560

Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu
                565                 570                 575

Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ile Gly
            580                 585                 590

Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu
        595                 600                 605

Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp
    610                 615                 620

Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu
625                 630                 635                 640

Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys
                645                 650                 655

Val Met Lys Gln Leu Lys Arg Arg His Tyr Thr Gly Trp Gly Arg Leu
            660                 665                 670

Ser Arg Lys Met Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr
        675                 680                 685

Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe Ser Asn Arg Asn Phe Met
    690                 695                 700

Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu Glu Ile Glu Lys
705                 710                 715                 720

Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu Gln Ile Ala Asp
```

```
                725                 730                 735

Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys
            740                 745                 750

Ile Val Asp Glu Leu Val Lys Val Met Gly His Lys Pro Glu Asn Ile
        755                 760                 765

Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Thr Lys Gly Leu Gln
    770                 775                 780

Gln Ser Arg Glu Arg Lys Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu
785                 790                 795                 800

Glu Ser Gln Ile Leu Lys Glu Asn Pro Val Glu Asn Thr Gln Leu Gln
                805                 810                 815

Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr
            820                 825                 830

Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser Asp Tyr Asp Val Asp
        835                 840                 845

His Ile Val Pro Gln Ser Phe Ile Lys Asp Asp Ser Ile Asp Asn Lys
    850                 855                 860

Val Leu Thr Arg Ser Val Glu Asn Arg Gly Lys Ser Asp Asn Val Pro
865                 870                 875                 880

Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr Trp Arg Gln Leu Leu
                885                 890                 895

Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn Leu Thr Lys Ala
            900                 905                 910

Glu Arg Gly Gly Leu Ser Glu Ala Asp Lys Ala Gly Phe Ile Lys Arg
        915                 920                 925
```

```
Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Arg Ile Leu
    930                 935                 940

Asp Ser Arg Met Asn Thr Lys Arg Asp Lys Asn Asp Lys Pro Ile Arg
945                 950                 955                 960

Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu Val Ser Asp Phe Arg
                965                 970                 975

Lys Asp Phe Gln Leu Tyr Lys Val Arg Asp Ile Asn Asn Tyr His His
            980                 985                 990

Ala His Asp Ala Tyr Leu Asn Ala  Val Val Gly Thr Ala  Leu Ile Lys
        995                 1000                1005

Lys Tyr  Pro Lys Leu Glu Ser  Glu Phe Val Tyr Gly  Asp Tyr Lys
    1010                1015                1020

Val Tyr  Asp Val Arg Lys Met  Ile Ala Lys Ser Glu  Gln Glu Ile
    1025                1030                1035

Gly Lys  Ala Thr Ala Lys Arg  Phe Phe Tyr Ser Asn  Ile Met Asn
    1040                1045                1050

Phe Phe  Lys Thr Glu Val Lys  Leu Ala Asn Gly Glu  Ile Arg Lys
    1055                1060                1065

Arg Pro  Leu Ile Glu Thr Asn  Gly Glu Thr Gly Glu  Val Val Trp
    1070                1075                1080

Asn Lys  Glu Lys Asp Phe Ala  Thr Val Arg Lys Val  Leu Ala Met
    1085                1090                1095

Pro Gln  Val Asn Ile Val Lys  Lys Thr Glu Val Gln  Thr Gly Gly
    1100                1105                1110

Phe Ser  Lys Glu Ser Ile Leu  Ser Lys Arg Glu Ser  Ala Lys Leu
```

```
    1115                1120                1125

Ile Pro  Arg Lys Lys Gly Trp  Asp Thr Arg Lys Tyr  Gly Gly Phe
    1130                1135                1140

Gly Ser  Pro Thr Val Ala Tyr  Ser Ile Leu Val Val  Ala Lys Val
    1145                1150                1155

Glu Lys  Gly Lys Ala Lys Lys  Leu Lys Ser Val Lys  Val Leu Val
    1160                1165                1170

Gly Ile  Thr Ile Met Glu Lys  Gly Ser Tyr Glu Lys  Asp Pro Ile
    1175                1180                1185

Gly Phe  Leu Glu Ala Lys Gly  Tyr Lys Asp Ile Lys  Lys Glu Leu
    1190                1195                1200

Ile Phe  Lys Leu Pro Lys Tyr  Ser Leu Phe Glu Leu  Glu Asn Gly
    1205                1210                1215

Arg Arg  Arg Met Leu Ala Ser  Ala Thr Glu Leu Gln  Lys Ala Asn
    1220                1225                1230

Glu Leu  Val Leu Pro Gln His  Leu Val Arg Leu Leu  Tyr Tyr Thr
    1235                1240                1245

Gln Asn  Ile Ser Ala Thr Thr  Gly Ser Asn Asn Leu  Gly Tyr Ile
    1250                1255                1260

Glu Gln  His Arg Glu Glu Phe  Lys Glu Ile Phe Glu  Lys Ile Ile
    1265                1270                1275

Asp Phe  Ser Glu Lys Tyr Ile  Leu Lys Asn Lys Val  Asn Ser Asn
    1280                1285                1290

Leu Lys  Ser Ser Phe Asp Glu  Gln Phe Ala Val Ser  Asp Ser Ile
    1295                1300                1305
```

```
Leu Leu  Ser Asn Ser Phe Val  Ser Leu Leu Lys Tyr  Thr Ser Phe
    1310                1315                1320


Gly Ala  Ser Gly Gly Phe Thr  Phe Leu Asp Leu Asp  Val Lys Gln
    1325                1330                1335


Gly Arg  Leu Arg Tyr Gln Thr  Val Thr Glu Val Leu  Asp Ala Thr
    1340                1345                1350


Leu Ile  Tyr Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Thr Asp
    1355                1360                1365


Leu Ser  Gln Leu Gly Gly Asp
    1370                1375


<210>  655
<211>  1345
<212>  PRT
<213>  Streptococcus constellatus

<400>  655

Met Gly Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Gln Ser Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Thr Gly Glu Met Asn Lys Val Asp Glu Asn
                85                  90                  95
```

```
Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Asp Glu Asp Lys Arg
            100                 105                 110

Gly Glu His His Pro Ile Phe Gly Asn Ile Ala Ala Glu Val Lys Tyr
        115                 120                 125

His Asp Asp Phe Pro Thr Ile Tyr His Leu Arg Arg His Leu Ala Asp
    130                 135                 140

Thr Ser Lys Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Tyr Glu Gly Asp Leu Lys Ala
                165                 170                 175

Glu Asn Thr Asp Val Gln Ala Leu Phe Lys Asp Phe Val Glu Glu Tyr
            180                 185                 190

Asp Lys Thr Ile Glu Glu Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205

Leu Ser Ile Leu Thr Glu Lys Val Ser Lys Ser Ser Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala His Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Asp Leu His Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Gln Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Gly Phe Leu Gly Glu Val Gly Asp Glu Tyr Ala Asp
        275                 280                 285
```

```
Leu Phe Ala Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Asp Asp Asn Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Val Lys Arg Tyr Glu Glu His Gln Lys Asp Leu Lys Lys Leu Lys
                325                 330                 335

Asp Phe Ile Lys Val Asn Ala Pro Asp Gln Tyr Asn Ala Ile Phe Lys
            340                 345                 350

Asp Lys Asn Lys Lys Gly Tyr Ala Ser Tyr Ile Glu Ser Gly Val Lys
        355                 360                 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Gly Ile Leu Leu Lys Ile Asn
    370                 375                 380

Gly Ser Gly Asp Phe Leu Asp Lys Ile Asp Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Gly Ser Arg Phe Ala Trp
    450                 455                 460

Ala Glu Tyr Lys Ala Asp Glu Lys Ile Thr Pro Trp Asn Phe Asp Asp
465                 470                 475                 480

Ile Leu Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met Thr
                485                 490                 495
```

```
Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Pro Leu Tyr Glu Ala Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Asn Glu Gln Gly Glu Ala Lys Phe Phe Asp Thr Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Leu Asn Tyr Leu Asn Lys Glu Phe Glu Glu Phe Arg Ile
                565                 570                 575

Val Asn Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ser Ser
            580                 585                 590

Leu Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Ser Phe Leu
        595                 600                 605

Asp Asp Lys Ala Asn Glu Lys Thr Ile Glu Asp Ile Ile Gln Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Gln Arg Leu Gln Lys Tyr
625                 630                 635                 640

Ser Asp Ile Phe Thr Lys Ala Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile Arg
            660                 665                 670

Asn Lys Glu Asn Lys Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685
```

```
Tyr Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Arg Ala Gln Ile Ile Asp Asp Val Asp Asp
705                 710                 715                 720

Ile Ala Asn Val Val His Asp Leu Pro Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val Lys Val Met
            740                 745                 750

Gly His Asn Pro Ala Asn Ile Ile Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Asp Lys Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Leu Leu
    770                 775                 780

Gln Asp Ser Leu Lys Asn Leu Asp Asn Pro Val Asn Ile Lys Asn Val
785                 790                 795                 800

Glu Asn Gln Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Ile Gln
                805                 810                 815

Asn Gly Lys Asp Met Tyr Thr Gly Glu Thr Leu Asp Ile Asn Asn Leu
            820                 825                 830

Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp
        835                 840                 845

Asn Ser Leu Asp Asn Arg Val Leu Thr Arg Ser Asp Lys Asn Arg Gly
    850                 855                 860

Lys Ser Asp Asp Val Pro Ser Ile Glu Val Val His Glu Met Lys Ser
865                 870                 875                 880

Phe Trp Ser Lys Leu Leu Ser Val Lys Leu Ile Thr Gln Arg Lys Phe
                885                 890                 895
```

```
Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Glu Asp Lys
            900                 905                 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925

His Val Ala Gln Ile Leu Asp Glu Arg Phe Asn Thr Glu Phe Asp Gly
    930                 935                 940

Asn Lys Arg Arg Ile Arg Asn Val Lys Ile Ile Thr Leu Lys Ser Asn
945                 950                 955                 960

Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu
                965                 970                 975

Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val
            980                 985                 990

Gly Asn Ala Leu Leu Leu Lys Tyr  Pro Gln Leu Glu Pro  Glu Phe Val
        995                 1000                1005

Tyr Gly  Glu Tyr Pro Lys Tyr  Asn Ser Tyr Arg Ser  Arg Lys Ser
    1010                1015                1020

Ala Thr  Glu Lys Phe Leu Phe  Tyr Ser Asn Ile Leu  Arg Phe Phe
    1025                1030                1035

Lys Lys  Glu Asp Ile Gln Thr  Asn Glu Asp Gly Glu  Ile Ala Trp
    1040                1045                1050

Asn Lys  Glu Lys His Ile Lys  Ile Leu Arg Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Thr Glu Glu Gln  Thr Gly Gly
    1070                1075                1080
```

```
Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Glu Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Asn  Ser Tyr Trp Asp Pro  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Val  Val Ala Tyr Ser Ile  Leu Val Phe
    1115                1120                1125

Ala Asp  Val Glu Lys Gly Lys  Ser Lys Lys Leu Arg  Lys Val Gln
    1130                1135                1140

Asp Met  Val Gly Ile Thr Ile  Met Glu Lys Lys Arg  Phe Glu Lys
    1145                1150                1155

Asn Pro  Val Asp Phe Leu Glu  Gln Arg Gly Tyr Arg  Asn Val Arg
    1160                1165                1170

Leu Glu  Lys Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu
    1175                1180                1185

Glu Asn  Lys Arg Arg Arg Leu  Leu Ala Ser Ala Lys  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Leu Val Ile  Pro Gln Arg Phe Thr  Thr Leu Leu
    1205                1210                1215

Tyr His  Ser Tyr Arg Ile Glu  Lys Asp Tyr Glu Pro  Glu His Arg
    1220                1225                1230

Glu Tyr  Val Glu Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Glu
    1235                1240                1245

Tyr Ile  Ser Val Phe Ser Arg  Lys Tyr Val Leu Ala  Asp Asn Asn
    1250                1255                1260

Leu Thr  Lys Ile Glu Met Leu  Phe Ser Lys Asn Lys  Asp Ala Glu
    1265                1270                1275
```

```
Val Ser  Ser Leu Ala Lys Ser  Phe Ile Ser Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Phe  Gly Ala Pro Ala Ala  Phe Asn Phe Phe Gly  Glu Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Val Thr Glu Cys Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Glu Asp
    1340                1345


<210>  656
<211>  538
<212>  PRT
<213>  Streptococcus dysgalactiae

<400>  656

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp Asp
1               5                   10                  15


Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
            20                  25                  30


Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
        35                  40                  45


Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
    50                  55                  60


Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
65                  70                  75                  80


Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
```

```
                85                  90                  95

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
            100                 105                 110

Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
        115                 120                 125

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
    130                 135                 140

Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
145                 150                 155                 160

Thr Ala Leu Ile Lys Lys Tyr Pro Lys Leu Glu Ser Glu Phe Val Tyr
                165                 170                 175

Gly Asp Tyr Lys Val Tyr Asp Val Arg Lys Met Ile Ala Lys Ser Glu
            180                 185                 190

Gln Glu Ile Gly Lys Ala Thr Ala Lys Arg Phe Phe Tyr Ser Asn Ile
        195                 200                 205

Met Asn Phe Phe Lys Thr Glu Ile Thr Leu Ala Asn Gly Glu Ile Arg
    210                 215                 220

Lys Arg Pro Leu Ile Glu Thr Asn Glu Glu Thr Gly Glu Ile Val Trp
225                 230                 235                 240

Asp Lys Gly Arg Asp Phe Ala Thr Val Arg Lys Val Leu Ser Met Pro
                245                 250                 255

Gln Val Asn Ile Val Lys Lys Thr Glu Val Gln Thr Gly Ala Leu Thr
            260                 265                 270

Asn Glu Ser Ile Tyr Ala Arg Gly Ser Phe Asp Lys Leu Ile Ser Arg
        275                 280                 285
```

```
Lys His Arg Phe Glu Ser Ser Lys Tyr Gly Gly Phe Gly Ser Pro Thr
    290                 295                 300

Val Thr Tyr Ser Val Leu Val Val Ala Lys Ser Lys Val Gln Asp Gly
305                 310                 315                 320

Lys Val Lys Lys Ile Lys Thr Gly Lys Glu Leu Ile Gly Ile Thr Leu
                325                 330                 335

Leu Asp Lys Leu Val Phe Glu Lys Asn Pro Leu Lys Phe Ile Glu Asp
            340                 345                 350

Lys Gly Tyr Gly Asn Val Gln Ile Asp Lys Cys Ile Arg Leu Pro Lys
        355                 360                 365

Tyr Ser Leu Phe Glu Phe Glu Asn Gly Thr Arg Arg Met Leu Ala Ser
    370                 375                 380

Val Met Ala Asn Asn Asn Ser Arg Gly Asp Leu Gln Lys Ala Asn Glu
385                 390                 395                 400

Met Phe Leu Pro Ala Lys Leu Val Thr Leu Leu Tyr His Ala His Lys
                405                 410                 415

Ile Glu Ser Ser Lys Glu Leu Glu His Glu Ala Tyr Ile Leu Asp His
            420                 425                 430

Tyr Asn Asp Leu Tyr Gln Leu Leu Ser Tyr Ile Glu Arg Phe Ala Ser
        435                 440                 445

Leu Tyr Val Asp Val Glu Lys Asn Ile Ser Lys Val Lys Glu Leu Phe
    450                 455                 460

Ser Asn Ile Glu Ser Tyr Ser Ile Ser Glu Ile Cys Ser Ser Val Ile
465                 470                 475                 480

Asn Leu Leu Thr Leu Thr Ala Ser Gly Ala Pro Ala Asp Phe Lys Phe
```

485 490 495

Leu Gly Thr Thr Ile Pro Arg Lys Arg Tyr Gly Ser Pro Gln Ser Ile
500 505 510

Leu Ser Ser Thr Leu Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr
515 520 525

Arg Ile Asp Leu Ser Gln Leu Gly Gly Asp
530 535

<210> 657
<211> 1155
<212> PRT
<213> Streptococcus dysgalactiae

<400> 657

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
20 25 30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
50 55 60

Lys Arg Ser Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Arg
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ser Ser Glu Met Ser Lys Val Asp Asp Ser
85 90 95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
100 105 110

```
His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Met Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Arg Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Arg Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320
```

```
Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510
```

```
Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Glu Phe Leu Ser Gly Lys Gln
    530                 535                 540

Lys Glu Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Lys Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg His Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Ile Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Ala Ile Gln Lys Ala Gln Val Ser Gly Gln Gly His Ser Leu
705                 710                 715                 720
```

```
His Glu Gln Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
               725                 730                 735

Ile Leu Gln Ser Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
        755                 760                 765

Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu
    770                 775                 780

Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val
785                 790                 795                 800

Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln
               805                 810                 815

Asn Arg Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu
            820                 825                 830

Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp
        835                 840                 845

Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly
    850                 855                 860

Lys Ser Asp Asp Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn
865                 870                 875                 880

Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe
               885                 890                 895

Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys
            900                 905                 910
```

```
Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925


His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu
    930                 935                 940


Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys
945                 950                 955                 960


Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu
                965                 970                 975


Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val
            980                 985                 990


Gly Thr Ala Leu Ile Lys Lys Tyr  Pro Lys Leu Glu Ser  Glu Phe Val
        995                 1000                1005


Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg Lys Met  Ile Ala Lys
    1010                1015                1020


Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala Lys Arg  Phe Phe Tyr
    1025                1030                1035


Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu Ile Thr  Leu Ala Asn
    1040                1045                1050


Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu Thr Asn  Glu Glu Thr
    1055                1060                1065


Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp Phe Ala  Thr Val Arg
    1070                1075                1080


Lys Val  Leu Ser Met Pro Gln  Val Asn Ile Val Lys  Lys Thr Glu
    1085                1090                1095


Val Gln  Thr Gly Ala Leu Thr  Asn Glu Ser Ile Tyr  Ala Arg Gly
    1100                1105                1110
```

Ser Phe Asp Lys Leu Ile Ser Arg Lys His Arg Phe Glu Ser Ser
    1115   1120   1125

Lys Tyr Gly Gly Phe Gly Ser Pro Thr Val Thr Tyr Ser Val Leu
    1130   1135   1140

Val Val Ala Lys Tyr Gln Ser Tyr Lys Met Glu Lys
    1145   1150   1155

<210> 658
<211> 1371
<212> PRT
<213> Streptococcus dysgalactiae

<400> 658

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20   25   30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35   40   45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50   55   60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Arg
65   70   75   80

Tyr Leu Gln Glu Ile Phe Ser Ser Glu Met Ser Lys Val Asp Asp Ser
                85   90   95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100   105   110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr

```
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Met Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Arg Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Arg Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320
```

```
Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
```

```
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Glu Phe Leu Ser Gly Lys Gln
    530                 535                 540

Lys Glu Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Lys Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg His Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Ile Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Ala Ile Gln Lys Ala Gln Val Ser Gly Gln Gly His Ser Leu
705                 710                 715                 720
```

```
His Glu Gln Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
               725                 730                 735

Ile Leu Gln Ser Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
        755                 760                 765

Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu
    770                 775                 780

Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val
785                 790                 795                 800

Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln
               805                 810                 815

Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu
            820                 825                 830

Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp
        835                 840                 845

Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly
    850                 855                 860

Lys Ser Asp Asp Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn
865                 870                 875                 880

Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe
               885                 890                 895

Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys
            900                 905                 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
```

```
        915                 920                 925

His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu
    930                 935                 940

Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys
945                 950                 955                 960

Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu
                965                 970                 975

Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val
            980                 985                 990

Gly Thr Ala Leu Ile Lys Lys Tyr  Pro Lys Leu Glu Ser  Glu Phe Val
        995                 1000                1005

Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg Lys Met  Ile Ala Lys
    1010                1015                1020

Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala Lys Arg  Phe Phe Tyr
    1025                1030                1035

Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu Ile Thr  Leu Ala Asn
    1040                1045                1050

Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu Thr Asn  Glu Glu Thr
    1055                1060                1065

Gly Glu  Ile Val Trp Asn Lys  Gly Arg Asp Phe Ala  Thr Val Arg
    1070                1075                1080

Lys Val  Leu Ser Met Pro Gln  Val Asn Ile Val Lys  Lys Thr Glu
    1085                1090                1095

Val Gln  Thr Gly Ala Leu Thr  Asn Glu Ser Ile Tyr  Ala Arg Gly
    1100                1105                1110
```

```
Ser Phe  Asp Lys Leu Ile Ser  Arg Lys His Arg Phe  Glu Ser Ser
    1115                1120                1125

Lys Tyr  Gly Gly Phe Gly Ser  Pro Thr Val Thr Tyr  Ser Val Leu
    1130                1135                1140

Val Val  Ala Lys Ser Lys Val  Gln Asp Gly Lys Val  Lys Lys Ile
    1145                1150                1155

Lys Thr  Gly Lys Glu Leu Ile  Gly Ile Thr Leu Leu  Asp Lys Leu
    1160                1165                1170

Val Phe  Glu Lys Asn Pro Leu  Lys Phe Ile Glu Asp  Lys Gly Tyr
    1175                1180                1185

Gly Asn  Val Gln Ile Asp Lys  Cys Ile Lys Leu Pro  Lys Tyr Ser
    1190                1195                1200

Leu Phe  Glu Phe Glu Asn Gly  Thr Arg Arg Met Leu  Ala Ser Val
    1205                1210                1215

Met Ala  Asn Asn Asn Ser Arg  Gly Asp Leu Gln Lys  Ala Asn Glu
    1220                1225                1230

Met Phe  Leu Pro Ala Lys Leu  Val Thr Leu Leu Tyr  His Ala His
    1235                1240                1245

Lys Ile  Glu Ser Ser Lys Glu  Leu Glu His Glu Ala  Tyr Ile Leu
    1250                1255                1260

Asp His  Tyr Asn Asp Leu Tyr  Gln Leu Leu Ser Tyr  Ile Glu Arg
    1265                1270                1275

Phe Ala  Ser Leu Tyr Val Asp  Val Glu Lys Asn Ile  Ser Lys Val
    1280                1285                1290

Lys Glu  Leu Phe Ser Asn Ile  Glu Ser Tyr Ser Ile  Ser Glu Ile
```

```
    1295                1300                1305

Cys Ser  Ser Val Ile Asn Leu  Leu Thr Leu Thr Ala  Ser Gly Ala
    1310                1315                1320

Pro Ala  Asp Phe Lys Phe Leu  Gly Thr Thr Ile Pro  Arg Lys Arg
    1325                1330                1335

Tyr Gly  Ser Pro Gln Ser Ile  Leu Ser Ser Thr Leu  Ile His Gln
    1340                1345                1350

Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile Asp Leu  Ser Gln Leu
    1355                1360                1365

Gly Gly  Asp
    1370
```

<210> 659
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<212> PRT
<213> Streptococcus dysgalactiae

<400> 659

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Arg
65                  70                  75                  80
```

```
Tyr Leu Gln Glu Ile Phe Ser Ser Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Met Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Arg Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Arg Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285
```

```
Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480
```

```
Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Glu Phe Leu Ser Gly Lys Gln
    530                 535                 540

Lys Glu Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Lys Glu Met Ile Glu Glu Arg Leu Lys Lys Tyr Ala
625                 630                 635                 640

Asn Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg His Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685
```

```
Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Ala Ile Gln Lys Ala Gln Val Ser Gly Gln Gly His Ser Leu
705                 710                 715                 720

His Glu Gln Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Ser Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
        755                 760                 765

Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu
    770                 775                 780

Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val
785                 790                 795                 800

Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln
                805                 810                 815

Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu
            820                 825                 830

Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp
        835                 840                 845

Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly
    850                 855                 860

Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn
865                 870                 875                 880
```

```
Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe
                885                 890                 895

Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys
            900                 905                 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925

His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu
    930                 935                 940

Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys
945                 950                 955                 960

Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu
                965                 970                 975

Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val
            980                 985                 990

Gly Thr Ala Leu Ile Lys Lys Tyr  Pro Lys Leu Glu Ser  Glu Phe Val
        995                 1000                1005

Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg Lys Met  Ile Ala Lys
    1010                1015                1020

Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala Lys Arg  Phe Phe Tyr
    1025                1030                1035

Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu Ile Thr  Leu Ala Asn
    1040                1045                1050

Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu Thr Asn  Glu Glu Thr
    1055                1060                1065

Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp Phe Ala  Thr Val Arg
    1070                1075                1080
```

```
Lys Val  Leu Ser Met Pro Gln  Val Asn Ile Val Lys  Lys Thr Glu
    1085                1090                1095

Val Gln  Thr Gly Ala Leu Thr  Asn Glu Ser Ile Tyr  Ala Arg Gly
    1100                1105                1110

Ser Phe  Asp Lys Leu Ile Ser  Arg Lys His Arg Phe  Glu Ser Ser
    1115                1120                1125

Lys Tyr  Gly Gly Phe Gly Ser  Pro Thr Val Thr Tyr  Ser Val Leu
    1130                1135                1140

Val Val  Ala Lys Ser Lys Val  Gln Asp Gly Lys Val  Lys Lys Ile
    1145                1150                1155

Lys Thr  Gly Lys Glu Leu Ile  Gly Ile Thr Leu Leu  Asp Lys Leu
    1160                1165                1170

Val Phe  Glu Lys Asn Pro Leu  Lys Phe Ile Glu Asp  Lys Gly Tyr
    1175                1180                1185

Gly Asn  Val Gln Ile Asp Lys  Cys Ile Lys Leu Pro  Lys Tyr Ser
    1190                1195                1200

Leu Phe  Glu Phe Glu Asn Gly  Thr Arg Arg Met Leu  Ala Ser Val
    1205                1210                1215

Met Ala  Asn Asn Asn Ser Arg  Gly Asp Leu Gln Lys  Ala Asn Glu
    1220                1225                1230

Met Phe  Leu Pro Ala Lys Leu  Val Thr Leu Leu Tyr  His Ala His
    1235                1240                1245

Lys Ile  Glu Ser Ser Lys Glu  Leu Glu His Glu Ala  Tyr Ile Leu
    1250                1255                1260
```

```
Asp His  Tyr Asn Asp Leu Tyr  Gln Leu Leu Ser Tyr  Ile Glu Arg
    1265                 1270                 1275


Phe Ala  Ser Leu Tyr Val Asp  Val Glu Lys Asn Ile  Ser Lys Val
    1280                 1285                 1290


Lys Glu  Leu Phe Ser Asn Ile  Glu Ser Tyr Ser Ile  Ser Glu Ile
    1295                 1300                 1305


Cys Ser  Ser Val Ile Asn Leu  Leu Thr Leu Thr Ala  Ser Gly Ala
    1310                 1315                 1320


Pro Ala  Asp Phe Lys Phe Leu  Gly Thr Thr Ile Pro  Arg Lys Arg
    1325                 1330                 1335


Tyr Gly  Ser Pro Gln Ser Ile  Leu Ser Ser Thr Leu  Ile His Gln
    1340                 1345                 1350


Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile Asp Leu  Ser Gln Leu
    1355                 1360                 1365


Gly Gly  Asp
    1370


<210>  660
<211>  1371
<212>  PRT
<213>  Streptococcus dysgalactiae

<400>  660

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45
```

```
Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Arg
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Ser Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Lys Pro Ile Asn Ala Ser Gly Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Lys Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
```

```
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asn Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445
```

```
Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Glu Phe Leu Ser Gly Lys Gln
    530                 535                 540

Lys Glu Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Lys Glu Met Ile Glu Glu Arg Leu Lys Lys Tyr Ala
625                 630                 635                 640

Asn Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg His Tyr
```

```
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Ala Ile Gln Lys Ala Gln Val Ser Gly Gln Gly His Ser Leu
705                 710                 715                 720

His Glu Gln Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Ser Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
        755                 760                 765

Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu
    770                 775                 780

Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val
785                 790                 795                 800

Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln
                805                 810                 815

Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu
            820                 825                 830

Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp
        835                 840                 845
```

```
Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly
    850                 855                 860

Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn
865                 870                 875                 880

Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe
                885                 890                 895

Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys
            900                 905                 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925

His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu
    930                 935                 940

Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys
945                 950                 955                 960

Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu
                965                 970                 975

Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val
            980                 985                 990

Gly Thr Ala Leu Ile Lys Lys Tyr  Pro Lys Leu Glu Ser  Glu Phe Val
        995                 1000                1005

Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg Lys Met  Ile Ala Lys
    1010                1015                1020

Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala Lys Arg  Phe Phe Tyr
    1025                1030                1035

Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu Ile Thr  Leu Ala Asn
```

```
    1040                1045                1050

Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu Thr Asn  Glu Glu Thr
    1055                1060                1065

Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp Phe Ala  Thr Val Arg
    1070                1075                1080

Lys Val  Leu Ser Met Pro Gln  Val Asn Ile Val Lys  Lys Thr Glu
    1085                1090                1095

Val Gln  Thr Gly Ala Leu Thr  Asn Glu Ser Ile Tyr  Ala Arg Gly
    1100                1105                1110

Ser Phe  Asp Lys Leu Ile Ser  Arg Lys His Arg Phe  Glu Ser Ser
    1115                1120                1125

Lys Tyr  Gly Gly Phe Gly Ser  Pro Thr Val Thr Tyr  Ser Val Leu
    1130                1135                1140

Val Val  Ala Lys Ser Lys Val  Gln Asp Gly Lys Val  Lys Lys Ile
    1145                1150                1155

Lys Thr  Gly Lys Glu Leu Ile  Gly Ile Thr Leu Leu  Asp Lys Leu
    1160                1165                1170

Val Phe  Glu Lys Asn Pro Leu  Lys Phe Ile Glu Asp  Lys Gly Tyr
    1175                1180                1185

Gly Asn  Val Gln Ile Asp Lys  Cys Ile Lys Leu Pro  Lys Tyr Ser
    1190                1195                1200

Leu Phe  Glu Phe Glu Asn Gly  Thr Arg Arg Met Leu  Ala Ser Val
    1205                1210                1215

Met Ala  Asn Asn Asn Ser Arg  Gly Asp Leu Gln Lys  Ala Asn Glu
    1220                1225                1230
```

```
Met Phe  Leu Pro Ala Lys Leu  Val Thr Leu Leu Tyr  His Ala His
    1235                1240                1245


Lys Ile  Glu Ser Ser Lys Glu  Leu Glu His Glu Ala  Tyr Ile Leu
    1250                1255                1260


Asp His  Tyr Asn Asp Leu Tyr  Gln Leu Leu Ser Tyr  Ile Glu Arg
    1265                1270                1275


Phe Ala  Ser Leu Tyr Val Asp  Val Glu Lys Asn Ile  Ser Lys Val
    1280                1285                1290


Lys Glu  Leu Phe Ser Asn Ile  Glu Ser Tyr Ser Ile  Ser Glu Ile
    1295                1300                1305


Cys Ser  Ser Val Ile Asn Leu  Leu Thr Leu Thr Ala  Ser Gly Ala
    1310                1315                1320


Pro Ala  Asp Phe Lys Phe Leu  Gly Thr Thr Ile Pro  Arg Lys Arg
    1325                1330                1335


Tyr Gly  Ser Pro Gln Ser Ile  Leu Ser Ser Thr Leu  Ile His Gln
    1340                1345                1350


Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile Asp Leu  Ser Gln Leu
    1355                1360                1365


Gly Gly  Asp
    1370


<210>  661
<211>  1370
<212>  PRT
<213>  Streptococcus gallolyticus

<400>  661

Met Thr Lys Lys Asn Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser
1               5                  10                  15
```

```
Val Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys
            20                  25                  30

Met Lys Val Leu Gly Asn Thr Asp Lys Lys Tyr Ile Lys Lys Asn Leu
        35                  40                  45

Leu Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg
    50                  55                  60

Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu
65                  70                  75                  80

Arg Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Thr Lys Val Asp Glu
                85                  90                  95

Ser Phe Phe Tyr Arg Leu Asp Glu Ser Phe Leu Thr Thr Asp Glu Lys
            100                 105                 110

Asp Phe Glu Arg His Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala
        115                 120                 125

Tyr His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Asn Tyr Leu Ala
    130                 135                 140

Asp Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala
145                 150                 155                 160

His Met Ile Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Asn
                165                 170                 175

Ala Glu Asn Thr Asp Val Gln Lys Leu Phe Thr Asp Phe Val Gly Val
            180                 185                 190

Tyr Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp
        195                 200                 205
```

```
Val Ala Ser Thr Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu
    210                 215                 220

Asn Leu Ile Lys Tyr Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly
225                 230                 235                 240

Asn Leu Ile Ala Leu Ala Leu Gly Leu Gln Pro Asn Phe Lys Met Asn
                245                 250                 255

Phe Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala
        275                 280                 285

Asp Leu Phe Thr Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Asp Asp Asn Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Lys Arg Tyr Val Glu His His Glu Asp Leu Glu Lys Leu
                325                 330                 335

Lys Glu Phe Ile Lys Ala Asn Lys Ser Glu Leu Tyr His Asp Ile Phe
            340                 345                 350

Lys Asp Lys Asn Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val
        355                 360                 365

Lys Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Asn Thr Leu Ser Lys Ile
    370                 375                 380

Asp Gly Ser Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His
                405                 410                 415
```

```
Leu Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Asp Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Lys Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Val Arg Lys Asp Ser Arg Phe Ala
    450                 455                 460

Trp Ala Glu Tyr Arg Ser Asp Glu Lys Ile Thr Pro Trp Asn Phe Asp
465                 470                 475                 480

Lys Val Ile Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met
                485                 490                 495

Thr Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser His Val Tyr Glu Thr Tyr Ala Val Tyr Asn Glu Leu Thr Lys Ile
        515                 520                 525

Lys Tyr Val Asn Glu Gln Gly Lys Glu Ser Phe Phe Asp Ser Asn Met
    530                 535                 540

Lys Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys Val Thr
545                 550                 555                 560

Lys Glu Lys Leu Leu Asn Tyr Leu Asn Lys Glu Phe Pro Glu Tyr Arg
                565                 570                 575

Ile Lys Asp Leu Ile Gly Leu Asp Lys Glu Asn Lys Ser Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Ala Phe
        595                 600                 605
```

```
Leu Asp Asp Lys Val Asn Glu Glu Val Ile Glu Asp Ile Ile Lys Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Lys Asp Met Ile His Glu Arg Leu Gln Lys
625                 630                 635                 640

Tyr Ser Asp Ile Phe Thr Ala Asn Gln Leu Lys Lys Leu Glu Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asn Lys Glu Asn Asn Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Ser Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Thr Leu
    690                 695                 700

Pro Phe Lys Gln Ile Ile Gln Lys Ser Gln Val Val Gly Asp Val Asp
705                 710                 715                 720

Asp Ile Glu Ala Val Val His Asp Leu Pro Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Asp Asn Pro Asp Asn Ile Val Ile Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Arg Gly Arg Ser Gln Ser Gln Gln Arg Leu Lys Lys
    770                 775                 780

Leu Gln Ser Ser Leu Lys Glu Leu Gly Ser Asn Ile Leu Asn Glu Glu
785                 790                 795                 800

Lys Pro Ser Tyr Ile Glu Asp Lys Val Glu Asn Ser His Leu Gln Asn
                805                 810                 815
```

```
Asp Gln Leu Phe Leu Tyr Tyr Ile Gln Asn Gly Lys Asp Met Tyr Thr
            820                 825                 830

Gly Asp Glu Leu Asp Ile Asp His Leu Ser Asp Tyr Asp Ile Asp His
        835                 840                 845

Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp Ser Ile Asp Asn Arg Val
    850                 855                 860

Leu Thr Ser Ser Ala Lys Asn Arg Gly Lys Ser Asp Asp Val Pro Ser
865                 870                 875                 880

Leu Asp Ile Val Arg Ala Arg Lys Ala Glu Trp Val Arg Leu Tyr Lys
                885                 890                 895

Ser Gly Leu Ile Ser Lys Arg Lys Phe Asp Asn Leu Thr Lys Ala Glu
            900                 905                 910

Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Gly Phe Ile Lys Arg Gln
        915                 920                 925

Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln Ile Leu Asp
    930                 935                 940

Ala Arg Phe Asn Thr Glu His Asp Glu Asn Asp Lys Val Ile Arg Asp
945                 950                 955                 960

Val Lys Val Ile Thr Leu Lys Ser Asn Leu Val Ser Gln Phe Arg Lys
                965                 970                 975

Asp Phe Glu Phe Tyr Lys Val Arg Glu Ile Asn Asp Tyr His His Ala
            980                 985                 990

His Asp Ala Tyr Leu Asn Ala Val  Val Gly Thr Ala Leu  Leu Lys Lys
        995                 1000                1005
```

```
Tyr Pro  Lys Leu Ala Ser Glu  Phe Val Tyr Gly Glu  Tyr Lys Lys
    1010                1015                1020

Tyr Asp  Ile Arg Lys Phe Ile  Thr Asn Ser Ser Asp  Lys Ala Thr
    1025                1030                1035

Ala Lys  Tyr Phe Phe Tyr Ser  Asn Leu Met Asn Phe  Phe Lys Thr
    1040                1045                1050

Lys Val  Lys Tyr Ala Asp Gly  Thr Val Phe Glu Arg  Pro Ile Ile
    1055                1060                1065

Glu Thr  Asn Ala Asp Gly Glu  Ile Ala Trp Asn Lys  Gln Ile Asp
    1070                1075                1080

Phe Glu  Lys Val Arg Lys Val  Leu Ser Tyr Pro Gln  Val Asn Ile
    1085                1090                1095

Val Lys  Lys Val Glu Thr Gln  Thr Gly Gly Phe Ser  Lys Glu Ser
    1100                1105                1110

Ile Leu  Pro Lys Gly Asp Ser  Asp Lys Leu Ile Pro  Arg Lys Thr
    1115                1120                1125

Lys Lys  Val Tyr Trp Asp Thr  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1130                1135                1140

Pro Thr  Val Ala Tyr Ser Val  Phe Val Val Ala Asp  Val Glu Lys
    1145                1150                1155

Gly Lys  Ala Lys Lys Leu Lys  Thr Val Lys Glu Leu  Val Gly Ile
    1160                1165                1170

Ser Ile  Met Glu Arg Ser Phe  Phe Glu Glu Asn Pro  Val Glu Phe
    1175                1180                1185

Leu Glu  Asn Lys Gly Tyr His  Asn Ile Arg Glu Asp  Lys Leu Ile
    1190                1195                1200
```

```
Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Phe Glu Gly  Gly Arg Arg
    1205                1210                1215

Arg Leu  Leu Ala Ser Ala Ser  Glu Leu Gln Lys Gly  Asn Glu Met
    1220                1225                1230

Val Leu  Pro Gly Tyr Leu Val  Glu Leu Leu Tyr His  Ala His Arg
    1235                1240                1245

Ala Asp  Asn Phe Asn Ser Thr  Glu Tyr Leu Asn Tyr  Val Ser Glu
    1250                1255                1260

His Lys  Lys Glu Phe Glu Lys  Val Leu Ser Cys Val  Glu Asp Phe
    1265                1270                1275

Ala Asn  Leu Tyr Val Asp Val  Glu Lys Asn Leu Ser  Lys Ile Arg
    1280                1285                1290

Ala Val  Ala Asp Ser Met Asp  Asn Phe Ser Ile Glu  Glu Ile Ser
    1295                1300                1305

Asn Ser  Phe Ile Asn Leu Leu  Thr Leu Thr Ala Leu  Gly Ala Pro
    1310                1315                1320

Ala Asp  Phe Asn Phe Leu Gly  Glu Lys Ile Pro Arg  Lys Arg Tyr
    1325                1330                1335

Thr Ser  Thr Lys Glu Cys Leu  Thr Ala Thr Leu Ile  His Gln Ser
    1340                1345                1350

Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Lys Leu Gly
    1355                1360                1365

Glu Glu
    1370
```

<210> 662
<211> 1375
<212> PRT
<213> Streptococcus infantarius

<400> 662

```
Met Glu Lys Ser Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Lys Tyr Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Val Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Lys Glu Met Thr Lys Val Asp Glu Ser
                85                  90                  95


Phe Phe Gln Arg Leu Glu Glu Ser Phe Leu Thr Asp Asp Asp Lys Thr
            100                 105                 110


Phe Asp Ser His Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala Tyr
        115                 120                 125


His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Tyr Leu Ala Asp
    130                 135                 140


Ser Gln Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Met Ile Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Ala
                165                 170                 175
```

```
Glu Asn Thr Asp Val Gln Lys Leu Phe Asn Val Phe Val Glu Thr Tyr
            180                 185                 190

Asp Lys Ile Val Asp Glu Ser His Leu Ser Glu Ile Glu Val Asp Ala
        195                 200                 205

Ser Ser Ile Leu Thr Glu Lys Val Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Lys Gln Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ala Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Val Gly Asp Asp Tyr Ala Asp
        275                 280                 285

Leu Phe Ile Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Asp Asp Asn Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Val Glu His His Glu Asp Leu Glu Lys Leu Lys
                325                 330                 335

Glu Phe Ile Lys Ile Asn Lys Leu Lys Leu Tyr His Asp Ile Phe Lys
            340                 345                 350

Asp Lys Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Asn Gly Val Lys
        355                 360                 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Thr Ile Leu Thr Lys Ile Asp
```

```
    370                 375                 380

Asp Ser Asp Tyr Phe Leu Asp Lys Ile Glu Arg Asp Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ser Ile Leu Arg Arg Gln Gly Asp Tyr Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Gln Ala Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Asp Ser Arg Phe Ala Trp
    450                 455                 460

Ala Asn Tyr His Ser Asp Glu Pro Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Val Val Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met Thr
                485                 490                 495

Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

His Val Tyr Glu Thr Phe Thr Val Tyr Asn Glu Leu Thr Lys Ile Lys
        515                 520                 525

Tyr Val Asn Glu Gln Gly Glu Ser Phe Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys Val Thr Lys
545                 550                 555                 560

Ala Lys Leu Leu Ser Tyr Leu Asn Asn Glu Phe Glu Glu Phe Arg Ile
                565                 570                 575
```

```
Asn Asp Leu Ile Gly Leu Asp Lys Asp Ser Lys Ser Phe Asn Ala Ser
            580                 585                 590

Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Ser Phe Leu
        595                 600                 605

Asp Asp Lys Thr Asn Gly Gln Ile Ile Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Asp Met Ile His Glu Arg Leu Gln Lys Tyr
625                 630                 635                 640

Ser Asp Phe Phe Thr Ser Gln Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile Arg
            660                 665                 670

Asn Lys Glu Asn Asn Lys Thr Ile Leu Asp Phe Leu Ile Asp Asp Gly
        675                 680                 685

His Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Glu Ser Leu Ser
    690                 695                 700

Phe Lys Thr Ile Ile Gln Glu Ala Gln Val Val Gly Asp Val Asp Asp
705                 710                 715                 720

Ile Glu Ala Val Val His Asp Leu Pro Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val Lys Val Met
            740                 745                 750

Gly Asp Asn Pro Asp Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gly Tyr Gly Arg Asn Lys Ser Asn Gln Arg Leu Lys Arg Leu
```

```
    770                 775                 780

Gln Asp Ser Leu Lys Glu Phe Gly Ser Asp Ile Leu Ser Lys Lys Lys
785                 790                 795                 800

Pro Ser Tyr Val Asp Ser Lys Val Glu Asn Ser His Leu Gln Asn Asp
                805                 810                 815

Arg Leu Phe Leu Tyr Tyr Ile Gln Asn Gly Lys Asp Met Tyr Thr Gly
            820                 825                 830

Glu Glu Leu Asp Ile Asp Arg Leu Ser Asp Tyr Asp Ile Asp His Ile
        835                 840                 845

Ile Pro Gln Ala Phe Ile Lys Asp Asn Ser Ile Asp Asn Lys Val Leu
    850                 855                 860

Thr Ser Ser Ala Lys Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Ile
865                 870                 875                 880

Glu Ile Val Arg Asn Arg Arg Ser Tyr Trp Tyr Lys Leu Tyr Lys Ser
                885                 890                 895

Gly Leu Ile Ser Lys Arg Lys Phe Asp Asn Leu Thr Lys Ala Glu Arg
            900                 905                 910

Gly Gly Leu Thr Glu Ala Asp Lys Ala Gly Phe Ile Lys Arg Gln Leu
        915                 920                 925

Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln Ile Leu Asp Ala
    930                 935                 940

Arg Phe Asn Thr Lys Arg Asp Glu Asn Asp Lys Val Ile Arg Asp Val
945                 950                 955                 960

Lys Val Ile Thr Leu Lys Ser Asn Leu Val Ser Gln Phe Arg Lys Glu
                965                 970                 975
```

```
Phe Lys Phe Tyr Lys Val Arg Glu Ile Asn Asp Tyr His His Ala His
            980                 985                 990


Asp Ala Tyr Leu Asn Ala Val Val  Gly Thr Ala Leu Leu  Lys Lys Tyr
        995                 1000                1005


Pro Lys  Leu Thr Pro Glu Phe  Val Tyr Gly Glu Tyr  Lys Lys Tyr
    1010                1015                1020


Asp Val  Arg Lys Leu Ile Ala  Lys Ser Ser Asp Asp  Tyr Ser Glu
    1025                1030                1035


Met Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe Tyr Ser  Asn Leu Met
    1040                1045                1050


Asn Phe  Phe Lys Thr Glu Val  Lys Tyr Ala Asp Gly  Arg Val Phe
    1055                1060                1065


Glu Arg  Pro Asp Ile Glu Thr  Asn Ala Asp Gly Glu  Val Val Trp
    1070                1075                1080


Asn Lys  Gln Lys Asp Phe Asp  Ile Val Arg Lys Val  Leu Ser Tyr
    1085                1090                1095


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Ala Gln  Thr Gly Gly
    1100                1105                1110


Phe Ser  Lys Glu Ser Ile Leu  Ser Lys Gly Asp Ser  Asp Lys Leu
    1115                1120                1125


Ile Pro  Arg Lys Thr Lys Lys  Val Tyr Trp Asn Thr  Lys Lys Tyr
    1130                1135                1140


Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr Ser Val  Leu Val Val
    1145                1150                1155


Ala Asp  Ile Glu Lys Gly Lys  Ala Lys Lys Leu Lys  Thr Val Lys
```

```
    1160                1165                1170

Glu Leu  Val Gly Ile Ser Ile  Met Glu Arg Ser Phe  Phe Glu Glu
    1175                1180                1185

Asn Pro  Val Ser Phe Leu Glu  Lys Lys Gly Tyr His  Asn Val Gln
    1190                1195                1200

Glu Asp  Lys Leu Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Phe
    1205                1210                1215

Glu Gly  Gly Arg Arg Arg Leu  Leu Ala Ser Ala Thr  Glu Leu Gln
    1220                1225                1230

Lys Gly  Asn Glu Val Met Leu  Pro Ala His Leu Val  Glu Leu Leu
    1235                1240                1245

Tyr His  Ala His Arg Ile Asp  Ser Phe Asn Ser Thr  Glu His Leu
    1250                1255                1260

Lys Tyr  Val Ser Glu His Lys  Lys Glu Phe Glu Lys  Val Leu Ser
    1265                1270                1275

Cys Val  Glu Asn Phe Ser Asn  Leu Tyr Val Asp Val  Glu Lys Asn
    1280                1285                1290

Leu Ser  Lys Val Arg Ala Ala  Ala Glu Ser Met Thr  Asn Phe Ser
    1295                1300                1305

Leu Glu  Glu Ile Ser Ala Ser  Phe Ile Asn Leu Leu  Thr Leu Thr
    1310                1315                1320

Ala Leu  Gly Ala Pro Ala Asp  Phe Asn Phe Leu Gly  Glu Lys Ile
    1325                1330                1335

Pro Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu Cys Leu  Ser Ala Thr
    1340                1345                1350
```

```
Leu Ile  His Gln Ser Val Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1355                1360                1365


Leu Ser  Lys Leu Gly Glu Glu
    1370                1375


<210>  663
<211>  1368
<212>  PRT
<213>  Streptococcus iniae

<400>  663

Met Arg Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30


Arg Ile Gln Gly Thr Thr Asp Arg Thr Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Asn Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Thr Arg Arg Arg Tyr Thr Arg Arg Lys Tyr Arg Ile Lys
65                  70                  75                  80


Glu Leu Gln Lys Ile Phe Ser Ser Glu Met Asn Glu Leu Asp Ile Ala
                85                  90                  95


Phe Phe Pro Arg Leu Ser Glu Ser Phe Leu Val Ser Asp Asp Lys Glu
            100                 105                 110


Phe Glu Asn His Pro Ile Phe Gly Asn Leu Lys Asp Glu Ile Thr Tyr
        115                 120                 125


His Asn Asp Tyr Pro Thr Ile Tyr His Leu Arg Gln Thr Leu Ala Asp
    130                 135                 140
```

```
Ser Asp Gln Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asn Leu Asp Ser
                165                 170                 175

Glu Asn Thr Asp Val His Val Leu Phe Leu Asn Leu Val Asn Ile Tyr
            180                 185                 190

Asn Asn Leu Phe Glu Glu Asp Ile Val Glu Thr Ala Ser Ile Asp Ala
        195                 200                 205

Glu Lys Ile Leu Thr Ser Lys Thr Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Glu Ile Pro Asn Gln Lys Arg Asn Met Leu Phe Gly Asn
225                 230                 235                 240

Leu Val Ser Leu Ala Leu Gly Leu Thr Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Glu Leu Leu Glu Asp Ala Lys Leu Gln Ile Ser Lys Asp Ser Tyr Glu
            260                 265                 270

Glu Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Ile Ala Ala Lys Lys Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Ile Thr Val Lys Gly Ala Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Val Gln Arg Tyr Glu Glu His Gln Gln Asp Leu Ala Leu Leu Lys
                325                 330                 335
```

```
Asn Leu Val Lys Lys Gln Ile Pro Glu Lys Tyr Lys Glu Ile Phe Asp
            340                 345                 350

Asn Lys Glu Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Tyr Ile Lys Pro Ile Leu Leu Lys Leu Asp
    370                 375                 380

Gly Thr Glu Lys Leu Ile Ser Lys Leu Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Asn Glu Leu Lys Ala Ile Ile Arg Arg Gln Glu Lys Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Gln Lys Lys Ile Glu Lys Leu Phe Thr Phe Lys Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Asn Gly Gln Ser Ser Phe Ala Trp
    450                 455                 460

Leu Lys Arg Gln Ser Asn Glu Ser Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Gln Glu Ala Ser Ala Arg Ala Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Thr Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Pro Leu Tyr Glu Met Phe Met Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Gln Thr Glu Gly Met Lys Arg Pro Val Phe Leu Ser Ser Glu Asp
    530                 535                 540
```

```
Lys Glu Glu Ile Val Asn Leu Leu Phe Lys Lys Glu Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Glu Tyr Phe Ser Lys Met Lys Cys Phe His
                565                 570                 575

Thr Val Thr Ile Leu Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Phe Lys Asp Lys Ala Phe Leu Asp
        595                 600                 605

Asp Glu Ala Asn Gln Asp Ile Leu Glu Glu Ile Val Trp Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Gln Ala Met Ile Glu Arg Arg Leu Val Lys Tyr Ala
625                 630                 635                 640

Asp Val Phe Glu Lys Ser Val Leu Lys Lys Leu Lys Lys Arg His Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Gln Lys Leu Ile Asn Gly Ile Lys Asp
            660                 665                 670

Lys Gln Thr Gly Lys Thr Ile Leu Gly Phe Leu Lys Asp Asp Gly Val
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Ser Ser Leu Asp Phe
    690                 695                 700

Ala Lys Ile Ile Lys Asn Glu Gln Glu Lys Thr Ile Lys Asn Glu Ser
705                 710                 715                 720

Leu Glu Glu Thr Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735
```

```
Gly Ile Leu Gln Ser Ile Lys Ile Val Asp Glu Ile Val Lys Ile Met
            740                 745                 750

Gly Gln Asn Pro Asp Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Ser Thr Met Gln Gly Ile Lys Asn Ser Arg Gln Arg Leu Arg Lys Leu
    770                 775                 780

Glu Glu Val His Lys Asn Thr Gly Ser Lys Ile Leu Lys Glu Tyr Asn
785                 790                 795                 800

Val Ser Asn Thr Gln Leu Gln Ser Asp Arg Leu Tyr Leu Tyr Leu Leu
                805                 810                 815

Gln Asp Gly Lys Asp Met Tyr Thr Gly Lys Glu Leu Asp Tyr Asp Asn
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ser Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Thr Val Leu Thr Thr Gln Ala Ser Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Asn Ile Glu Thr Val Asn Lys Met Lys
865                 870                 875                 880

Ser Phe Trp Tyr Lys Gln Leu Lys Ser Gly Ala Ile Ser Gln Arg Lys
                885                 890                 895

Phe Asp His Leu Thr Lys Ala Glu Arg Gly Ala Leu Ser Asp Phe Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Phe Asn Ser Asn Leu Thr
    930                 935                 940
```

```
Glu Asp Ser Lys Ser Asn Arg Asn Val Lys Ile Ile Thr Leu Lys Ser
945                 950                 955                 960


Lys Met Val Ser Asp Phe Arg Lys Asp Phe Gly Phe Tyr Lys Leu Arg
                965                 970                 975


Glu Val Asn Asp Tyr His His Ala Gln Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Val Gly Thr Ala Leu Leu Lys Lys  Tyr Pro Lys Leu Glu  Ala Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Lys His  Tyr Asp Leu Ala Lys  Leu Met Ile
    1010                1015                1020


Gln Pro  Asp Ser Ser Leu Gly  Lys Ala Thr Thr Arg  Met Phe Phe
    1025                1030                1035


Tyr Ser  Asn Leu Met Asn Phe  Phe Lys Lys Glu Ile  Lys Leu Ala
    1040                1045                1050


Asp Asp  Thr Ile Phe Thr Arg  Pro Gln Ile Glu Val  Asn Thr Glu
    1055                1060                1065


Thr Gly  Glu Ile Val Trp Asp  Lys Val Lys Asp Met  Gln Thr Ile
    1070                1075                1080


Arg Lys  Val Met Ser Tyr Pro  Gln Val Asn Ile Val  Met Lys Thr
    1085                1090                1095


Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Trp Pro Lys
    1100                1105                1110


Gly Asp  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Ser  Trp Asp Pro
    1115                1120                1125
```

```
Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Ile Ile Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Ile Ala  Lys Gly Lys Thr Gln  Lys Leu Lys
    1145                1150                1155

Thr Ile  Lys Glu Leu Val Gly  Ile Lys Ile Met Glu  Gln Asp Glu
    1160                1165                1170

Phe Glu  Lys Asp Pro Ile Ala  Phe Leu Glu Lys Lys  Gly Tyr Gln
    1175                1180                1185

Asp Ile  Gln Thr Ser Ser Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Leu Leu Ala  Ser Ala Lys
    1205                1210                1215

Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Asn  Lys Tyr Val
    1220                1225                1230

Lys Phe  Leu Tyr Leu Ala Ser  His Tyr Thr Lys Phe  Thr Gly Lys
    1235                1240                1245

Glu Glu  Asp Arg Glu Lys Lys  Arg Ser Tyr Val Glu  Ser His Leu
    1250                1255                1260

Tyr Tyr  Phe Asp Glu Ile Met  Gln Ile Ile Val Glu  Tyr Ser Asn
    1265                1270                1275

Arg Tyr  Ile Leu Ala Asp Ser  Asn Leu Ile Lys Ile  Gln Asn Leu
    1280                1285                1290

Tyr Lys  Glu Lys Asp Asn Phe  Ser Ile Glu Glu Gln  Ala Ile Asn
    1295                1300                1305

Met Leu  Asn Leu Phe Thr Phe  Thr Asp Leu Gly Ala  Pro Ser Ala
    1310                1315                1320
```

```
Phe Lys  Phe Phe Asn Gly Asp  Ile Asp Arg Lys Arg  Tyr Ser Ser
    1325                1330                1335


Thr Asn  Glu Ile Ile Asn Ser  Thr Leu Ile Tyr Gln  Ser Pro Thr
    1340                1345                1350


Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Lys Leu  Gly Gly Lys
    1355                1360                1365
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<210> 664
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<212> PRT
<213> Streptococcus mitis

<400> 664

```
Met Asn Asn Asn Asn Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser
1               5                   10                  15


Val Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys
            20                  25                  30


Met Lys Val Leu Gly Asn Thr Asp Lys His Phe Ile Lys Lys Asn Leu
        35                  40                  45


Ile Gly Ala Leu Leu Phe Asp Glu Gly Ala Thr Ala Glu Asp Arg Arg
    50                  55                  60


Phe Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu
65                  70                  75                  80


Arg Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Ser Lys Val Asp Ser
                85                  90                  95


Ser Phe Phe His Arg Leu Asp Asp Ser Phe Leu Val Pro Glu Asp Lys
            100                 105                 110


Arg Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Ala Glu Glu Lys Glu
```

```
        115                 120                 125

Tyr His Lys Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala
    130                 135                 140

Asp Ser Lys Glu Lys Thr Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala
145                 150                 155                 160

His Met Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Glu Ser Phe Asp
                165                 170                 175

Ile Lys Asn Asn Asp Ile Gln Lys Ile Phe Ser Glu Phe Ile Ser Ile
            180                 185                 190

Tyr Asp Asn Thr Phe Glu Gly Ser Ser Leu Ser Gly Gln Asn Ala Gln
        195                 200                 205

Val Glu Ala Ile Phe Thr Asp Lys Ile Ser Lys Ser Ala Lys Arg Glu
    210                 215                 220

Arg Ile Leu Lys Leu Phe Ala Tyr Glu Lys Ser Thr Asp Leu Phe Ser
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asp Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Asp Phe Ala
        275                 280                 285

Asp Leu Phe Leu Val Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320
```

```
Ser Met Ile Glu Arg Tyr Glu Asn His Gln Lys Asp Leu Ala Ala Leu
                325                 330                 335

Lys Gln Phe Ile Gln Asn Asn Leu Gln Glu Lys Tyr Asp Glu Val Phe
            340                 345                 350

Ser Asp Gln Ser Lys Asp Gly Tyr Ala Arg Tyr Ile Asn Gly Lys Thr
        355                 360                 365

Thr Gln Glu Ala Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Phe
    370                 375                 380

Glu Gly Ser Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His
                405                 410                 415

Leu Gln Glu Met Asn Ala Ile Ile Arg Arg Gln Gly Glu His Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Tyr Lys Glu Lys Ile Glu Thr Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Arg Asn Phe Ala
    450                 455                 460

Trp Leu Thr Arg Asn Ser Asp Gln Ala Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Glu Ile Val Asp Gln Ala Ser Ser Ala Glu Glu Phe Ile Asn Lys Met
                485                 490                 495

Thr Asn Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val
```

```
        515                 520                 525

Lys Phe Ile Ser Glu Gly Leu Arg Asp Tyr Gln Phe Leu Asp Ser Gly
    530                 535                 540

Gln Lys Lys Gln Ile Val Asn Gln Leu Phe Lys Glu Lys Arg Lys Val
545                 550                 555                 560

Thr Glu Lys Asp Ile Ile Gln Tyr Leu His Asn Val Asp Gly Tyr Asp
                565                 570                 575

Gly Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Glu Phe Met Asp
        595                 600                 605

Asp Pro Lys Asn Glu Glu Ile Leu Glu Asn Ile Val His Thr Leu Thr
    610                 615                 620

Ile Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln Tyr Ala
625                 630                 635                 640

Ser Ile Phe Asp Lys Lys Val Ile Lys Ala Leu Thr Arg Arg His Tyr
                645                 650                 655

Thr Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Cys Asp
            660                 665                 670

Lys Lys Thr Gly Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Tyr
        675                 680                 685

Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu Ser Phe
    690                 695                 700

Lys Asp Ile Ile Gln Lys Ala Gln Val Val Gly Lys Thr Asn Asp Val
705                 710                 715                 720
```

```
Lys Gln Val Val Gln Glu Leu Pro Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Ser Ile Lys Leu Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

His Ala Pro Glu Ser Ile Val Ile Glu Ile Ala Arg Glu Asn Gln Thr
        755                 760                 765

Thr Ala Arg Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile Glu
    770                 775                 780

Asp Ala Leu Lys Asn Leu Ala Pro Gly Leu Asp Ser Asn Ile Leu Lys
785                 790                 795                 800

Glu His Pro Thr Asp Asn Ile Gln Leu Gln Asn Asp Arg Leu Phe Leu
                805                 810                 815

Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Glu Ala Leu Asp
            820                 825                 830

Ile Asn Gln Leu Ser Ser Tyr Asp Ile Asp His Ile Val Pro Gln Ala
        835                 840                 845

Phe Ile Lys Asp Asp Ser Leu Asp Asn Arg Val Leu Thr Ser Ser Lys
    850                 855                 860

Asp Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Leu Glu Val Val Gln
865                 870                 875                 880

Lys Arg Lys Ala Phe Trp Gln Gln Leu Leu Asp Ser Lys Leu Ile Ser
                885                 890                 895

Glu His Lys Phe Asn Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Asp
            900                 905                 910

Glu Arg Asp Lys Val Gly Phe Ile Arg Arg Gln Leu Val Glu Thr Arg
```

```
        915                 920                 925

Gln Ile Thr Lys His Val Ala Gln Ile Leu Asp Ala Arg Phe Asn Thr
    930                 935                 940

Glu Val Asn Glu Lys Asp Lys Lys Asn Arg Thr Val Lys Ile Ile Thr
945                 950                 955                 960

Leu Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Lys Leu Tyr
                965                 970                 975

Lys Val Arg Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu
            980                 985                 990

Asn Ala Val Val Ala Lys Ala Ile  Leu Lys Lys Tyr Pro  Lys Leu Glu
        995                 1000                1005

Pro Gly  Phe Val Tyr Gly Asp  Tyr Gln Lys Tyr Asp  Ile Lys Arg
    1010                1015                1020

Tyr Ile  Ser Arg Ser Lys Asp  Pro Lys Glu Val Glu  Lys Ala Thr
    1025                1030                1035

Glu Lys  Tyr Phe Phe Tyr Ser  Asn Leu Leu Asn Phe  Phe Lys Glu
    1040                1045                1050

Glu Val  His Tyr Ala Asp Gly  Thr Ile Val Lys Arg  Glu Asn Ile
    1055                1060                1065

Glu Tyr  Ser Lys Asp Thr Gly  Glu Ile Ala Trp Asn  Lys Glu Lys
    1070                1075                1080

Asp Phe  Ala Thr Ile Lys Lys  Val Leu Ser Leu Pro  Gln Val Asn
    1085                1090                1095

Ile Val  Lys Lys Thr Glu Ile  Gln Thr His Gly Leu  Asp Arg Gly
    1100                1105                1110
```

```
Lys Pro  Arg Gly Leu Phe Asn  Ser Asn Pro Ser Pro  Lys Pro Ser
    1115                1120                1125

Glu Asp  Arg Lys Glu Asn Leu  Val Pro Ile Lys Gln  Gly Leu Asp
    1130                1135                1140

Pro Arg  Lys Tyr Gly Gly Tyr  Ala Gly Ile Ser Asn  Ser Tyr Ala
    1145                1150                1155

Val Leu  Val Lys Ala Ile Ile  Glu Lys Gly Ala Lys  Lys Gln Gln
    1160                1165                1170

Lys Thr  Val Leu Glu Phe Gln  Gly Ile Ser Ile Leu  Asp Lys Ile
    1175                1180                1185

Asn Phe  Glu Lys Asn Lys Glu  Asn Tyr Leu Leu Glu  Lys Gly Tyr
    1190                1195                1200

Ile Lys  Ile Leu Ser Thr Ile  Thr Leu Pro Lys Tyr  Ser Leu Phe
    1205                1210                1215

Glu Phe  Pro Asp Gly Thr Arg  Arg Arg Leu Ala Ser  Ile Leu Ser
    1220                1225                1230

Thr Asn  Asn Lys Arg Gly Glu  Ile His Lys Gly Asn  Glu Leu Val
    1235                1240                1245

Ile Pro  Glu Lys Tyr Thr Thr  Leu Leu Tyr His Ala  Lys Asn Ile
    1250                1255                1260

Asn Lys  Thr Leu Glu Pro Glu  His Leu Glu Tyr Val  Glu Lys His
    1265                1270                1275

Arg Asn  Asp Phe Ala Lys Leu  Leu Glu Tyr Val Leu  Asn Phe Asn
    1280                1285                1290

Asp Lys  Tyr Val Gly Ala Leu  Lys Asn Gly Glu Arg  Ile Arg Gln
```

```
    1295                1300                1305

Ala Phe  Ile Asp Trp Glu Thr  Val Asp Ile Glu Lys  Leu Cys Phe
    1310                1315                1320

Ser Phe  Ile Gly Pro Arg Asn  Ser Lys Asn Ala Gly  Leu Phe Glu
    1325                1330                1335

Leu Thr  Ser Gln Gly Ser Ala  Ser Asp Phe Glu Phe  Leu Gly Val
    1340                1345                1350

Lys Ile  Pro Arg Tyr Arg Asp  Tyr Thr Pro Ser Ser  Leu Leu Asn
    1355                1360                1365

Ala Thr  Leu Ile His Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg
    1370                1375                1380

Ile Asp  Leu Ser Lys Leu Gly  Glu Asp
    1385                1390
```

<210> 665
<211> 1134
<212> PRT
<213> Streptococcus mutans

<400> 665

```
Met Ala Asn Gly Lys Ile Leu Gly Leu Asp Ile Gly Ile Ala Ser Val
1               5                   10                  15

Gly Val Gly Ile Ile Asp Lys Glu Thr Gly Lys Ile Ile His Val Asn
            20                  25                  30

Ser Arg Ile Phe Pro Ala Ala Thr Ala Asp Ser Asn Val Glu Arg Arg
        35                  40                  45

Gly Phe Arg Gln Gly Arg Arg Leu Val Arg Arg Lys Lys His Arg Lys
    50                  55                  60
```

```
Val Arg Leu Ala Asp Leu Phe Leu Asp Ser Asn Leu Leu Thr Asp Phe
65                  70                  75                  80

Ser Lys Val Ser Leu Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly
                85                  90                  95

Leu Asn Glu Glu Leu Ser Asn Glu Glu Leu Phe Ile Ala Leu Lys Ser
            100                 105                 110

Ile Val Ser Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Glu Asp
        115                 120                 125

Ser Gly Ala Asn Ser Ser Glu Tyr Gly Lys Ala Val Glu Glu Asn Arg
    130                 135                 140

Lys Leu Leu Glu Asp Arg Thr Pro Gly Gln Ile Gln Leu Glu Arg Phe
145                 150                 155                 160

Glu Lys Tyr Gly Lys Val Arg Gly Asp Phe Thr Val Val Glu Asn Gly
                165                 170                 175

Glu Asn His Arg Leu Ile Asn Val Phe Ser Thr Ser Ala Tyr Lys Lys
            180                 185                 190

Glu Ala Glu Arg Ile Leu Arg Arg Gln Gln Glu Phe Asn Met Arg Ile
        195                 200                 205

Ala Asp Glu Phe Ile Glu Ala Tyr Leu Thr Ile Leu Thr Gly Lys Arg
    210                 215                 220

Lys Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly
225                 230                 235                 240

Arg Phe Arg Thr Asp Gly Thr Thr Leu Asp Asn Ile Phe Gly Ile Leu
                245                 250                 255

Ile Gly Lys Cys Thr Phe Tyr Pro Asp Glu Tyr Arg Ala Ala Lys Ala
            260                 265                 270
```

```
Ser Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu
        275                 280                 285

Thr Val Pro Thr Glu Thr Lys Lys Leu Ser Glu Glu Gln Lys Arg Gln
    290                 295                 300

Ile Ile Glu His Ala Lys Thr Val Lys Thr Leu Gly Ala Pro Thr Leu
305                 310                 315                 320

Leu Lys Tyr Ile Val Lys Leu Val Gly Cys Ser Ala Asp Asp Ile Lys
                325                 330                 335

Gly Tyr Arg Ile Asp Lys Ser Asp Lys Pro Glu Ile His Thr Phe Glu
            340                 345                 350

Ala Tyr Arg Lys Met Arg Thr Met Glu Leu Ile Lys Val Asp Asp Leu
        355                 360                 365

Ser Arg Glu Ser Leu Asp Ala Leu Ala His Ile Leu Thr Leu Asn Thr
    370                 375                 380

Glu Arg Glu Gly Ile Glu Glu Ala Ile Arg Asp Arg Phe Thr Asn Lys
385                 390                 395                 400

Glu Phe Asn Gln Glu Gln Ile Asn Glu Leu Val Leu Phe Arg Lys Asn
                405                 410                 415

Asn Ser Ser Leu Phe Gly Lys Gly Trp His Asn Phe Ser Leu Lys Leu
            420                 425                 430

Met Lys Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met
        435                 440                 445

Thr Ile Leu Thr Arg Leu Gly Lys Gln Arg Val Lys Lys Ser Ser Asn
    450                 455                 460
```

```
Arg Thr Asn Tyr Ile Asp Glu Lys Glu Leu Thr Glu Glu Ile Tyr Asn
465                 470                 475                 480

Pro Val Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Ile Asn Leu
                485                 490                 495

Ala Thr Lys Lys Tyr Gly Val Phe Asp Asn Ile Val Ile Glu Met Ala
            500                 505                 510

Arg Glu Ser Asn Glu Asp Asp Glu Lys Lys Ala Ile Gln Asn Ala Gln
        515                 520                 525

Lys Ala Asn Glu Asp Glu Lys Lys Ala Ala Leu Leu Lys Ala Ala His
    530                 535                 540

Gln Phe Asn Gly Lys Glu Glu Leu Pro Asp Ser Ile Phe His Gly His
545                 550                 555                 560

Lys Glu Leu Leu Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Lys
                565                 570                 575

Cys Leu Tyr Thr Gly Lys Thr Ile Phe Ile Asn Asp Leu Ile His Asn
            580                 585                 590

Pro Tyr Lys Tyr Glu Ile Asp His Ile Leu Pro Leu Ser Leu Ser Phe
        595                 600                 605

Asp Asp Ser Leu Ala Asn Lys Val Leu Val Leu Ser Thr Ala Asn Gln
    610                 615                 620

Glu Lys Gly Gln Arg Thr Pro Phe Gln Ser Leu Asp Ser Met Asp Gly
625                 630                 635                 640

Ala Trp Thr Tyr Arg Glu Phe Lys Ser Tyr Val Lys Gly Leu Lys Thr
                645                 650                 655

Leu Ser Asn Lys Lys Lys Asp Tyr Leu Leu Thr Glu Glu Asn Ile Asp
            660                 665                 670
```

```
Lys Ile Glu Val Lys Gln Lys Phe Ile Glu Arg Asn Leu Val Asp Thr
        675                 680                 685

Arg Tyr Ser Ser Arg Val Val Leu Asn Ala Leu Gln Asp Phe Tyr Lys
    690                 695                 700

Glu Arg Lys Phe Asp Thr Lys Ile Ser Val Val Arg Gly Gln Phe Thr
705                 710                 715                 720

Ser Gln Leu Arg Arg Lys Trp Arg Ile Glu Lys Thr Arg Glu Thr Tyr
                725                 730                 735

His His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu
            740                 745                 750

Asn Leu Trp Lys Lys Gln Asn Asn Pro Leu Ile Ser Tyr Lys Glu Asp
        755                 760                 765

Gln Phe Val Asp Pro Glu Thr Gly Glu Ile Leu Ser Leu Ser Asp Asp
    770                 775                 780

Glu Tyr Lys Lys Leu Val Phe Lys Ala Pro Tyr Glu His Phe Val Asp
785                 790                 795                 800

Thr Leu Lys Ser Lys Lys Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln
                805                 810                 815

Val Asp Ser Lys Tyr Asn Arg Lys Ile Ser Gly Ala Thr Ile Cys Gly
            820                 825                 830

Thr Arg Lys Ala Gln Leu Gly Lys Asp Thr Gln Glu Glu Thr Tyr Val
        835                 840                 845

Leu Gly Lys Ile Lys Asp Ile Tyr Ser Gln Lys Gly Tyr Glu Asp Phe
    850                 855                 860
```

```
Ile Lys Lys Tyr Lys Lys Asp Lys Thr Gln Phe Leu Met Tyr His Lys
865                 870                 875                 880


Asp Pro Gln Thr Phe Glu Lys Val Ile Glu Glu Ile Leu Lys Thr Tyr
                885                 890                 895


Pro Asp Lys Glu Leu Asn Glu Lys Gly Lys Glu Val Ser Cys Asn Pro
            900                 905                 910


Phe Glu Lys Tyr Arg Gln Glu Asn Gly Pro Val Arg Lys Tyr Ser Lys
        915                 920                 925


Lys Gly Asn Gly Pro Glu Ile Lys Ser Leu Lys Tyr Tyr Asp Glu Val
    930                 935                 940


Leu Gly Lys Asn Ile Asp Ile Thr Pro Lys Asn Ser Leu Asn Lys Val
945                 950                 955                 960


Val Leu Arg Ser Leu Asn Pro Trp Arg Thr Asp Val Tyr Phe Asn His
                965                 970                 975


Glu Thr Arg Lys Tyr Glu Phe Leu Gly Leu Lys Tyr Ser Asp Leu Arg
            980                 985                 990


Tyr Leu Lys Gly Glu His Arg Tyr  Gly Ile Leu Ile Gly  Asp Tyr Lys
        995                 1000                1005


Lys Ile  Lys Asp Lys Glu Gly  Ile Glu Lys Glu Ser  Glu Phe Lys
    1010                1015                1020


Phe Thr  Leu Tyr Lys Asn Asp  Leu Ile Leu Ile Lys  Asp Thr Ala
    1025                1030                1035


Lys Gly  Lys Glu Glu Leu Phe  Arg Phe Trp Ser Arg  Thr Gly Lys
    1040                1045                1050


Asp Asn  Ala Lys Thr Phe Glu  Lys Asn Lys Ile Glu  Leu Lys Pro
    1055                1060                1065
```

```
Tyr Ser  Lys Ser Gln Phe Glu  Lys Gly Glu Asp Thr  Asn Val Leu
    1070                1075                1080


Gly Lys  Leu Tyr Ala Ser Ser  Asn Gln Leu Gln Lys  Ser Phe Gly
    1085                1090                1095


Thr Leu  Glu Asn Leu Ser Ile  Tyr Lys Val Arg Thr  Asp Val Leu
    1100                1105                1110


Gly Asn  Lys Tyr Phe Ile Lys  Lys Glu Gly Asp Lys  Pro Gln Leu
    1115                1120                1125


Asn Phe  Lys Lys Lys Leu
    1130
```

<210> 666
<211> 1134
<212> PRT
<213> Streptococcus mutans

<400> 666

```
Met Ala Asn Gly Lys Ile Leu Gly Leu Asp Ile Gly Ile Ala Ser Val
1               5                   10                  15


Gly Val Gly Ile Ile Asp Lys Glu Thr Gly Lys Ile Ile His Val Asn
            20                  25                  30


Ser Arg Ile Phe Pro Ala Ala Thr Ala Asp Ser Asn Val Glu Arg Arg
        35                  40                  45


Gly Phe Arg Gln Gly Arg Arg Leu Val Arg Arg Lys Lys His Arg Lys
    50                  55                  60


Val Arg Leu Ala Asp Leu Phe Leu Asp Ser Asn Leu Leu Thr Asp Phe
65                  70                  75                  80


Ser Lys Val Ser Leu Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly
```

```
                85                  90                  95

Leu Asn Glu Glu Leu Ser Asn Glu Glu Leu Phe Ile Ala Leu Lys Ser
            100                 105                 110

Ile Val Ser Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Glu Asp
        115                 120                 125

Ser Gly Ala Asn Ser Ser Glu Tyr Gly Lys Ala Val Glu Glu Asn Arg
    130                 135                 140

Lys Leu Leu Glu Asp Arg Thr Pro Gly Gln Ile Gln Leu Glu Arg Phe
145                 150                 155                 160

Glu Lys Tyr Gly Lys Val Arg Gly Asp Phe Thr Val Val Glu Asn Gly
                165                 170                 175

Glu Asn His Arg Leu Ile Asn Val Phe Ser Thr Ser Ala Tyr Lys Lys
            180                 185                 190

Glu Ala Glu Arg Ile Leu Arg Arg Gln Gln Glu Phe Asn Met Arg Ile
        195                 200                 205

Ala Asp Glu Phe Ile Glu Ala Tyr Leu Thr Ile Leu Thr Gly Lys Arg
    210                 215                 220

Lys Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly
225                 230                 235                 240

Arg Phe Arg Thr Asp Gly Thr Thr Leu Asp Asn Ile Phe Gly Ile Leu
                245                 250                 255

Ile Gly Lys Cys Thr Phe Tyr Pro Asp Glu Tyr Arg Ala Ala Lys Ala
            260                 265                 270

Ser Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu
        275                 280                 285
```

```
Thr Val Pro Thr Glu Thr Lys Lys Leu Ser Glu Glu Gln Lys Arg Gln
    290                 295                 300

Ile Ile Glu His Ala Lys Thr Val Lys Thr Leu Gly Ala Pro Thr Leu
305                 310                 315                 320

Leu Lys Tyr Ile Val Lys Leu Val Gly Cys Ser Ala Asp Asp Ile Lys
                325                 330                 335

Gly Tyr Arg Ile Asp Lys Ser Asp Lys Pro Glu Ile His Thr Phe Glu
            340                 345                 350

Ala Tyr Arg Lys Met Arg Thr Met Glu Leu Ile Lys Val Asp Asp Leu
        355                 360                 365

Ser Arg Glu Ser Leu Asp Ala Leu Ala His Ile Leu Thr Leu Asn Thr
    370                 375                 380

Glu Arg Glu Gly Ile Glu Glu Ala Ile Arg Asp Arg Phe Thr Asn Lys
385                 390                 395                 400

Glu Phe Asn Gln Glu Gln Ile Asn Glu Leu Val Leu Phe Arg Lys Asn
                405                 410                 415

Asn Ser Ser Leu Phe Gly Lys Gly Trp His Asn Phe Ser Leu Lys Leu
            420                 425                 430

Met Lys Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met
        435                 440                 445

Thr Ile Leu Thr Arg Leu Gly Lys Gln Arg Val Lys Lys Ser Ser Asn
    450                 455                 460

Arg Thr Asn Tyr Ile Asp Glu Lys Glu Leu Thr Glu Glu Ile Tyr Asn
465                 470                 475                 480

Pro Val Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Ile Asn Leu
```

```
                485                 490                 495

Ala Thr Lys Lys Tyr Gly Val Phe Asp Asn Ile Val Ile Glu Met Ala
            500                 505                 510

Arg Glu Ser Asn Glu Asp Asp Glu Lys Lys Ala Ile Gln Asn Ala Gln
        515                 520                 525

Lys Ala Asn Glu Asp Glu Lys Lys Ala Ala Leu Leu Lys Ala Ala His
    530                 535                 540

Gln Phe Asn Gly Lys Glu Glu Leu Pro Asp Ser Ile Phe His Gly His
545                 550                 555                 560

Lys Glu Leu Leu Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Lys
                565                 570                 575

Cys Leu Tyr Thr Gly Lys Thr Ile Phe Ile Asn Asp Leu Ile His Asn
            580                 585                 590

Pro Tyr Lys Tyr Glu Ile Asp His Ile Leu Pro Leu Ser Leu Ser Phe
        595                 600                 605

Asp Asp Ser Leu Ala Asn Lys Val Leu Val Leu Ser Thr Ala Asn Gln
    610                 615                 620

Glu Lys Gly Gln Arg Thr Pro Phe Gln Ser Leu Asp Ser Met Asp Gly
625                 630                 635                 640

Ala Trp Thr Tyr Arg Glu Phe Lys Ser Tyr Val Lys Gly Leu Lys Thr
                645                 650                 655

Leu Ser Asn Lys Lys Lys Asp Tyr Leu Leu Thr Glu Glu Asn Ile Asp
            660                 665                 670

Lys Ile Glu Val Lys Gln Lys Phe Ile Glu Arg Asn Leu Val Asp Thr
        675                 680                 685
```

```
Arg Tyr Ser Ser Arg Val Val Leu Asn Ala Leu Gln Asp Phe Tyr Lys
    690                 695                 700

Glu Arg Lys Phe Asp Thr Lys Ile Ser Val Val Arg Gly Gln Phe Thr
705                 710                 715                 720

Ser Gln Leu Arg Arg Lys Trp Arg Ile Glu Lys Thr Arg Glu Thr Tyr
                725                 730                 735

His His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu
            740                 745                 750

Asn Leu Trp Lys Lys Gln Asn Asn Pro Leu Ile Ser Tyr Lys Glu Asp
        755                 760                 765

Gln Phe Val Asp Pro Glu Thr Gly Glu Ile Leu Ser Leu Ser Asp Asp
    770                 775                 780

Glu Tyr Lys Lys Leu Val Phe Lys Ala Pro Tyr Glu His Phe Val Asp
785                 790                 795                 800

Thr Leu Lys Ser Lys Lys Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln
                805                 810                 815

Val Asp Ser Lys Tyr Asn Arg Lys Ile Ser Gly Ala Thr Ile Cys Gly
            820                 825                 830

Thr Arg Lys Ala Gln Leu Gly Lys Asp Thr Gln Glu Glu Thr Tyr Val
        835                 840                 845

Leu Gly Lys Ile Lys Asp Ile Tyr Ser Gln Lys Gly Tyr Glu Asp Phe
    850                 855                 860

Ile Lys Lys Tyr Lys Lys Asp Lys Thr Gln Phe Leu Met Tyr His Lys
865                 870                 875                 880

Asp Pro Gln Thr Phe Glu Lys Val Ile Glu Glu Ile Leu Lys Thr Tyr
```

```
               885                 890                 895

Pro Asp Lys Glu Leu Asn Glu Lys Gly Lys Glu Val Ser Cys Asn Pro
            900                 905                 910

Phe Glu Lys Tyr Arg Gln Glu Asn Gly Pro Val Arg Lys Tyr Ser Lys
        915                 920                 925

Lys Gly Asn Gly Pro Glu Ile Lys Ser Leu Lys Tyr Tyr Asp Glu Val
    930                 935                 940

Leu Gly Lys Asn Ile Asp Ile Thr Pro Lys Asn Ser Leu Asn Lys Val
945                 950                 955                 960

Val Leu Arg Ser Leu Asn Pro Trp Arg Thr Asp Val Tyr Phe Asn His
               965                 970                 975

Glu Thr Arg Lys Tyr Glu Phe Leu Gly Leu Lys Tyr Ser Asp Leu Arg
            980                 985                 990

Tyr Leu Lys Gly Glu His Arg Tyr  Gly Ile Leu Ile Gly  Asp Tyr Lys
        995                 1000                1005

Lys Ile  Lys Asp Lys Glu Gly  Ile Glu Lys Glu Ser  Glu Phe Lys
    1010                1015                1020

Phe Thr  Leu Tyr Lys Asn Asp  Leu Ile Leu Ile Lys  Asp Thr Ala
    1025                1030                1035

Lys Gly  Lys Glu Glu Leu Phe  Arg Phe Trp Ser Arg  Thr Gly Lys
    1040                1045                1050

Asp Asn  Ala Lys Thr Phe Glu  Lys Asn Lys Ile Glu  Leu Lys Pro
    1055                1060                1065

Tyr Ser  Lys Ser Gln Phe Glu  Lys Gly Glu Asp Thr  Asn Val Leu
    1070                1075                1080
```

```
Gly Lys  Leu Tyr Ala Ser Ser  Asn Gln Leu Gln Lys  Ser Phe Gly
    1085                1090                1095


Thr Leu  Glu Asn Leu Ser Ile  Tyr Lys Val Arg Thr  Asp Val Leu
    1100                1105                1110


Gly Asn  Lys Tyr Phe Ile Lys  Lys Glu Gly Asp Lys  Pro Gln Leu
    1115                1120                1125


Asn Phe  Lys Lys Lys Leu
    1130
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<210> 667
<211> 1128
<212> PRT
<213> Streptococcus mutans

<400> 667

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Met Ala Asn Ser Lys Ile Leu Gly Leu Asp Ile Gly Ile Ala Ser Val
1               5                   10                  15


Gly Val Gly Ile Ile Asp Lys Glu Thr Gly Lys Ile Ile His Val Asn
            20                  25                  30


Ser Arg Ile Phe Pro Ala Ala Thr Ala Asp Ser Asn Val Glu Arg Arg
        35                  40                  45


Gly Phe Arg Gln Gly Arg Arg Leu Val Arg Arg Lys Lys His Arg Lys
    50                  55                  60


Val Arg Leu Ala Asp Leu Phe Leu Asp Ser Asn Leu Leu Thr Asp Phe
65                  70                  75                  80


Ser Lys Val Ser Leu Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly
                85                  90                  95


Leu Asn Glu Glu Leu Ser Asn Glu Glu Leu Phe Ile Ala Leu Lys Ser
            100                 105                 110
```

```
Ile Val Ser Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Glu Asp
        115                 120                 125

Ser Gly Ala Asn Ser Ser Glu Tyr Gly Lys Ala Val Glu Glu Asn Arg
    130                 135                 140

Lys Leu Leu Glu Asp Arg Thr Pro Gly Gln Ile Gln Leu Glu Arg Phe
145                 150                 155                 160

Glu Lys Tyr Gly Lys Val Arg Gly Asp Phe Thr Val Val Glu Asn Gly
                165                 170                 175

Glu Asn His Arg Leu Ile Asn Val Phe Ser Thr Ser Ala Tyr Lys Lys
            180                 185                 190

Glu Ala Glu Arg Ile Leu Arg Arg Gln Gln Glu Phe Asn Ile Arg Ile
        195                 200                 205

Ala Asp Glu Phe Ile Glu Ala Tyr Leu Thr Ile Leu Thr Gly Lys Arg
    210                 215                 220

Lys Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly
225                 230                 235                 240

Arg Phe Arg Thr Asp Gly Thr Thr Leu Asp Asn Ile Phe Gly Ile Leu
                245                 250                 255

Ile Gly Lys Cys Thr Phe Tyr Pro Asp Glu Tyr Arg Ala Ala Lys Ala
            260                 265                 270

Ser Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu
        275                 280                 285

Thr Val Pro Thr Glu Thr Lys Lys Leu Ser Glu Glu Gln Lys Arg Gln
    290                 295                 300
```

```
Ile Ile Glu His Ala Lys Thr Val Lys Thr Leu Gly Ala Pro Thr Leu
305                 310                 315                 320

Leu Lys Tyr Ile Ala Lys Leu Val Gly Cys Ser Ala Asp Asp Ile Lys
                325                 330                 335

Gly Tyr Arg Ile Asp Lys Ser Asp Lys Pro Glu Ile His Thr Phe Glu
            340                 345                 350

Ala Tyr Arg Lys Met Arg Thr Met Glu Leu Ile Lys Val Ala Asp Leu
        355                 360                 365

Ser Arg Glu Ser Leu Asp Ala Leu Ala His Ile Leu Thr Leu Asn Thr
    370                 375                 380

Glu Arg Glu Gly Ile Glu Glu Ala Ile Arg Asp Arg Phe Thr Asn Lys
385                 390                 395                 400

Glu Phe Asn Gln Glu Gln Ile Asn Glu Leu Val Leu Phe Arg Lys Asn
                405                 410                 415

Asn Ser Ser Leu Phe Gly Lys Gly Trp His Asn Phe Ser Leu Lys Leu
            420                 425                 430

Met Lys Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met
        435                 440                 445

Thr Ile Leu Thr Arg Leu Gly Lys Gln Arg Val Lys Lys Ser Ser Asn
    450                 455                 460

Arg Thr Asn Tyr Ile Asp Glu Lys Glu Leu Thr Glu Glu Ile Tyr Asn
465                 470                 475                 480

Pro Val Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Ile Asn Leu
                485                 490                 495

Ala Thr Lys Lys Tyr Gly Val Phe Asp Asn Ile Val Ile Glu Met Ala
            500                 505                 510
```

```
Arg Glu Ser Asn Glu Asp Asp Glu Lys Lys Ala Ile Gln Asn Ala Gln
        515                 520                 525

Lys Ala Asn Glu Asp Glu Lys Glu Ala Ala Leu Leu Lys Ala Ala His
    530                 535                 540

Gln Phe Asn Gly Lys Glu Glu Leu Pro Asp Ser Ile Phe His Gly His
545                 550                 555                 560

Lys Glu Leu Leu Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Lys
                565                 570                 575

Cys Leu Tyr Thr Gly Lys Thr Ile Phe Ile Asn Asp Leu Ile His Asn
            580                 585                 590

Pro Tyr Lys Tyr Glu Ile Asp His Ile Leu Pro Leu Ser Leu Ser Phe
        595                 600                 605

Asp Asp Ser Leu Ala Asn Lys Val Leu Val Leu Ser Thr Ala Asn Gln
    610                 615                 620

Glu Lys Gly Gln Arg Thr Pro Phe Gln Ser Leu Asp Ser Met Asp Gly
625                 630                 635                 640

Ala Trp Thr Tyr Arg Glu Phe Lys Ala Tyr Val Lys Gly Leu Lys Thr
                645                 650                 655

Leu Ser Asn Lys Lys Lys Asp Tyr Leu Leu Asn Glu Glu Asp Ile Asn
            660                 665                 670

Lys Asn Glu Val Lys Gln Lys Phe Ile Glu Arg Asn Leu Val Asp Thr
        675                 680                 685

Arg Tyr Ser Ser Arg Val Val Leu Asn Thr Leu Gln Asp Phe Tyr Lys
    690                 695                 700
```

```
Lys Arg Glu Phe Asp Thr Lys Ile Ser Val Val Arg Gly Gln Phe Thr
705                 710                 715                 720

Ser Gln Ile Arg Arg Lys Trp Arg Ile Glu Lys Thr Arg Glu Thr Tyr
                725                 730                 735

His His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu
            740                 745                 750

Asn Leu Trp Lys Lys Gln Asn Asn Pro Leu Ile Ser Tyr Lys Glu Asp
        755                 760                 765

Gln Phe Val Asp Pro Glu Thr Gly Glu Ile Leu Ser Leu Ser Asp Asp
    770                 775                 780

Glu Tyr Lys Glu Leu Val Phe Lys Ala Pro Tyr Asp His Phe Val Asp
785                 790                 795                 800

Thr Leu Lys Ser Lys Lys Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln
                805                 810                 815

Val Asp Ser Lys Tyr Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Gly
            820                 825                 830

Thr Arg Lys Ala Arg Leu Gly Lys Asp Ser Gln Glu Glu Thr Tyr Val
        835                 840                 845

Leu Gly Lys Ile Lys Asp Ile Tyr Ser Gln Lys Gly Tyr Glu Asp Phe
    850                 855                 860

Ile Lys Lys Tyr Lys Lys Asp Lys Thr Gln Phe Leu Met Tyr His Lys
865                 870                 875                 880

Asp Pro Gln Thr Phe Glu Lys Val Ile Glu Glu Ile Leu Lys Thr Tyr
                885                 890                 895

Ser Asp Lys Glu Leu Asn Glu Lys Gly Lys Glu Val Pro Cys Asn Pro
            900                 905                 910
```

```
Phe Glu Lys Tyr Arg Gln Glu Asn Gly Pro Val Arg Lys Tyr Ser Lys
        915                 920                 925

Lys Gly Asn Gly Pro Glu Ile Lys Ser Ile Lys Tyr Tyr Asp Asn Lys
    930                 935                 940

Leu Gly Asn His Ile Asp Ile Thr Pro Asn Asn Ser His His Gln Val
945                 950                 955                 960

Val Leu Gln Ser Leu Lys Pro Trp Arg Thr Asp Val Tyr Phe Asn Pro
                965                 970                 975

Lys Ser Gly Lys Tyr Glu Leu Met Gly Leu Lys Tyr Ser Asp Leu Arg
            980                 985                 990

Phe Glu Lys Val Ser Gly Asp Tyr  Gly Ile Ser Val Lys  Lys Tyr Asn
        995                 1000                1005

Glu Ile  Lys Ser Lys Glu Gly  Val Asp Glu Asn Ser  Glu Phe Lys
    1010                1015                1020

Phe Thr  Leu Tyr Lys Asn Asp  Leu Ile Leu Ile Lys  Asp Thr Glu
    1025                1030                1035

Ser Gly  Glu Gln Glu Leu Phe  Arg Phe Leu Ser Arg  Thr Met Pro
    1040                1045                1050

Asn Gln  Lys His Tyr Val Glu  Leu Lys Pro Tyr Asp  Lys Ser Lys
    1055                1060                1065

Phe Glu  Gly His Gln Lys Leu  Met Asp Ile Phe Gly  Glu Val Ala
    1070                1075                1080

Lys Gly  Gly Gln Cys Leu Lys  Gly Leu Asn Lys Ser  Asn Ile Ser
    1085                1090                1095
```

```
Ile Tyr  Lys Val Lys Thr Asp  Val Leu Gly Asn Lys  Tyr Phe Ile
    1100                1105                1110


Lys Lys  Glu Gly Asp Gln Pro  Gln Leu Asn Phe Lys  Lys Lys Ile
    1115                1120                1125
```

<210> 668
<211> 1128
<212> PRT
<213> Streptococcus mutans

<400> 668

```
Met Ala Asn Ser Lys Ile Leu Gly Leu Asp Ile Gly Ile Ala Ser Val
1               5                   10                  15


Gly Val Gly Ile Ile Asp Lys Glu Thr Gly Lys Ile Ile His Val Asn
            20                  25                  30


Ser Arg Ile Phe Pro Ala Ala Thr Ala Asp Ser Asn Val Glu Arg Arg
        35                  40                  45


Gly Phe Arg Gln Gly Arg Arg Leu Val Arg Arg Lys Lys His Arg Lys
    50                  55                  60


Val Arg Leu Ala Asp Leu Phe Leu Asp Ser Asn Leu Leu Thr Asp Phe
65                  70                  75                  80


Ser Lys Val Ser Leu Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly
                85                  90                  95


Leu Asn Glu Glu Leu Ser Asn Glu Glu Leu Phe Ile Ala Leu Lys Ser
            100                 105                 110


Ile Val Ser Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Glu Asp
        115                 120                 125


Ser Gly Ala Asn Ser Ser Glu Tyr Gly Lys Ala Val Glu Glu Asn Arg
    130                 135                 140
```

```
Lys Leu Leu Glu Asp Arg Thr Pro Gly Gln Ile Gln Leu Glu Arg Phe
145                 150                 155                 160

Glu Lys Tyr Gly Lys Val Arg Gly Asp Phe Thr Val Val Glu Asn Gly
                165                 170                 175

Glu Asn His Arg Leu Ile Asn Val Phe Ser Thr Ser Ala Tyr Lys Lys
            180                 185                 190

Glu Ala Glu Arg Ile Leu Arg Arg Gln Gln Glu Phe Asn Ile Arg Ile
        195                 200                 205

Ala Asp Glu Phe Ile Glu Ala Tyr Leu Thr Ile Leu Thr Gly Lys Arg
    210                 215                 220

Lys Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly
225                 230                 235                 240

Arg Phe Arg Thr Asp Gly Thr Thr Leu Asp Asn Ile Phe Gly Ile Leu
                245                 250                 255

Ile Gly Lys Cys Thr Phe Tyr Pro Asp Glu Tyr Arg Ala Ala Lys Ala
            260                 265                 270

Ser Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu
        275                 280                 285

Thr Val Pro Thr Glu Thr Lys Lys Leu Ser Glu Glu Gln Lys Arg Gln
    290                 295                 300

Ile Ile Glu His Ala Lys Thr Val Lys Thr Leu Gly Ala Pro Thr Leu
305                 310                 315                 320

Leu Lys Tyr Ile Ala Lys Leu Val Gly Cys Ser Ala Asp Asp Ile Lys
                325                 330                 335

Gly Tyr Arg Ile Asp Lys Ser Asp Lys Pro Glu Ile His Thr Phe Glu
```

```
            340                 345                 350

Ala Tyr Arg Lys Met Arg Thr Met Glu Leu Ile Lys Val Ala Asp Leu
        355                 360                 365

Ser Arg Glu Ser Leu Asp Ala Leu Ala His Ile Leu Thr Leu Asn Thr
    370                 375                 380

Glu Arg Glu Gly Ile Glu Glu Ala Ile Arg Asp Arg Phe Thr Asn Lys
385                 390                 395                 400

Glu Phe Asn Gln Glu Gln Ile Asn Glu Leu Val Leu Phe Arg Lys Asn
                405                 410                 415

Asn Ser Ser Leu Phe Gly Lys Gly Trp His Asn Phe Ser Leu Lys Leu
            420                 425                 430

Met Lys Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met
        435                 440                 445

Thr Ile Leu Thr Arg Leu Gly Lys Gln Arg Val Lys Lys Ser Ser Asn
    450                 455                 460

Arg Thr Asn Tyr Ile Asp Glu Lys Glu Leu Thr Glu Glu Ile Tyr Asn
465                 470                 475                 480

Pro Val Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Ile Asn Leu
                485                 490                 495

Ala Thr Lys Lys Tyr Gly Val Phe Asp Asn Ile Val Ile Glu Met Ala
            500                 505                 510

Arg Glu Ser Asn Glu Asp Asp Glu Lys Lys Ala Ile Gln Asn Ala Gln
        515                 520                 525

Lys Ala Asn Glu Asp Glu Lys Glu Ala Ala Leu Leu Lys Ala Ala His
    530                 535                 540
```

```
Gln Phe Asn Gly Lys Glu Glu Leu Pro Asp Ser Ile Phe His Gly His
545                 550                 555                 560

Lys Glu Leu Leu Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Lys
                565                 570                 575

Cys Leu Tyr Thr Gly Lys Thr Ile Phe Ile Asn Asp Leu Ile His Asn
            580                 585                 590

Pro Tyr Lys Tyr Glu Ile Asp His Ile Leu Pro Leu Ser Leu Ser Phe
        595                 600                 605

Asp Asp Ser Leu Ala Asn Lys Val Leu Val Leu Ser Thr Ala Asn Gln
    610                 615                 620

Glu Lys Gly Gln Arg Thr Pro Phe Gln Ser Leu Asp Ser Met Asp Gly
625                 630                 635                 640

Ala Trp Thr Tyr Arg Glu Phe Lys Ala Tyr Val Lys Gly Leu Lys Thr
                645                 650                 655

Leu Ser Asn Lys Lys Lys Asp Tyr Leu Leu Asn Glu Glu Asp Ile Asn
            660                 665                 670

Lys Asn Glu Val Lys Gln Lys Phe Ile Glu Arg Asn Leu Val Asp Thr
        675                 680                 685

Arg Tyr Ser Ser Arg Val Val Leu Asn Thr Leu Gln Asp Phe Tyr Lys
    690                 695                 700

Lys Arg Glu Phe Asp Thr Lys Ile Ser Val Val Arg Gly Gln Phe Thr
705                 710                 715                 720

Ser Gln Ile Arg Arg Lys Trp Arg Ile Glu Lys Thr Arg Glu Thr Tyr
                725                 730                 735

His His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu
```

```
            740                 745                 750

Asn Leu Trp Lys Lys Gln Asn Asn Pro Leu Ile Ser Tyr Lys Glu Asp
        755                 760                 765

Gln Phe Val Asp Pro Glu Thr Gly Glu Ile Leu Ser Leu Ser Asp Asp
    770                 775                 780

Glu Tyr Lys Glu Leu Val Phe Lys Ala Pro Tyr Asp His Phe Val Asp
785                 790                 795                 800

Thr Leu Lys Ser Lys Lys Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln
                805                 810                 815

Val Asp Ser Lys Tyr Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Gly
            820                 825                 830

Thr Arg Lys Ala Arg Leu Gly Lys Asp Ser Gln Glu Glu Thr Tyr Val
        835                 840                 845

Leu Gly Lys Ile Lys Asp Ile Tyr Ser Gln Lys Gly Tyr Glu Asp Phe
    850                 855                 860

Ile Lys Lys Tyr Lys Lys Asp Lys Thr Gln Phe Leu Met Tyr His Lys
865                 870                 875                 880

Asp Pro Gln Thr Phe Glu Lys Val Ile Glu Glu Ile Leu Lys Thr Tyr
                885                 890                 895

Ser Asp Lys Glu Leu Asn Glu Lys Gly Lys Glu Val Pro Cys Asn Pro
            900                 905                 910

Phe Glu Lys Tyr Arg Gln Glu Asn Gly Pro Val Arg Lys Tyr Ser Lys
        915                 920                 925

Lys Gly Asn Gly Pro Glu Ile Lys Ser Ile Lys Tyr Tyr Asp Asn Lys
    930                 935                 940
```

```
Leu Gly Asn His Ile Asp Ile Thr Pro Asn Asn Ser His His Gln Val
945                 950                 955                 960


Val Leu Gln Ser Leu Lys Pro Trp Arg Thr Asp Val Tyr Phe Asn Pro
                965                 970                 975


Lys Ser Gly Lys Tyr Glu Leu Met Gly Leu Lys Tyr Ser Asp Leu Arg
            980                 985                 990


Phe Glu Lys Val Ser Gly Asp Tyr  Gly Ile Ser Val Lys  Lys Tyr Asn
        995                 1000                1005


Glu Ile  Lys Ser Lys Glu Gly  Val Asp Glu Asn Ser  Glu Phe Lys
    1010                1015                1020


Phe Thr  Leu Tyr Lys Asn Asp  Leu Ile Leu Ile Lys  Asp Thr Glu
    1025                1030                1035


Ser Gly  Glu Gln Glu Leu Phe  Arg Phe Leu Ser Arg  Thr Met Pro
    1040                1045                1050


Asn Gln  Lys His Tyr Val Glu  Leu Lys Pro Tyr Asp  Lys Ser Lys
    1055                1060                1065


Phe Glu  Gly His Gln Lys Leu  Met Asp Ile Phe Gly  Glu Val Ala
    1070                1075                1080


Lys Gly  Gly Gln Cys Leu Lys  Gly Leu Asn Lys Ser  Asn Ile Ser
    1085                1090                1095


Ile Tyr  Lys Val Lys Thr Asp  Val Leu Gly Asn Lys  Tyr Phe Ile
    1100                1105                1110


Lys Lys  Glu Gly Asp Gln Pro  Gln Leu Asn Phe Lys  Lys Lys Ile
    1115                1120                1125


<210>  669
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<211> 1338
<212> PRT
<213> Streptococcus mutans

<400> 669

```
Met Asp Leu Ile Gly Thr Asn Ser Val Gly Trp Ala Val Val Thr Asp
1               5                  10                  15


Asp Tyr Lys Val Pro Ala Lys Lys Met Lys Val Leu Gly Asn Thr Asp
            20                  25                  30


Lys Ser His Ile Lys Lys Asn Leu Leu Gly Ala Leu Leu Phe Asp Ser
        35                  40                  45


Gly Asn Thr Ala Ala Asp Arg Arg Leu Lys Arg Thr Ala Arg Arg Arg
    50                  55                  60


Tyr Thr Arg Arg Arg Asn Arg Ile Leu Tyr Leu Gln Glu Ile Phe Ala
65                  70                  75                  80


Glu Glu Met Ser Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Asp
                85                  90                  95


Ser Phe Leu Val Thr Glu Asp Lys Arg Gly Glu Arg His Pro Ile Phe
            100                 105                 110


Gly Asn Leu Glu Glu Glu Val Lys Tyr His Glu Asn Phe Pro Thr Ile
        115                 120                 125


Tyr His Leu Arg Gln Tyr Leu Ala Asp Asn Pro Glu Lys Val Asp Leu
    130                 135                 140


Arg Leu Val Tyr Leu Ala Leu Ala His Ile Ile Lys Phe Arg Gly His
145                 150                 155                 160


Phe Leu Ile Glu Gly Lys Phe Asp Thr Arg Asn Asn Asp Val Gln Arg
                165                 170                 175
```

```
Leu Phe Gln Glu Phe Leu Ala Val Tyr Asp Asn Thr Phe Glu Asn Ser
            180                 185                 190

Ser Leu Gln Glu Gln Asn Val Gln Val Glu Glu Ile Leu Thr Asp Lys
        195                 200                 205

Ile Ser Lys Ser Ala Lys Lys Asp Arg Val Leu Lys Leu Phe Pro Asn
    210                 215                 220

Glu Lys Ser Asn Gly Arg Phe Ala Glu Phe Leu Lys Leu Ile Val Gly
225                 230                 235                 240

Asn Gln Ala Asp Phe Lys Lys His Phe Glu Leu Glu Glu Lys Ala Pro
                245                 250                 255

Leu Gln Phe Ser Lys Asp Thr Tyr Glu Glu Glu Leu Glu Val Leu Leu
            260                 265                 270

Ala Gln Ile Gly Asp Asn Tyr Ala Glu Leu Phe Leu Ser Ala Lys Lys
        275                 280                 285

Leu Tyr Asp Ser Ile Leu Leu Ser Gly Ile Leu Thr Val Thr Asp Val
    290                 295                 300

Ser Thr Lys Ala Pro Leu Ser Ala Ser Met Ile Gln Arg Tyr Asn Glu
305                 310                 315                 320

His Gln Met Asp Leu Ala Gln Leu Lys Gln Phe Ile Arg Gln Lys Leu
                325                 330                 335

Ser Asp Lys Tyr Asn Glu Val Phe Ser Asp Val Ser Lys Asp Gly Tyr
            340                 345                 350

Ala Gly Tyr Ile Asp Gly Lys Thr Asn Gln Glu Ala Phe Tyr Lys Tyr
        355                 360                 365

Leu Lys Gly Leu Leu Asn Lys Ile Glu Gly Ser Gly Tyr Phe Leu Asp
    370                 375                 380
```

```
Lys Ile Glu Arg Glu Asp Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn
385                 390                 395                 400

Gly Ser Ile Pro His Gln Ile His Leu Gln Glu Met Arg Ala Ile Ile
                405                 410                 415

Arg Arg Gln Ala Glu Phe Tyr Pro Phe Leu Ala Asp Asn Gln Asp Arg
            420                 425                 430

Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu
        435                 440                 445

Ala Arg Gly Lys Ser Asp Phe Ala Trp Leu Ser Arg Lys Ser Ala Asp
    450                 455                 460

Lys Ile Thr Pro Trp Asn Phe Asp Glu Ile Val Asp Lys Glu Ser Ser
465                 470                 475                 480

Ala Glu Ala Phe Ile Asn Arg Met Thr Asn Tyr Asp Leu Tyr Leu Pro
                485                 490                 495

Asn Gln Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Lys Phe Thr
            500                 505                 510

Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Lys Thr Glu Gln Gly Lys
        515                 520                 525

Thr Ala Phe Phe Asp Ala Asn Met Lys Gln Glu Ile Phe Asp Gly Val
    530                 535                 540

Phe Lys Val Tyr Arg Lys Val Thr Lys Asp Lys Leu Met Asp Phe Leu
545                 550                 555                 560

Glu Lys Glu Phe Asp Glu Phe Arg Ile Val Asp Leu Thr Gly Leu Asp
                565                 570                 575
```

```
Lys Glu Asn Lys Ala Phe Asn Ala Ser Tyr Gly Thr Tyr His Asp Leu
            580                 585                 590

Arg Lys Ile Leu Asp Lys Asp Phe Leu Asp Asn Ser Lys Asn Glu Lys
        595                 600                 605

Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu
    610                 615                 620

Met Ile Arg Lys Arg Leu Glu Asn Tyr Ser Asp Leu Leu Thr Lys Glu
625                 630                 635                 640

Gln Val Lys Lys Leu Glu Arg Arg His Tyr Thr Gly Trp Gly Arg Leu
                645                 650                 655

Ser Ala Glu Leu Ile His Gly Ile Arg Asn Lys Glu Ser Arg Lys Thr
            660                 665                 670

Ile Leu Asp Tyr Leu Ile Asp Asp Gly Asn Ser Asn Arg Asn Phe Met
        675                 680                 685

Gln Leu Ile Asn Asp Asp Ala Leu Ser Phe Lys Glu Glu Ile Ala Lys
    690                 695                 700

Ala Gln Val Ile Gly Glu Thr Asp Asn Leu Asn Gln Val Val Ser Asp
705                 710                 715                 720

Ile Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys
                725                 730                 735

Ile Val Asp Glu Leu Val Lys Ile Met Gly His Gln Pro Glu Asn Ile
            740                 745                 750

Val Val Glu Met Ala Arg Glu Asn Gln Phe Thr Asn Gln Gly Arg Arg
        755                 760                 765

Asn Ser Gln Gln Arg Leu Lys Gly Leu Thr Asp Ser Ile Lys Glu Phe
    770                 775                 780
```

```
Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu His Ser Gln Leu Gln
785                 790                 795                 800

Asn Asp Arg Leu Phe Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr
                805                 810                 815

Thr Gly Glu Glu Leu Asp Ile Asp Tyr Leu Ser Gln Tyr Asp Ile Asp
            820                 825                 830

His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asn Ser Ile Asp Asn Arg
        835                 840                 845

Val Leu Thr Ser Ser Lys Glu Asn Arg Gly Lys Ser Asp Asp Val Pro
    850                 855                 860

Ser Lys Asn Val Val Arg Lys Met Lys Ser Tyr Trp Ser Lys Leu Leu
865                 870                 875                 880

Ser Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn Leu Thr Lys Ala
                885                 890                 895

Glu Arg Gly Gly Leu Thr Asp Asp Asp Lys Ala Gly Phe Ile Lys Arg
            900                 905                 910

Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Arg Ile Leu
        915                 920                 925

Asp Glu Arg Phe His Thr Glu Thr Asp Glu Asn Asn Lys Lys Ile Arg
    930                 935                 940

Gln Val Lys Ile Val Thr Leu Lys Ser Asn Leu Val Ser Asn Phe Arg
945                 950                 955                 960

Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile Asn Asp Tyr His His
                965                 970                 975
```

```
Ala His Asp Ala Tyr Leu Asn Ala Val Ile Gly Lys Ala Leu Leu Gly
            980                 985                 990


Val Tyr Pro Gln Leu Glu Pro Glu  Phe Val Tyr Gly Asp  Tyr Pro His
        995                 1000                1005


Phe His  Gly His Lys Glu Asn  Lys Ala Thr Ala Lys  Lys Phe Phe
    1010                1015                1020


Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Lys Asp Asp  Val Arg Thr
    1025                1030                1035


Asp Lys  Asn Gly Glu Ile Ile  Trp Lys Lys Asp Glu  His Ile Ser
    1040                1045                1050


Asn Ile  Lys Lys Val Leu Ser  Tyr Pro Gln Val Asn  Ile Val Lys
    1055                1060                1065


Lys Val  Glu Glu Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1070                1075                1080


Pro Lys  Gly Asn Ser Asp Lys  Leu Ile Pro Arg Lys  Thr Lys Lys
    1085                1090                1095


Phe Tyr  Trp Asp Thr Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Ile
    1100                1105                1110


Val Ala  Tyr Ser Ile Leu Val  Ile Ala Asp Ile Glu  Lys Gly Lys
    1115                1120                1125


Ser Lys  Lys Leu Lys Thr Val  Lys Ala Leu Val Gly  Val Thr Ile
    1130                1135                1140


Met Glu  Lys Met Thr Phe Glu  Arg Asp Pro Val Ala  Phe Leu Glu
    1145                1150                1155


Arg Lys  Gly Tyr Arg Asn Val  Gln Glu Glu Asn Ile  Ile Lys Leu
    1160                1165                1170
```

```
Pro Lys  Tyr Ser Leu Phe Lys  Leu Glu Asn Gly Arg  Lys Arg Leu
    1175                1180                1185

Leu Ala  Ser Ala Arg Glu Leu  Gln Lys Gly Asn Glu  Ile Val Leu
    1190                1195                1200

Pro Asn  His Leu Gly Thr Leu  Leu Tyr His Ala Lys  Asn Ile His
    1205                1210                1215

Lys Val  Asp Glu Pro Lys His  Leu Asp Tyr Val Asp  Lys His Lys
    1220                1225                1230

Asp Glu  Phe Lys Glu Leu Leu  Asp Val Val Ser Asn  Phe Ser Lys
    1235                1240                1245

Lys Tyr  Thr Leu Ala Glu Gly  Asn Leu Glu Lys Ile  Lys Glu Leu
    1250                1255                1260

Tyr Ala  Gln Asn Asn Gly Glu  Asp Leu Lys Glu Leu  Ala Ser Ser
    1265                1270                1275

Phe Ile  Asn Leu Leu Thr Phe  Thr Ala Ile Gly Ala  Pro Ala Thr
    1280                1285                1290

Phe Lys  Phe Phe Asp Lys Asn  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1295                1300                1305

Thr Thr  Glu Ile Leu Asn Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1310                1315                1320

Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Lys Leu  Gly Gly Asp
    1325                1330                1335
```

<210> 670
<211> 1338
<212> PRT
<213> Streptococcus mutans

<400> 670

```
Met Asp Leu Ile Gly Thr Asn Ser Val Gly Trp Ala Val Val Thr Asp
1               5                  10                  15

Asp Tyr Lys Val Pro Ala Lys Lys Met Lys Val Leu Gly Asn Thr Asp
            20                  25                  30

Lys Ser His Ile Lys Lys Asn Leu Leu Gly Ala Leu Leu Phe Asp Ser
        35                  40                  45

Gly Asn Thr Ala Ala Asp Arg Arg Leu Lys Arg Thr Ala Arg Arg Arg
    50                  55                  60

Tyr Thr Arg Arg Arg Asn Arg Ile Leu Tyr Leu Gln Glu Ile Phe Ala
65                  70                  75                  80

Glu Glu Met Ser Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Asp
                85                  90                  95

Ser Phe Leu Val Thr Glu Asp Lys Arg Gly Glu Arg His Pro Ile Phe
            100                 105                 110

Gly Asn Leu Glu Glu Glu Val Lys Tyr His Glu Asn Phe Pro Thr Ile
        115                 120                 125

Tyr His Leu Arg Gln Tyr Leu Ala Asp Asn Pro Glu Lys Val Asp Leu
    130                 135                 140

Arg Leu Val Tyr Leu Ala Leu Ala His Ile Ile Lys Phe Arg Gly His
145                 150                 155                 160

Phe Leu Ile Glu Gly Lys Phe Asp Thr Arg Asn Asn Asp Val Gln Arg
                165                 170                 175

Leu Phe Gln Glu Phe Leu Ala Val Tyr Asp Asn Thr Phe Glu Asn Ser
            180                 185                 190
```

```
Ser Leu Gln Glu Gln Asn Val Gln Val Glu Glu Ile Leu Thr Asp Lys
        195                 200                 205

Ile Ser Lys Ser Ala Lys Lys Asp Arg Val Leu Lys Leu Phe Pro Asn
    210                 215                 220

Glu Lys Ser Asn Gly Arg Phe Ala Glu Phe Leu Lys Leu Ile Val Gly
225                 230                 235                 240

Asn Gln Ala Asp Phe Lys Lys His Phe Glu Leu Glu Glu Lys Ala Pro
                245                 250                 255

Leu Gln Phe Ser Lys Asp Thr Tyr Glu Glu Glu Leu Glu Val Leu Leu
            260                 265                 270

Ala Gln Ile Gly Asp Asn Tyr Ala Glu Leu Phe Leu Ser Ala Lys Lys
        275                 280                 285

Leu Tyr Asp Ser Ile Leu Leu Ser Gly Ile Leu Thr Val Thr Asp Val
    290                 295                 300

Ser Thr Lys Ala Pro Leu Ser Ala Ser Met Ile Gln Arg Tyr Asn Glu
305                 310                 315                 320

His Gln Met Asp Leu Ala Gln Leu Lys Gln Phe Ile Arg Gln Lys Leu
                325                 330                 335

Ser Asp Lys Tyr Asn Glu Val Phe Ser Asp Val Ser Lys Asp Gly Tyr
            340                 345                 350

Ala Gly Tyr Ile Asp Gly Lys Thr Asn Gln Glu Ala Phe Tyr Lys Tyr
        355                 360                 365

Leu Lys Gly Leu Leu Asn Lys Ile Glu Gly Ser Gly Tyr Phe Leu Asp
    370                 375                 380

Lys Ile Glu Arg Glu Asp Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn
```

385 390 395 400

Gly Ser Ile Pro His Gln Ile His Leu Gln Glu Met Arg Ala Ile Ile
405 410 415

Arg Arg Gln Ala Glu Phe Tyr Pro Phe Leu Ala Asp Asn Gln Asp Arg
420 425 430

Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu
435 440 445

Ala Arg Gly Lys Ser Asp Phe Ala Trp Leu Ser Arg Lys Ser Ala Asp
450 455 460

Lys Ile Thr Pro Trp Asn Phe Asp Glu Ile Val Asp Lys Glu Ser Ser
465 470 475 480

Ala Glu Ala Phe Ile Asn Arg Met Thr Asn Tyr Asp Leu Tyr Leu Pro
485 490 495

Asn Gln Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Lys Phe Thr
500 505 510

Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Lys Thr Glu Gln Gly Lys
515 520 525

Thr Ala Phe Phe Asp Ala Asn Met Lys Gln Glu Ile Phe Asp Gly Val
530 535 540

Phe Lys Val Tyr Arg Lys Val Thr Lys Asp Lys Leu Met Asp Phe Leu
545 550 555 560

Glu Lys Glu Phe Asp Glu Phe Arg Ile Val Asp Leu Thr Gly Leu Asp
565 570 575

Lys Glu Asn Lys Ala Phe Asn Ala Ser Tyr Gly Thr Tyr His Asp Leu
580 585 590

```
Arg Lys Ile Leu Asp Lys Asp Phe Leu Asp Asn Ser Lys Asn Glu Lys
        595                 600                 605

Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu
    610                 615                 620

Met Ile Arg Lys Arg Leu Glu Asn Tyr Ser Asp Leu Leu Thr Lys Glu
625                 630                 635                 640

Gln Val Lys Lys Leu Glu Arg Arg His Tyr Thr Gly Trp Gly Arg Leu
                645                 650                 655

Ser Ala Glu Leu Ile His Gly Ile Arg Asn Lys Glu Ser Arg Lys Thr
            660                 665                 670

Ile Leu Asp Tyr Leu Ile Asp Asp Gly Asn Ser Asn Arg Asn Phe Met
        675                 680                 685

Gln Leu Ile Asn Asp Asp Ala Leu Ser Phe Lys Glu Glu Ile Ala Lys
    690                 695                 700

Ala Gln Val Ile Gly Glu Thr Asp Asn Leu Asn Gln Val Val Ser Asp
705                 710                 715                 720

Ile Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys
                725                 730                 735

Ile Val Asp Glu Leu Val Lys Ile Met Gly His Gln Pro Glu Asn Ile
            740                 745                 750

Val Val Glu Met Ala Arg Glu Asn Gln Phe Thr Asn Gln Gly Arg Arg
        755                 760                 765

Asn Ser Gln Gln Arg Leu Lys Gly Leu Thr Asp Ser Ile Lys Glu Phe
    770                 775                 780

Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu His Ser Gln Leu Gln
```

```
785                 790                 795                 800

Asn Asp Arg Leu Phe Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr
                805                 810                 815

Thr Gly Glu Glu Leu Asp Ile Asp Tyr Leu Ser Gln Tyr Asp Ile Asp
            820                 825                 830

His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asn Ser Ile Asp Asn Arg
        835                 840                 845

Val Leu Thr Ser Ser Lys Glu Asn Arg Gly Lys Ser Asp Asp Val Pro
    850                 855                 860

Ser Lys Asn Val Val Arg Lys Met Lys Ser Tyr Trp Ser Lys Leu Leu
865                 870                 875                 880

Ser Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn Leu Thr Lys Ala
                885                 890                 895

Glu Arg Gly Gly Leu Thr Asp Asp Asp Lys Ala Gly Phe Ile Lys Arg
            900                 905                 910

Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Arg Ile Leu
        915                 920                 925

Asp Glu Arg Phe His Thr Glu Thr Asp Glu Asn Asn Lys Lys Ile Arg
    930                 935                 940

Gln Val Lys Ile Val Thr Leu Lys Ser Asn Leu Val Ser Asn Phe Arg
945                 950                 955                 960

Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile Asn Asp Tyr His His
                965                 970                 975

Ala His Asp Ala Tyr Leu Asn Ala Val Ile Gly Lys Ala Leu Leu Gly
            980                 985                 990
```

```
Val Tyr Pro Gln Leu Glu Pro Glu  Phe Val Tyr Gly Asp  Tyr Pro His
        995                 1000                1005


Phe His  Gly His Lys Glu Asn  Lys Ala Thr Ala Lys  Lys Phe Phe
    1010                1015                1020


Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Lys Asp Asp  Val Arg Thr
    1025                1030                1035


Asp Lys  Asn Gly Glu Ile Ile  Trp Lys Lys Asp Glu  His Ile Ser
    1040                1045                1050


Asn Ile  Lys Lys Val Leu Ser  Tyr Pro Gln Val Asn  Ile Val Lys
    1055                1060                1065


Lys Val  Glu Glu Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1070                1075                1080


Pro Lys  Gly Asn Ser Asp Lys  Leu Ile Pro Arg Lys  Thr Lys Lys
    1085                1090                1095


Phe Tyr  Trp Asp Thr Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Ile
    1100                1105                1110


Val Ala  Tyr Ser Ile Leu Val  Ile Ala Asp Ile Glu  Lys Gly Lys
    1115                1120                1125


Ser Lys  Lys Leu Lys Thr Val  Lys Ala Leu Val Gly  Val Thr Ile
    1130                1135                1140


Met Glu  Lys Met Thr Phe Glu  Arg Asp Pro Val Ala  Phe Leu Glu
    1145                1150                1155


Arg Lys  Gly Tyr Arg Asn Val  Gln Glu Glu Asn Ile  Ile Lys Leu
    1160                1165                1170


Pro Lys  Tyr Ser Leu Phe Lys  Leu Glu Asn Gly Arg  Lys Arg Leu
```

```
    1175                1180                1185

Leu Ala  Ser Ala Arg Glu Leu  Gln Lys Gly Asn Glu  Ile Val Leu
    1190                1195                1200

Pro Asn  His Leu Gly Thr Leu  Leu Tyr His Ala Lys  Asn Ile His
    1205                1210                1215

Lys Val  Asp Glu Pro Lys His  Leu Asp Tyr Val Asp  Lys His Lys
    1220                1225                1230

Asp Glu  Phe Lys Glu Leu Leu  Asp Val Val Ser Asn  Phe Ser Lys
    1235                1240                1245

Lys Tyr  Thr Leu Ala Glu Gly  Asn Leu Glu Lys Ile  Lys Glu Leu
    1250                1255                1260

Tyr Ala  Gln Asn Asn Gly Glu  Asp Leu Lys Glu Leu  Ala Ser Ser
    1265                1270                1275

Phe Ile  Asn Leu Leu Thr Phe  Thr Ala Ile Gly Ala  Pro Ala Thr
    1280                1285                1290

Phe Lys  Phe Phe Asp Lys Asn  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1295                1300                1305

Thr Thr  Glu Ile Leu Asn Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1310                1315                1320

Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Lys Leu  Gly Gly Asp
    1325                1330                1335


<210>  671
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  671
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```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Phe Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205
```

```
Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400
```

```
Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ser Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Glu Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605
```

```
Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800
```

```
Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Pro Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005
```

```
Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Glu  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185
```

```
Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 672
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 672

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Phe Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
```

```
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400
```

```
Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ser Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Glu Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
```

```
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800
```

```
Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Pro Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
```

```
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Glu  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185
```

```
Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 673
<211> 1229
<212> PRT
<213> Streptococcus mutans

<400> 673

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190
```

```
Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Ile Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Gly Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Thr Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400
```

```
Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590
```

```
Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800
```

```
Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Pro Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990
```

```
Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Glu  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Ile Gly
    1070                1075                1080


Gln Asn  Gly Gly Leu Phe Asp  Asp Asn Pro Lys Ser  Pro Leu Glu
    1085                1090                1095


Val Ile  Pro Ser Lys Leu Val  Pro Leu Lys Lys Ala  Leu Asn Pro
    1100                1105                1110


Glu Lys  Tyr Gly Gly Tyr Gln  Lys Pro Thr Thr Ala  Tyr Pro Ile
    1115                1120                1125


Leu Leu  Ile Val Asp Thr Lys  Gln Leu Ile Pro Ile  Ser Val Met
    1130                1135                1140


Asp Lys  Lys Arg Phe Glu Gln  Asn Pro Val Lys Phe  Leu Lys Asp
    1145                1150                1155


Lys Gly  Tyr Gln Gln Ile Glu  Lys Asn Asn Phe Val  Lys Leu Pro
    1160                1165                1170


Lys Tyr  Thr Leu Val Asp Ile  Gly Asn Gly Ile Lys  Arg Leu Trp
    1175                1180                1185
```

```
Ala Ser  Ser Lys Glu Val His  Lys Gly Asn Gln Leu  Val Val Ser
    1190                 1195                 1200


Lys Lys  Ser Gln Asp Leu Leu  Tyr His Ala His His  Leu Asp Asn
    1205                 1210                 1215


Asp Tyr  Ser Asn Glu Tyr Val  Lys Asn His Tyr
    1220                 1225


<210>  674
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<212>  PRT
<213>  Streptococcus mutans

<400>  674

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
```

```
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Ile Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Gly Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320
```

```
Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Thr Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
```

```
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720
```

```
Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
               725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
               805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Pro Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
               885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
```

```
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Glu  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Ile Gly
    1070                1075                1080

Gln Asn  Gly Gly Leu Phe Asp  Asp Asn Pro Lys Ser  Pro Leu Glu
    1085                1090                1095

Val Ile  Pro Ser Lys Leu Val  Pro Leu Lys Lys Ala  Leu Asn Pro
    1100                1105                1110
```

```
Glu Lys  Tyr Gly Gly Tyr Gln  Lys Pro Thr Thr Ala  Tyr Pro Ile
    1115                 1120                 1125


Leu Leu  Ile Val Asp Thr Lys  Gln Leu Ile Pro Ile  Ser Val Met
    1130                 1135                 1140


Asp Lys  Lys Arg Phe Glu Gln  Asn Pro Val Lys Phe  Leu Lys Asp
    1145                 1150                 1155


Lys Gly  Tyr Gln Gln Ile Glu  Lys Asn Asn Phe Val  Lys Leu Pro
    1160                 1165                 1170


Lys Tyr  Thr Leu Val Asp Ile  Gly Asn Gly Ile Lys  Arg Leu Trp
    1175                 1180                 1185


Ala Ser  Ser Lys Glu Val His  Lys Gly Asn Gln Leu  Val Val Ser
    1190                 1195                 1200


Lys Lys  Ser Gln Asp Leu Leu  Tyr His Ala His His  Leu Asp Asn
    1205                 1210                 1215


Asp Tyr  Ser Asn Glu Tyr Val  Lys Asn His Tyr
    1220                 1225
```

<210> 675
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<400> 675

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
        35                  40                  45
```

```
Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240
```

```
Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Gly Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Leu Leu Thr Phe Arg Ile
        435                 440                 445
```

```
Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Ile Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640
```

```
Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845
```

```
Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035
```

```
Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230
```

```
Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Asn  Lys Leu Gly Gly Asp
    1340                1345


<210>  676
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<213>  Streptococcus mutans

<400>  676

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
```

```
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240
```

```
Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Thr Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Ser Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
```

```
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640
```

```
Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
               645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
               725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
               805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
```

```
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Glu Asp Val Val Asn Arg Met Arg
865                 870                 875                 880

Pro Phe Trp Asn Lys Leu Leu Ser Ser Gly Leu Ile Ser Gln Arg Lys
                885                 890                 895

Tyr Asn Asn Leu Thr Lys Lys Glu Leu Thr Leu Asp Asp Lys Ala Gly
            900                 905                 910

Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Arg Met Leu Asp Glu Arg Phe Asn Lys Glu Phe Asp Asp Asn Asn
    930                 935                 940

Lys Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys Ser Asn Leu Val
945                 950                 955                 960

Ser Ser Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile Asn
                965                 970                 975

Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Val Lys
            980                 985                 990

Ala Leu Leu Val Lys Tyr Ser Lys  Leu Glu Pro Glu Phe  Val Tyr Gly
        995                 1000                1005

Glu Tyr  Pro Lys Tyr Asn Ser  Tyr Arg Glu Arg Lys  Thr Ala Thr
    1010                1015                1020

Gln Lys  Met Phe Phe Tyr Ser  Asn Ile Met Asn Met  Phe Lys Ser
    1025                1030                1035
```

```
Lys Val  Lys Leu Ala Asp Asp  Gln Ile Val Glu Arg  Pro Met Ile
    1040                1045                1050

Glu Val  Asn Asp Glu Thr Gly  Glu Ile Ala Trp Asp  Lys Thr Lys
    1055                1060                1065

His Ile  Thr Thr Val Lys Lys  Val Leu Ser Tyr Pro  Gln Val Asn
    1070                1075                1080

Ile Val  Lys Lys Val Glu Glu  Gln Thr Ile Gly Gln  Asn Gly Gly
    1085                1090                1095

Leu Phe  Asp Asp Asn Pro Lys  Ser Pro Leu Glu Val  Ile Pro Ser
    1100                1105                1110

Lys Leu  Val Pro Leu Lys Lys  Ala Leu Asn Pro Glu  Lys Tyr Gly
    1115                1120                1125

Gly Tyr  Gln Lys Pro Thr Thr  Ala Tyr Pro Ile Leu  Leu Ile Val
    1130                1135                1140

Asp Thr  Lys Gln Leu Ile Pro  Ile Ser Val Met Asp  Lys Lys Arg
    1145                1150                1155

Phe Glu  Gln Asn Pro Val Lys  Phe Leu Lys Asp Lys  Gly Tyr Gln
    1160                1165                1170

Gln Ile  Glu Lys Asn Asn Phe  Val Lys Leu Pro Lys  Tyr Thr Leu
    1175                1180                1185

Val Asp  Ile Gly Asn Gly Ile  Lys Arg Leu Trp Ala  Ser Ser Lys
    1190                1195                1200

Glu Val  His Lys Gly Asn Gln  Leu Val Val Ser Lys  Lys Ser Gln
    1205                1210                1215

Asp Leu  Leu Tyr His Ala His  His Leu Asp Asn Asp  Tyr Ser Asn
```

```
    1220                1225                1230

Glu Tyr  Val Lys Asn His Tyr  Gln Gln Phe Asp Ile  Leu Phe Asn
    1235                1240                1245

Glu Ile  Thr Ser Phe Ser Lys  Lys Cys Lys Leu Gly  Lys Glu His
    1250                1255                1260

Ile Gln  Lys Ile Glu Glu Ala  Tyr Ser Lys Glu Arg  Asp Ser Ala
    1265                1270                1275

Ser Ile  Glu Glu Leu Ala Asp  Gly Phe Ile Lys Leu  Leu Gly Phe
    1280                1285                1290

Thr Gln  Leu Gly Ala Thr Ser  Pro Phe Ser Phe Leu  Gly Ile Lys
    1295                1300                1305

Leu Asn  Gln Lys Gln Tyr Thr  Gly Lys Lys Asp Tyr  Leu Leu Pro
    1310                1315                1320

Cys Met  Glu Ala Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1325                1330                1335

Glu Thr  Arg Ile Asp Leu Ser  Lys Leu Gly Gly Asp
    1340                1345                1350
```

<210> 677
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<212> PRT
<213> Streptococcus mutans

<400> 677

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30
```

```
Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240
```

```
Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
               245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Thr Gln Leu Lys
               325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
               405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430
```

```
Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640
```

```
Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Gln Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830
```

```
Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Glu Asp Val Val Asn Arg Met Arg
865                 870                 875                 880

Pro Phe Trp Asn Lys Leu Leu Ser Ser Gly Leu Ile Ser Gln Arg Lys
                885                 890                 895

Tyr Asn Asn Leu Thr Lys Lys Glu Leu Thr Leu Asp Asp Lys Ala Gly
            900                 905                 910

Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Arg Met Leu Asp Glu Arg Phe Asn Lys Glu Phe Asp Asp Asn Asn
    930                 935                 940

Lys Arg Ile Cys Lys Val Lys Ile Val Thr Leu Lys Ser Asn Leu Val
945                 950                 955                 960

Ser Ser Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile Asn
                965                 970                 975

Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Val Lys
            980                 985                 990

Ala Leu Leu Val Lys Tyr Ser Lys  Leu Glu Pro Glu Phe  Val Tyr Gly
        995                 1000                1005

Glu Tyr  Pro Lys Tyr Asn Ser  Tyr Arg Glu Arg Lys  Thr Ala Thr
    1010                1015                1020

Gln Lys  Met Phe Phe Tyr Ser  Asn Ile Met Asn Met  Phe Lys Ser
    1025                1030                1035
```

```
Lys Val  Lys Leu Ala Asp Asp  Gln Ile Val Glu Arg  Pro Met Ile
    1040                1045                1050

Glu Val  Asn Asp Glu Thr Gly  Glu Ile Ala Trp Asp  Lys Thr Lys
    1055                1060                1065

His Ile  Thr Thr Val Lys Lys  Val Leu Ser Tyr Pro  Gln Val Asn
    1070                1075                1080

Ile Val  Lys Lys Val Glu Glu  Gln Thr Ile Gly Gln  Asn Gly Gly
    1085                1090                1095

Leu Phe  Asp Asp Asn Pro Lys  Ser Pro Leu Glu Val  Ile Pro Ser
    1100                1105                1110

Lys Leu  Val Pro Leu Lys Lys  Ala Leu Asn Pro Glu  Lys Tyr Gly
    1115                1120                1125

Gly Tyr  Gln Lys Pro Thr Thr  Ala Tyr Pro Ile Leu  Leu Ile Val
    1130                1135                1140

Asp Thr  Lys Gln Leu Ile Pro  Ile Ser Val Met Asp  Lys Lys Arg
    1145                1150                1155

Phe Glu  Gln Asn Pro Val Lys  Phe Leu Lys Asp Lys  Gly Tyr Gln
    1160                1165                1170

Gln Ile  Glu Lys Asn Asn Phe  Val Lys Leu Pro Lys  Tyr Thr Leu
    1175                1180                1185

Val Asp  Ile Gly Asn Gly Ile  Lys Arg Leu Trp Ala  Ser Ser Lys
    1190                1195                1200

Glu Val  His Lys Gly Asn Gln  Leu Val Val Ser Lys  Lys Ser Gln
    1205                1210                1215
```

```
Asp Leu  Leu Tyr His Ala His  His Leu Asp Asn Asp  Tyr Ser Asn
    1220                 1225                 1230


Glu Tyr  Val Lys Asn His Tyr  Gln Gln Phe Asp Ile  Leu Phe Asn
    1235                 1240                 1245


Glu Ile  Thr Ser Phe Ser Lys  Lys Cys Lys Leu Gly  Lys Glu His
    1250                 1255                 1260


Ile Gln  Lys Ile Glu Glu Ala  Tyr Ser Lys Glu Arg  Asp Ser Ala
    1265                 1270                 1275


Ser Ile  Glu Glu Leu Ala Asp  Gly Phe Ile Lys Leu  Leu Gly Phe
    1280                 1285                 1290


Thr Gln  Leu Gly Ala Thr Ser  Pro Phe Ser Phe Leu  Gly Ile Lys
    1295                 1300                 1305


Leu Asn  Gln Lys Gln Tyr Thr  Gly Lys Lys Asp Tyr  Leu Leu Pro
    1310                 1315                 1320


Cys Met  Glu Ala Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1325                 1330                 1335


Glu Thr  Arg Ile Asp Leu Ser  Lys Leu Gly Gly Asp
    1340                 1345                 1350


<210>  678
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<212>  PRT
<213>  Streptococcus mutans

<400>  678

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30
```

```
Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
```

```
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Gly Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430
```

```
Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Leu Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Ile Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
```

625 630 635 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
645 650 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
660 665 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
675 680 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
690 695 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705 710 715 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
725 730 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
740 745 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
755 760 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
770 775 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785 790 795 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
805 810 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
820 825 830

```
Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
```

```
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215
```

```
Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Asn  Lys Leu Gly Gly Asp
    1340                1345


<210>  679
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<212>  PRT
<213>  Streptococcus mutans

<400>  679

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30
```

```
Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220
```

```
Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Thr Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Ser Phe
            420                 425                 430
```

```
Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620
```

```
Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830
```

```
Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Glu Asp Val Val Asn Arg Met Arg
865                 870                 875                 880

Pro Phe Trp Asn Lys Leu Leu Ser Ser Gly Leu Ile Ser Gln Arg Lys
                885                 890                 895

Tyr Asn Asn Leu Thr Lys Lys Glu Leu Thr Leu Asp Asp Lys Ala Gly
            900                 905                 910

Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Arg Met Leu Asp Glu Arg Phe Asn Lys Glu Phe Asp Asp Asn Asn
    930                 935                 940

Lys Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys Ser Asn Leu Val
945                 950                 955                 960

Ser Ser Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile Asn
                965                 970                 975

Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Val Lys
            980                 985                 990

Ala Leu Leu Val Lys Tyr Ser Lys  Leu Glu Pro Glu Phe  Val Tyr Gly
        995                 1000                1005

Glu Tyr  Pro Lys Tyr Asn Ser  Tyr Arg Glu Arg Lys  Thr Ala Thr
    1010                1015                1020
```

```
Gln Lys  Met Phe Phe Tyr Ser  Asn Ile Met Asn Met  Phe Lys Ser
    1025                1030                1035

Lys Val  Lys Leu Ala Asp Asp  Gln Ile Val Glu Arg  Pro Met Ile
    1040                1045                1050

Glu Val  Asn Asp Glu Thr Gly  Glu Ile Ala Trp Asp  Lys Thr Lys
    1055                1060                1065

His Ile  Thr Thr Val Lys Lys  Val Leu Ser Tyr Pro  Gln Val Asn
    1070                1075                1080

Ile Val  Lys Lys Val Glu Glu  Gln Thr Ile Gly Gln  Asn Gly Gly
    1085                1090                1095

Leu Phe  Asp Asp Asn Pro Lys  Ser Pro Leu Glu Val  Ile Pro Ser
    1100                1105                1110

Lys Leu  Val Pro Leu Lys Lys  Ala Leu Asn Pro Glu  Lys Tyr Gly
    1115                1120                1125

Gly Tyr  Gln Lys Pro Thr Thr  Ala Tyr Pro Ile Leu  Leu Ile Val
    1130                1135                1140

Asp Thr  Lys Gln Leu Ile Pro  Ile Ser Val Met Asp  Lys Lys Arg
    1145                1150                1155

Phe Glu  Gln Asn Pro Val Lys  Phe Leu Lys Asp Lys  Gly Tyr Gln
    1160                1165                1170

Gln Ile  Glu Lys Asn Asn Phe  Val Lys Leu Pro Lys  Tyr Thr Leu
    1175                1180                1185

Val Asp  Ile Gly Asn Gly Ile  Lys Arg Leu Trp Ala  Ser Ser Lys
    1190                1195                1200

Glu Val  His Lys Gly Asn Gln  Leu Val Val Ser Lys  Lys Ser Gln
    1205                1210                1215
```

```
Asp Leu  Leu Tyr His Ala His  His Leu Asp Asn Asp  Tyr Ser Asn
    1220                1225                1230


Glu Tyr  Val Lys Asn His Tyr  Gln Gln Phe Asp Ile  Leu Phe Asn
    1235                1240                1245


Glu Ile  Thr Ser Phe Ser Lys  Lys Cys Lys Leu Gly  Lys Glu His
    1250                1255                1260


Ile Gln  Lys Ile Glu Glu Ala  Tyr Ser Lys Glu Arg  Asp Ser Ala
    1265                1270                1275


Ser Ile  Glu Glu Leu Ala Asp  Gly Phe Ile Lys Leu  Leu Gly Phe
    1280                1285                1290


Thr Gln  Leu Gly Ala Thr Ser  Pro Phe Ser Phe Leu  Gly Ile Lys
    1295                1300                1305


Leu Asn  Gln Lys Gln Tyr Thr  Gly Lys Lys Asp Tyr  Leu Leu Pro
    1310                1315                1320


Cys Met  Glu Ala Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1325                1330                1335


Glu Thr  Arg Ile Asp Leu Ser  Lys Leu Gly Gly Asp
    1340                1345                1350


<210>  680
<211>  1350
<212>  PRT
<213>  Streptococcus mutans

<400>  680

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
```

```
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220
```

```
Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Thr Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
```

```
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620
```

```
Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Gln Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
```

```
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Glu Asp Val Val Asn Arg Met Arg
865                 870                 875                 880

Pro Phe Trp Asn Lys Leu Leu Ser Ser Gly Leu Ile Ser Gln Arg Lys
                885                 890                 895

Tyr Asn Asn Leu Thr Lys Lys Glu Leu Thr Leu Asp Asp Lys Ala Gly
            900                 905                 910

Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Arg Met Leu Asp Glu Arg Phe Asn Lys Glu Phe Asp Asp Asn Asn
    930                 935                 940

Lys Arg Ile Cys Lys Val Lys Ile Val Thr Leu Lys Ser Asn Leu Val
945                 950                 955                 960

Ser Ser Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile Asn
                965                 970                 975

Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Val Lys
            980                 985                 990

Ala Leu Leu Val Lys Tyr Ser Lys  Leu Glu Pro Glu Phe  Val Tyr Gly
        995                 1000                1005

Glu Tyr  Pro Lys Tyr Asn Ser  Tyr Arg Glu Arg Lys  Thr Ala Thr
    1010                1015                1020
```

```
Gln Lys  Met Phe Phe Tyr Ser  Asn Ile Met Asn Met  Phe Lys Ser
    1025                1030                1035

Lys Val  Lys Leu Ala Asp Asp  Gln Ile Val Glu Arg  Pro Met Ile
    1040                1045                1050

Glu Val  Asn Asp Glu Thr Gly  Glu Ile Ala Trp Asp  Lys Thr Lys
    1055                1060                1065

His Ile  Thr Thr Val Lys Lys  Val Leu Ser Tyr Pro  Gln Val Asn
    1070                1075                1080

Ile Val  Lys Lys Val Glu Glu  Gln Thr Ile Gly Gln  Asn Gly Gly
    1085                1090                1095

Leu Phe  Asp Asp Asn Pro Lys  Ser Pro Leu Glu Val  Ile Pro Ser
    1100                1105                1110

Lys Leu  Val Pro Leu Lys Lys  Ala Leu Asn Pro Glu  Lys Tyr Gly
    1115                1120                1125

Gly Tyr  Gln Lys Pro Thr Thr  Ala Tyr Pro Ile Leu  Leu Ile Val
    1130                1135                1140

Asp Thr  Lys Gln Leu Ile Pro  Ile Ser Val Met Asp  Lys Lys Arg
    1145                1150                1155

Phe Glu  Gln Asn Pro Val Lys  Phe Leu Lys Asp Lys  Gly Tyr Gln
    1160                1165                1170

Gln Ile  Glu Lys Asn Asn Phe  Val Lys Leu Pro Lys  Tyr Thr Leu
    1175                1180                1185

Val Asp  Ile Gly Asn Gly Ile  Lys Arg Leu Trp Ala  Ser Ser Lys
    1190                1195                1200

Glu Val  His Lys Gly Asn Gln  Leu Val Val Ser Lys  Lys Ser Gln
```

```
    1205                1210                1215

Asp Leu  Leu Tyr His Ala His  His Leu Asp Asn Asp  Tyr Ser Asn
    1220                1225                1230

Glu Tyr  Val Lys Asn His Tyr  Gln Gln Phe Asp Ile  Leu Phe Asn
    1235                1240                1245

Glu Ile  Thr Ser Phe Ser Lys  Lys Cys Lys Leu Gly  Lys Glu His
    1250                1255                1260

Ile Gln  Lys Ile Glu Glu Ala  Tyr Ser Lys Glu Arg  Asp Ser Ala
    1265                1270                1275

Ser Ile  Glu Glu Leu Ala Asp  Gly Phe Ile Lys Leu  Leu Gly Phe
    1280                1285                1290

Thr Gln  Leu Gly Ala Thr Ser  Pro Phe Ser Phe Leu  Gly Ile Lys
    1295                1300                1305

Leu Asn  Gln Lys Gln Tyr Thr  Gly Lys Lys Asp Tyr  Leu Leu Pro
    1310                1315                1320

Cys Met  Glu Ala Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1325                1330                1335

Glu Thr  Arg Ile Asp Leu Ser  Lys Leu Gly Gly Asp
    1340                1345                1350


<210>  681
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  681

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15
```

```
Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220
```

```
Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Thr Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415
```

```
Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620
```

```
Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Leu Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815
```

```
Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Pro Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Glu  Glu Asn Lys
    1010                1015                1020
```

```
Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200
```

```
Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                 1210                 1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                 1225                 1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                 1240                 1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                 1255                 1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                 1270                 1275


Leu Lys  Glu Leu Ser Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                 1285                 1290


Ala Ile  Gly Ala Pro Ala Ala  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                 1300                 1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                 1315                 1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                 1330                 1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                 1345


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<213>  Streptococcus mutans

<400>  682

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15
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```
Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
```

```
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415
```

```
Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
```

```
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu His Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815
```

```
Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
```

```
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200
```

```
Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  683
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<213>  Streptococcus mutans

<400>  683

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15
```

```
Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205
```

```
Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415
```

```
Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605
```

```
Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Lys Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815
```

```
Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005
```

```
Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200
```

```
Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                 1210                 1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                 1225                 1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                 1240                 1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                 1255                 1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                 1270                 1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                 1285                 1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                 1300                 1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                 1315                 1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                 1330                 1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                 1345


<210>  684
<211>  1345
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<400>  684

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
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```
1               5                   10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205
```

```
Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
```

```
               405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
               485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
               565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605
```

```
Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
```

```
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005
```

```
Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
```

```
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ser Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Ala  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  685
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  685
```

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205
```

```
Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Thr Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400
```

```
Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605
```

```
Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Leu Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800
```

```
Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Pro Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005
```

```
Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Glu  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185
```

```
Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ser Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Ala  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 686
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 686

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
```

```
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400
```

```
Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
```

```
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800
```

```
Val Glu His Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
```

```
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185
```

```
Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 687
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 687

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190
```

```
Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400
```

```
Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590
```

```
Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Lys Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800
```

```
Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990
```

```
Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110


Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125


Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155


Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170


Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185
```

```
Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200


Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  688
<211>  1345
<212>  PRT
<213>  Streptococcus mutans
```

<400> 688

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190
```

```
Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
```

```
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590
```

```
Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
```

785 790 795 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
805 810 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
820 825 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
835 840 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
850 855 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865 870 875 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
885 890 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
900 905 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
915 920 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
930 935 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945 950 955 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
965 970 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
980 985 990

```
Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110


Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125


Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155


Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170


Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
```

```
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ser Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Ala  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 689
<211> 1345
<212> PRT

<213> Streptococcus mutans

<400> 689

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140


Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175


Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190
```

```
Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380
```

```
Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590
```

```
Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780
```

```
Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800


Val Glu His Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815


Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830


Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845


Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860


Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865                 870                 875                 880


Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895


Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910


Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925


Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
    930                 935                 940


Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960


Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975


Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990
```

```
Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110


Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125


Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155


Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170
```

```
Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 690
<211> 1345

<212> PRT
<213> Streptococcus mutans

<400> 690

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140


Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175


Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
```

```
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380
```

```
Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
```

```
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780
```

```
Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu His Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
```

```
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170
```

```
Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 691

<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 691

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140


Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175
```

```
Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380
```

```
Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575
```

```
Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780
```

```
Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu His Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975
```

```
Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110


Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125


Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155


Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170
```

```
Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 692
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 692

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140


Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175
```

```
Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
```

```
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575
```

```
Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
```

```
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu His Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975
```

```
Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110


Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125


Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155


Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
```

```
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 693
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<212> PRT
<213> Streptococcus mutans

<400> 693

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Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Met Gln Val Asp Glu Ser
                85                  90                  95


Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110


Gly Ser Arg Tyr Pro Ile Phe Gly Thr Leu Lys Glu Glu Lys Lys Tyr
        115                 120                 125


His Lys Glu Phe Lys Thr Ile Tyr His Leu Arg Glu Lys Leu Ala Asn
    130                 135                 140


Ser Thr Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ser Leu Ala His
145                 150                 155                 160


Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Gln Leu Lys Ala
                165                 170                 175
```

```
Glu Asn Thr Asn Val Gln Ala Leu Phe Lys Asp Phe Val Glu Val Tyr
            180                 185                 190

Asp Lys Thr Val Glu Glu Ser His Leu Ser Glu Met Thr Val Asp Ala
        195                 200                 205

Leu Ser Ile Leu Thr Glu Lys Val Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Val Glu Cys Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Gln Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Gly Leu Leu Gly Glu Ile Gly Asp Glu Tyr Ala Asp
        275                 280                 285

Leu Phe Ala Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Ala Val Asp Asp Asn Thr Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Val Lys Arg Tyr Lys Glu His Lys Glu Glu Leu Ala Ala Phe Lys
                325                 330                 335

Arg Phe Ile Lys Glu Lys Leu Pro Lys Lys Tyr Glu Glu Ile Phe Lys
            340                 345                 350

Asp Asp Thr Lys Asn Gly Tyr Ala Gly Tyr Val Gly Ala Asp Lys Lys
        355                 360                 365
```

```
Leu Arg Lys Arg Ser Gly Lys Leu Ala Thr Glu Glu Glu Phe Tyr Lys
    370                 375                 380

Tyr Val Lys Gly Ile Leu Asn Lys Val Glu Gly Ala Asp Val Trp Leu
385                 390                 395                 400

Asp Lys Ile Asp Arg Glu Asp Phe Leu Arg Lys Gln Arg Thr Phe Asp
                405                 410                 415

Asn Gly Ser Ile Pro His Gln Ile His Leu Gln Glu Met His Ala Ile
            420                 425                 430

Leu Arg Arg Gln Gly Glu His Tyr Pro Phe Leu Lys Glu Asn Gln Asp
        435                 440                 445

Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro
    450                 455                 460

Leu Val Arg Lys Gly Ser Arg Phe Ala Trp Ala Glu Tyr Lys Ala Asp
465                 470                 475                 480

Glu Lys Ile Thr Pro Trp Asn Phe Asp Asp Ile Leu Asp Lys Glu Lys
                485                 490                 495

Ser Ala Glu Lys Phe Ile Thr Arg Met Thr Leu Asn Asp Leu Tyr Leu
            500                 505                 510

Pro Glu Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Thr Phe
        515                 520                 525

Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Asn Glu Gln Gly
    530                 535                 540

Glu Ala Lys Phe Phe Asp Ala Asn Met Lys Gln Glu Ile Phe Asp His
545                 550                 555                 560

Val Phe Lys Glu Asn Arg Lys Val Thr Lys Asp Lys Leu Leu Asn Tyr
                565                 570                 575
```

```
Leu Asn Lys Glu Phe Glu Glu Phe Arg Ile Val Asn Leu Thr Gly Leu
            580                 585                 590

Asp Lys Glu Asn Lys Val Phe Asn Ser Ser Leu Gly Thr Tyr His Asp
        595                 600                 605

Leu Arg Lys Ile Leu Asn Lys Ser Phe Leu Asp Asn Lys Glu Asn Glu
    610                 615                 620

Gln Ile Ile Glu Asp Ile Ile Gln Thr Leu Thr Leu Phe Glu Asp Arg
625                 630                 635                 640

Glu Met Ile Arg Gln Arg Leu Gln Lys Tyr Ser Asp Ile Phe Thr Lys
                645                 650                 655

Ala Gln Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly Trp Gly Arg
            660                 665                 670

Leu Ser Tyr Lys Leu Ile Asn Gly Ile Arg Asp Lys Gln Ser Asn Lys
        675                 680                 685

Thr Ile Leu Gly Tyr Leu Ile Asp Asp Gly Tyr Ser Asn Arg Asn Phe
    690                 695                 700

Met Gln Leu Ile Asn Asp Asp Ala Leu Ser Phe Lys Glu Glu Ile Ala
705                 710                 715                 720

Lys Ala Gln Val Ile Gly Glu Met Asp Gly Leu Asn Gln Val Val Ser
                725                 730                 735

Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Ser Leu
            740                 745                 750

Lys Ile Val Asp Glu Leu Val Lys Val Met Gly His Asn Pro Ala Asn
        755                 760                 765
```

```
Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Ala Lys Gly Arg
    770                 775                 780

Arg Ser Ser Gln Lys Arg Tyr Lys Arg Leu Glu Glu Ala Ile Lys Asn
785                 790                 795                 800

Leu Asp His Asp Leu Asn His Lys Ile Leu Lys Glu His Pro Thr Asp
                805                 810                 815

Asn Gln Ala Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu Gln Asn
            820                 825                 830

Gly Arg Asp Met Tyr Thr Glu Asp Pro Leu Asp Ile Asn Arg Leu Ser
        835                 840                 845

Asp Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asn
    850                 855                 860

Ser Ile Asp Asn Arg Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
865                 870                 875                 880

Ser Asp Asp Val Pro Ser Glu Glu Val Val His Lys Met Lys Pro Phe
                885                 890                 895

Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
            900                 905                 910

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp Lys Ala
        915                 920                 925

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
    930                 935                 940

Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp Glu Asn
945                 950                 955                 960

Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser Asn Leu
                965                 970                 975
```

```
Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile
            980                 985                 990

Asn Asp Tyr His His Ala His Asp  Ala Tyr Leu Asn Ala  Val Ile Gly
        995                 1000                1005

Lys Ala  Leu Leu Gly Val Tyr  Pro Gln Leu Glu Pro  Glu Phe Val
    1010                1015                1020

Tyr Gly  Asp Tyr Pro His Phe  His Gly His Lys Glu  Asn Lys Ala
    1025                1030                1035

Thr Ala  Lys Lys Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1040                1045                1050

Lys Gly  Asp Val Arg Thr Asp  Lys Asn Gly Glu Ile  Ile Trp Lys
    1055                1060                1065

Lys Asp  Glu His Ile Ser Asn  Ile Lys Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Val  Asn Ile Val Lys Lys  Val Glu Glu Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Pro  Lys Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Lys Phe  Tyr Trp Asp Thr Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Ile Leu  Val Ile Ala
    1130                1135                1140

Asp Ile  Glu Lys Gly Lys Ser  Lys Lys Leu Lys Thr  Val Lys Ala
    1145                1150                1155
```

```
Leu Val  Gly Val Thr Ile Met  Glu Lys Met Thr Phe  Glu Arg Asp
    1160                1165                1170

Pro Val  Ala Phe Leu Glu Arg  Lys Gly Tyr Arg Asn  Val Gln Glu
    1175                1180                1185

Glu Asn  Ile Ile Lys Leu Pro  Lys Tyr Ser Leu Phe  Lys Leu Glu
    1190                1195                1200

Asn Gly  Arg Lys Arg Leu Leu  Ala Ser Ala Arg Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Ile Val Leu Pro  Asn His Leu Glu Thr  Leu Leu Tyr
    1220                1225                1230

His Ala  Lys Asn Ile His Lys  Val Asp Glu Pro Lys  His Leu Asp
    1235                1240                1245

Tyr Val  Asp Lys His Lys Asp  Glu Phe Lys Glu Leu  Leu Asp Val
    1250                1255                1260

Val Ser  Asn Phe Ser Lys Lys  Tyr Thr Leu Ala Glu  Gly Asn Leu
    1265                1270                1275

Glu Lys  Ile Lys Glu Leu Tyr  Ala Gln Asn Asn Gly  Glu Asp Leu
    1280                1285                1290

Lys Glu  Leu Ala Ser Ser Phe  Ile Asn Leu Leu Thr  Phe Thr Ala
    1295                1300                1305

Ile Gly  Ala Pro Ala Ala Phe  Lys Phe Phe Asp Lys  Asn Ile Asp
    1310                1315                1320

Arg Lys  Arg Tyr Thr Ser Thr  Thr Glu Ile Leu Asn  Ala Thr Leu
    1325                1330                1335

Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                1345                1350
```

Asn Lys Leu Gly Gly Asp
    1355

<210> 694
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<213> Streptococcus mutans

<400> 694

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20   25   30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35   40   45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50   55   60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65   70   75   80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Met Gln Val Asp Glu Ser
                85   90   95

Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100   105   110

Gly Ser Arg Tyr Pro Ile Phe Gly Thr Leu Lys Glu Glu Lys Lys Tyr
        115   120   125

His Lys Glu Phe Lys Thr Ile Tyr His Leu Arg Glu Lys Leu Ala Asn
    130   135   140

Ser Thr Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ser Leu Ala His

```
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Gln Leu Lys Ala
                165                 170                 175

Glu Asn Thr Asn Val Gln Ala Leu Phe Lys Asp Phe Val Glu Val Tyr
            180                 185                 190

Asp Lys Thr Val Glu Glu Ser His Leu Ser Glu Met Thr Val Asp Ala
        195                 200                 205

Leu Ser Ile Leu Thr Glu Lys Val Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Val Glu Cys Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Gln Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Gly Leu Leu Gly Glu Ile Gly Asp Glu Tyr Ala Asp
        275                 280                 285

Leu Phe Ala Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Ala Val Asp Asp Asn Thr Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Val Lys Arg Tyr Lys Glu His Lys Glu Glu Leu Ala Ala Phe Lys
                325                 330                 335

Arg Phe Ile Lys Glu Lys Leu Pro Lys Lys Tyr Glu Glu Ile Phe Lys
            340                 345                 350
```

```
Asp Asp Thr Lys Asn Gly Tyr Ala Gly Tyr Val Gly Ala Asp Lys Lys
        355                 360                 365

Leu Arg Lys Arg Ser Gly Lys Leu Ala Thr Glu Glu Glu Phe Tyr Lys
    370                 375                 380

Tyr Val Lys Gly Ile Leu Asn Lys Val Glu Gly Ala Asp Val Trp Leu
385                 390                 395                 400

Asp Lys Ile Asp Arg Glu Asp Phe Leu Arg Lys Gln Arg Thr Phe Asp
                405                 410                 415

Asn Gly Ser Ile Pro His Gln Ile His Leu Gln Glu Met His Ala Ile
            420                 425                 430

Leu Arg Arg Gln Gly Glu His Tyr Pro Phe Leu Lys Glu Asn Gln Asp
        435                 440                 445

Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro
    450                 455                 460

Leu Val Arg Lys Gly Ser Arg Phe Ala Trp Ala Glu Tyr Lys Ala Asp
465                 470                 475                 480

Glu Lys Ile Thr Pro Trp Asn Phe Asp Asp Ile Leu Asp Lys Glu Lys
                485                 490                 495

Ser Ala Glu Lys Phe Ile Thr Arg Met Thr Leu Asn Asp Leu Tyr Leu
            500                 505                 510

Pro Glu Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Thr Phe
        515                 520                 525

Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Asn Glu Gln Gly
    530                 535                 540

Glu Ala Lys Phe Phe Asp Ala Asn Met Lys Gln Glu Ile Phe Asp His
```

```
545                 550                 555                 560

Val Phe Lys Glu Asn Arg Lys Val Thr Lys Asp Lys Leu Leu Asn Tyr
                565                 570                 575

Leu Asn Lys Glu Phe Glu Glu Phe Arg Ile Val Asn Leu Thr Gly Leu
            580                 585                 590

Asp Lys Glu Asn Lys Val Phe Asn Ser Ser Leu Gly Thr Tyr His Asp
        595                 600                 605

Leu Arg Lys Ile Leu Asn Lys Ser Phe Leu Asp Asn Lys Glu Asn Glu
    610                 615                 620

Gln Ile Ile Glu Asp Ile Ile Gln Thr Leu Thr Leu Phe Glu Asp Arg
625                 630                 635                 640

Glu Met Ile Arg Gln Arg Leu Gln Lys Tyr Ser Asp Ile Phe Thr Lys
                645                 650                 655

Ala Gln Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly Trp Gly Arg
            660                 665                 670

Leu Ser Tyr Lys Leu Ile Asn Gly Ile Arg Asp Lys Gln Ser Asn Lys
        675                 680                 685

Thr Ile Leu Gly Tyr Leu Ile Asp Asp Gly Tyr Ser Asn Arg Asn Phe
    690                 695                 700

Met Gln Leu Ile Asn Asp Asp Ala Leu Ser Phe Lys Glu Glu Ile Ala
705                 710                 715                 720

Lys Ala Gln Val Ile Gly Glu Met Asp Gly Leu Asn Gln Val Val Ser
                725                 730                 735

Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Ser Leu
            740                 745                 750
```

```
Lys Ile Val Asp Glu Leu Val Lys Val Met Gly His Asn Pro Ala Asn
        755                 760                 765

Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Ala Lys Gly Arg
    770                 775                 780

Arg Ser Ser Gln Lys Arg Tyr Lys Arg Leu Glu Glu Ala Ile Lys Asn
785                 790                 795                 800

Leu Asp His Asp Leu Asn His Lys Ile Leu Lys Glu His Pro Thr Asp
                805                 810                 815

Asn Gln Ala Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu Gln Asn
            820                 825                 830

Gly Arg Asp Met Tyr Thr Glu Asp Pro Leu Asp Ile Asn Arg Leu Ser
        835                 840                 845

Asp Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asn
    850                 855                 860

Ser Ile Asp Asn Arg Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
865                 870                 875                 880

Ser Asp Asp Val Pro Ser Glu Glu Val Val His Lys Met Lys Pro Phe
                885                 890                 895

Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
            900                 905                 910

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp Lys Ala
        915                 920                 925

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
    930                 935                 940

Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp Glu Asn
```

```
945                 950                 955                 960

Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser Asn Leu
                965                 970                 975

Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile
            980                 985                 990

Asn Asp Tyr His His Ala His Asp  Ala Tyr Leu Asn Ala  Val Ile Gly
        995                 1000                1005

Lys Ala  Leu Leu Gly Val Tyr  Pro Gln Leu Glu Pro  Glu Phe Val
    1010                1015                1020

Tyr Gly  Asp Tyr Pro His Phe  His Gly His Lys Glu  Asn Lys Ala
    1025                1030                1035

Thr Ala  Lys Lys Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1040                1045                1050

Lys Gly  Asp Val Arg Thr Asp  Lys Asn Gly Glu Ile  Ile Trp Lys
    1055                1060                1065

Lys Asp  Glu His Ile Ser Asn  Ile Lys Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Val  Asn Ile Val Lys Lys  Val Glu Glu Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Pro  Lys Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Lys Phe  Tyr Trp Asp Thr Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Ile Leu  Val Ile Ala
    1130                1135                1140
```

```
Asp Ile  Glu Lys Gly Lys Ser  Lys Lys Leu Lys Thr  Val Lys Ala
    1145                1150                1155

Leu Val  Gly Val Thr Ile Met  Glu Lys Met Thr Phe  Glu Arg Asp
    1160                1165                1170

Pro Val  Ala Phe Leu Glu Arg  Lys Gly Tyr Arg Asn  Val Gln Glu
    1175                1180                1185

Glu Asn  Ile Ile Lys Leu Pro  Lys Tyr Ser Leu Phe  Lys Leu Glu
    1190                1195                1200

Asn Gly  Arg Lys Arg Leu Leu  Ala Ser Ala Arg Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Ile Val Leu Pro  Asn His Leu Glu Thr  Leu Leu Tyr
    1220                1225                1230

His Ala  Lys Asn Ile His Lys  Val Asp Glu Pro Lys  His Leu Asp
    1235                1240                1245

Tyr Val  Asp Lys His Lys Asp  Glu Phe Lys Glu Leu  Leu Asp Val
    1250                1255                1260

Val Ser  Asn Phe Ser Lys Lys  Tyr Thr Leu Ala Glu  Gly Asn Leu
    1265                1270                1275

Glu Lys  Ile Lys Glu Leu Tyr  Ala Gln Asn Asn Gly  Glu Asp Leu
    1280                1285                1290

Lys Glu  Leu Ala Ser Ser Phe  Ile Asn Leu Leu Thr  Phe Thr Ala
    1295                1300                1305

Ile Gly  Ala Pro Ala Ala Phe  Lys Phe Phe Asp Lys  Asn Ile Asp
    1310                1315                1320

Arg Lys  Arg Tyr Thr Ser Thr  Thr Glu Ile Leu Asn  Ala Thr Leu
```

```
    1325                1330                1335


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                1345                1350


Asn Lys  Leu Gly Gly Asp
    1355


<210>  695
<211>  1355
<212>  PRT
<213>  Streptococcus mutans

<400>  695

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Asp Glu Ser Phe Leu Thr Asp Asp Asp Lys Asn
            100                 105                 110


Phe Asp Ser His Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala Tyr
        115                 120                 125
```

```
His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140

Ser Thr Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Ala
                165                 170                 175

Glu Asn Thr Asp Val Gln Lys Leu Phe Ala Asp Phe Val Gly Val Tyr
            180                 185                 190

Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205

Ser Ser Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu Lys
    210                 215                 220

Leu Ile Asn Asn Tyr Pro Lys Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285

Leu Phe Thr Leu Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Ala Glu His His Glu Asp Leu Glu Lys Leu Lys
                325                 330                 335
```

```
Glu Phe Ile Lys Ala Asn Lys Pro Glu Leu Tyr His Asp Ile Phe Lys
            340                 345                 350

Asp Glu Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val Lys
        355                 360                 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Asn Thr Leu Ser Lys Ile Thr
    370                 375                 380

Gly Ser Asp Tyr Phe Leu Asp Gln Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Asp Tyr Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Asn Ser Arg Phe Ala Trp
    450                 455                 460

Ala Glu Tyr His Ser Asp Glu Ala Val Thr Pro Trp Asn Phe Asp Gln
465                 470                 475                 480

Val Ile Asp Lys Glu Ser Ser Ala Gln Ala Phe Ile Glu His Met Thr
                485                 490                 495

Asn Asn Asp Leu Tyr Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Pro Leu Tyr Glu Lys Tyr Thr Val Tyr Asn Glu Leu Thr Lys Ile Lys
        515                 520                 525
```

```
Tyr Val Thr Glu Ile Gly Glu Ala Lys Phe Phe Asp Ala Asn Leu Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Leu Phe Lys His Glu Arg Lys Val Thr Lys
545                 550                 555                 560

Lys Lys Leu Arg Thr Phe Leu Asp Lys Asn Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Ile Gln Gly Leu Asp Lys Glu Thr Glu Thr Phe Asn Ala Ser
            580                 585                 590

Tyr Ala Thr Tyr Gln Asp Leu Leu Lys Val Ile Lys Asp Lys Val Phe
        595                 600                 605

Met Asp Asn Pro Glu Asn Ala Glu Ile Leu Glu Asn Ile Val Leu Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Lys
625                 630                 635                 640

Tyr Ala Asp Val Phe Asp Lys Lys Val Ile Asp Gln Leu Ala Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu Asn Gly Ile
            660                 665                 670

Arg Asp Lys Gln Ser Cys Lys Thr Ile Met Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Ala Gln Ser Asn Arg Asn Leu Met Gln Leu Ile Thr Asp Asp Asn Leu
    690                 695                 700

Thr Phe Lys Asp Asp Ile Val Lys Ala Gln Tyr Val Asp Asn Ser Asp
705                 710                 715                 720

Asp Leu His Gln Val Val Gln Ser Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735
```

```
Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Lys Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Ala Lys Gly Arg Arg Asn Ser Gln Gln Arg Tyr Lys Arg
    770                 775                 780

Leu Lys Glu Ala Ile Lys Ser Leu Asp Arg Asp Leu Asn His Lys Ile
785                 790                 795                 800

Leu Lys Glu His Pro Thr Asp Asn Gln Ala Leu Gln Asn Asn Arg Leu
                805                 810                 815

Phe Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ser
            820                 825                 830

Leu Asp Ile Asn Arg Leu Ser Asp Tyr Asp Ile Asp His Val Ile Pro
        835                 840                 845

Gln Ala Phe Ile Lys Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser
    850                 855                 860

Ser Lys Ala Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Glu Asp Val
865                 870                 875                 880

Val Asn Arg Met Arg Pro Phe Trp Asn Lys Leu Leu Ser Ser Gly Leu
                885                 890                 895

Ile Ser Gln Arg Lys Tyr Asn Asn Leu Thr Lys Lys Glu Leu Thr Leu
            900                 905                 910

Asp Asp Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln
        915                 920                 925
```

```
Ile Thr Lys His Val Ala Arg Met Leu Asp Glu Arg Phe Asn Lys Glu
    930                 935                 940

Phe Asp Asp Asn Asn Lys Arg Ile Arg Arg Val Lys Ile Val Thr Leu
945                 950                 955                 960

Lys Ser Asn Leu Val Ser Ser Phe Arg Lys Glu Phe Glu Leu Tyr Lys
                965                 970                 975

Val Arg Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn
            980                 985                 990

Ala Val Val Val Lys Ala Leu Leu  Val Lys Tyr Pro Lys  Leu Glu Pro
        995                 1000                1005

Glu Phe  Val Tyr Gly Glu Tyr  Pro Lys Tyr Asn Ser  Tyr Arg Glu
    1010                1015                1020

Arg Lys  Thr Ala Thr Gln Lys  Met Phe Phe Tyr Ser  Asn Ile Met
    1025                1030                1035

Asn Met  Phe Lys Ser Lys Val  Lys Leu Ala Asp Asp  Gln Ile Val
    1040                1045                1050

Glu Arg  Pro Met Ile Glu Val  Asn Asp Glu Thr Gly  Glu Ile Ala
    1055                1060                1065

Trp Asp  Lys Thr Lys His Ile  Thr Thr Val Lys Lys  Val Leu Ser
    1070                1075                1080

Tyr Pro  Gln Val Asn Ile Val  Lys Lys Val Glu Glu  Gln Thr Ile
    1085                1090                1095

Gly Gln  Asn Gly Gly Leu Phe  Asp Asp Asn Pro Lys  Ser Pro Leu
    1100                1105                1110

Glu Val  Ile Pro Ser Lys Leu  Val Pro Leu Lys Lys  Ala Leu Asn
    1115                1120                1125
```

```
Pro Glu  Lys Tyr Gly Gly Tyr  Gln Lys Pro Thr Thr  Ala Tyr Pro
    1130                1135                1140

Ile Leu  Leu Ile Val Asp Thr  Lys Gln Leu Ile Pro  Ile Ser Val
    1145                1150                1155

Met Asp  Lys Lys Arg Phe Glu  Gln Asn Pro Val Lys  Phe Leu Lys
    1160                1165                1170

Asp Lys  Gly Tyr Gln Gln Ile  Glu Lys Asn Asn Phe  Val Lys Leu
    1175                1180                1185

Pro Lys  Tyr Thr Leu Val Asp  Ile Gly Asn Gly Ile  Lys Arg Leu
    1190                1195                1200

Trp Ala  Ser Ser Lys Glu Val  His Lys Gly Asn Gln  Leu Val Val
    1205                1210                1215

Ser Lys  Lys Ser Gln Asp Leu  Leu Tyr His Ala His  His Leu Asp
    1220                1225                1230

Asn Asp  Tyr Ser Asn Glu Tyr  Val Lys Asn His Tyr  Gln Gln Phe
    1235                1240                1245

Asp Ile  Leu Phe Asn Glu Ile  Thr Ser Phe Ser Lys  Lys Cys Lys
    1250                1255                1260

Leu Gly  Lys Glu His Ile Gln  Lys Ile Glu Glu Ala  Tyr Ser Lys
    1265                1270                1275

Glu Arg  Asp Phe Ala Ser Ile  Glu Glu Leu Ala Asp  Gly Phe Ile
    1280                1285                1290

Lys Leu  Leu Gly Phe Thr Gln  Leu Gly Ala Thr Ser  Pro Phe Ser
    1295                1300                1305
```

```
Phe Leu  Gly Ile Lys Leu Asn  Gln Lys Gln Tyr Thr  Gly Lys Lys
    1310                1315                1320


Asp Tyr  Leu Leu Pro Cys Met  Glu Ala Thr Leu Ile  His Gln Ser
    1325                1330                1335


Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Lys Leu Gly
    1340                1345                1350


Gly Asp
    1355
```

<210> 696
<211> 1355
<212> PRT
<213> Streptococcus mutans

<400> 696

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Asp Glu Ser Phe Leu Thr Asp Asp Asp Lys Asn
            100                 105                 110
```

```
Phe Asp Ser His Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala Tyr
        115                 120                 125

His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140

Ser Thr Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Ala
                165                 170                 175

Glu Asn Thr Asp Val Gln Lys Leu Phe Ala Asp Phe Val Gly Val Tyr
            180                 185                 190

Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205

Ser Ser Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu Lys
    210                 215                 220

Leu Ile Asn Asn Tyr Pro Lys Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285

Leu Phe Thr Leu Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
```

```
305                 310                 315                 320

Met Ile Lys Arg Tyr Ala Glu His His Glu Asp Leu Glu Lys Leu Lys
                325                 330                 335

Glu Phe Ile Lys Ala Asn Lys Pro Glu Leu Tyr His Asp Ile Phe Lys
            340                 345                 350

Asp Glu Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val Lys
        355                 360                 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Asn Thr Leu Ser Lys Ile Thr
    370                 375                 380

Gly Ser Asp Tyr Phe Leu Asp Gln Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Asp Tyr Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Asn Ser Arg Phe Ala Trp
    450                 455                 460

Ala Glu Tyr His Ser Asp Glu Ala Val Thr Pro Trp Asn Phe Asp Gln
465                 470                 475                 480

Val Ile Asp Lys Glu Ser Ser Ala Gln Ala Phe Ile Glu His Met Thr
                485                 490                 495

Asn Asn Asp Leu Tyr Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510
```

```
Pro Leu Tyr Glu Lys Tyr Thr Val Tyr Asn Glu Leu Thr Lys Ile Lys
        515                 520                 525

Tyr Val Thr Glu Ile Gly Glu Ala Lys Phe Phe Asp Ala Asn Leu Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Leu Phe Lys His Glu Arg Lys Val Thr Lys
545                 550                 555                 560

Lys Lys Leu Arg Thr Phe Leu Asp Lys Asn Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Ile Gln Gly Leu Asp Lys Glu Thr Glu Thr Phe Asn Ala Ser
            580                 585                 590

Tyr Ala Thr Tyr Gln Asp Leu Leu Lys Val Ile Lys Asp Lys Val Phe
        595                 600                 605

Met Asp Asn Pro Glu Asn Ala Glu Ile Leu Glu Asn Ile Val Leu Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Lys
625                 630                 635                 640

Tyr Ala Asp Val Phe Asp Lys Lys Val Ile Asp Gln Leu Ala Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu Asn Gly Ile
            660                 665                 670

Arg Asp Lys Gln Ser Cys Lys Thr Ile Met Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Ala Gln Ser Asn Arg Asn Leu Met Gln Leu Ile Thr Asp Asp Asn Leu
    690                 695                 700

Thr Phe Lys Asp Asp Ile Val Lys Ala Gln Tyr Val Asp Asn Ser Asp
```

```
705                 710                 715                 720

Asp Leu His Gln Val Val Gln Ser Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Lys Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Ala Lys Gly Arg Arg Asn Ser Gln Gln Arg Tyr Lys Arg
    770                 775                 780

Leu Lys Glu Ala Ile Lys Ser Leu Asp Arg Asp Leu Asn His Lys Ile
785                 790                 795                 800

Leu Lys Glu His Pro Thr Asp Asn Gln Ala Leu Gln Asn Asn Arg Leu
                805                 810                 815

Phe Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ser
            820                 825                 830

Leu Asp Ile Asn Arg Leu Ser Asp Tyr Asp Ile Asp His Val Ile Pro
        835                 840                 845

Gln Ala Phe Ile Lys Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser
    850                 855                 860

Ser Lys Ala Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Glu Asp Val
865                 870                 875                 880

Val Asn Arg Met Arg Pro Phe Trp Asn Lys Leu Leu Ser Ser Gly Leu
                885                 890                 895

Ile Ser Gln Arg Lys Tyr Asn Asn Leu Thr Lys Lys Glu Leu Thr Leu
            900                 905                 910
```

```
Asp Asp Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln
        915                 920                 925


Ile Thr Lys His Val Ala Arg Met Leu Asp Glu Arg Phe Asn Lys Glu
    930                 935                 940


Phe Asp Asp Asn Asn Lys Arg Ile Arg Arg Val Lys Ile Val Thr Leu
945                 950                 955                 960


Lys Ser Asn Leu Val Ser Ser Phe Arg Lys Glu Phe Glu Leu Tyr Lys
                965                 970                 975


Val Arg Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn
            980                 985                 990


Ala Val Val Val Lys Ala Leu Leu  Val Lys Tyr Pro Lys  Leu Glu Pro
        995                 1000                1005


Glu Phe  Val Tyr Gly Glu Tyr  Pro Lys Tyr Asn Ser  Tyr Arg Glu
    1010                1015                1020


Arg Lys  Thr Ala Thr Gln Lys  Met Phe Phe Tyr Ser  Asn Ile Met
    1025                1030                1035


Asn Met  Phe Lys Ser Lys Val  Lys Leu Ala Asp Asp  Gln Ile Val
    1040                1045                1050


Glu Arg  Pro Met Ile Glu Val  Asn Asp Glu Thr Gly  Glu Ile Ala
    1055                1060                1065


Trp Asp  Lys Thr Lys His Ile  Thr Thr Val Lys Lys  Val Leu Ser
    1070                1075                1080


Tyr Pro  Gln Val Asn Ile Val  Lys Lys Val Glu Glu  Gln Thr Ile
    1085                1090                1095


Gly Gln  Asn Gly Gly Leu Phe  Asp Asp Asn Pro Lys  Ser Pro Leu
```

```
    1100                1105                1110

Glu Val  Ile Pro Ser Lys Leu  Val Pro Leu Lys Lys  Ala Leu Asn
    1115                1120                1125

Pro Glu  Lys Tyr Gly Gly Tyr  Gln Lys Pro Thr Thr  Ala Tyr Pro
    1130                1135                1140

Ile Leu  Leu Ile Val Asp Thr  Lys Gln Leu Ile Pro  Ile Ser Val
    1145                1150                1155

Met Asp  Lys Lys Arg Phe Glu  Gln Asn Pro Val Lys  Phe Leu Lys
    1160                1165                1170

Asp Lys  Gly Tyr Gln Gln Ile  Glu Lys Asn Asn Phe  Val Lys Leu
    1175                1180                1185

Pro Lys  Tyr Thr Leu Val Asp  Ile Gly Asn Gly Ile  Lys Arg Leu
    1190                1195                1200

Trp Ala  Ser Ser Lys Glu Val  His Lys Gly Asn Gln  Leu Val Val
    1205                1210                1215

Ser Lys  Lys Ser Gln Asp Leu  Leu Tyr His Ala His  His Leu Asp
    1220                1225                1230

Asn Asp  Tyr Ser Asn Glu Tyr  Val Lys Asn His Tyr  Gln Gln Phe
    1235                1240                1245

Asp Ile  Leu Phe Asn Glu Ile  Thr Ser Phe Ser Lys  Lys Cys Lys
    1250                1255                1260

Leu Gly  Lys Glu His Ile Gln  Lys Ile Glu Glu Ala  Tyr Ser Lys
    1265                1270                1275

Glu Arg  Asp Phe Ala Ser Ile  Glu Glu Leu Ala Asp  Gly Phe Ile
    1280                1285                1290
```

```
Lys Leu  Leu Gly Phe Thr Gln  Leu Gly Ala Thr Ser  Pro Phe Ser
    1295                1300                1305


Phe Leu  Gly Ile Lys Leu Asn  Gln Lys Gln Tyr Thr  Gly Lys Lys
    1310                1315                1320


Asp Tyr  Leu Leu Pro Cys Met  Glu Ala Thr Leu Ile  His Gln Ser
    1325                1330                1335


Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Lys Leu Gly
    1340                1345                1350


Gly Asp
    1355
```

<210> 697
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<212> PRT
<213> Streptococcus mutans

<400> 697

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Asp Lys Val Asp Asp Ser
                85                  90                  95
```

```
Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285
```

```
Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495
```

```
Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685
```

```
Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Lys Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895
```

```
Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080
```

```
Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275
```

```
Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  698
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  698

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Asp Lys Val Asp Asp Ser
```

```
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285
```

```
Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
```

```
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685
```

```
Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Lys Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
```

```
               885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
               965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080
```

```
Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
```

```
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 699
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 699

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Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80
```

```
Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Asp Glu Ser Phe Leu Thr Asp Asp Asp Lys Asn
            100                 105                 110

Phe Asp Ser His Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala Tyr
        115                 120                 125

His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140

Ser Thr Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Ala
                165                 170                 175

Glu Asn Thr Asp Val Gln Lys Leu Phe Ala Asp Phe Val Gly Val Tyr
            180                 185                 190

Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205

Ser Ser Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu Lys
    210                 215                 220

Leu Ile Asn Asn Tyr Pro Lys Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285
```

```
Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480
```

```
Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685
```

```
Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880
```

```
Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895


Phe Asp Asn Leu Thr Lys Gly Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910


Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925


Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940


Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960


Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975


Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu Tyr Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080
```

```
Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asp Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260
```

```
Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  700
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<212>  PRT
<213>  Streptococcus mutans

<400>  700

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80
```

```
Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Asp Glu Ser Phe Leu Thr Asp Asp Asp Lys Asn
            100                 105                 110

Phe Asp Ser Tyr Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala Tyr
        115                 120                 125

His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140

Ser Thr Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Ala
                165                 170                 175

Glu Asn Thr Asp Val Gln Lys Leu Phe Ala Asp Phe Val Gly Val Tyr
            180                 185                 190

Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205

Ser Ser Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu Lys
    210                 215                 220

Leu Ile Asn Asn Tyr Pro Lys Glu Lys Lys Asn Thr Leu Phe Arg Asn
225                 230                 235                 240

Leu Val Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
```

```
        275                 280                 285

Leu Phe Thr Leu Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Ala Glu His His Glu Asp Leu Glu Lys Leu Lys
                325                 330                 335

Glu Phe Ile Lys Ala Asn Lys Pro Glu Leu Tyr His Asp Ile Phe Lys
            340                 345                 350

Asp Glu Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val Lys
        355                 360                 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Asn Thr Leu Ser Lys Ile Ala
    370                 375                 380

Gly Ser Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Asp Tyr Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480
```

```
Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
```

```
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880
```

```
Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
               885                 890                 895

Phe Asp Asn Leu Thr Lys Gly Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
               965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu Tyr Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
```

```
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asp Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260
```

```
Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

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<212> PRT
<213> Streptococcus mutans

<400> 701

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80
```

```
Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Asp Glu Ser Phe Leu Thr Asp Asp Asp Lys Asn
            100                 105                 110

Phe Asp Ser Tyr Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala Tyr
        115                 120                 125

His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140

Ser Thr Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Ala
                165                 170                 175

Glu Asn Thr Asp Val Gln Lys Leu Phe Ala Asp Phe Val Gly Val Tyr
            180                 185                 190

Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205

Ser Ser Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu Lys
    210                 215                 220

Leu Ile Asn Asn Tyr Pro Lys Glu Lys Lys Asn Thr Leu Phe Arg Asn
225                 230                 235                 240

Leu Val Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270
```

```
Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285

Leu Phe Thr Leu Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Ala Glu His His Glu Asp Leu Glu Lys Leu Lys
                325                 330                 335

Glu Phe Ile Lys Ala Asn Lys Pro Glu Leu Tyr His Asp Ile Phe Lys
            340                 345                 350

Asp Glu Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val Lys
        355                 360                 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Asn Thr Leu Ser Lys Ile Ala
    370                 375                 380

Gly Ser Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Asp Tyr Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480
```

```
Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670
```

```
Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880
```

```
Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
               885                 890                 895


Phe Asp Asn Leu Thr Lys Gly Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910


Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925


Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940


Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960


Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
               965                 970                 975


Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu Tyr Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065
```

```
Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asp Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260
```

```
Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  702
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  702

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
```

```
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Gly Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Ile Tyr Glu
            260                 265                 270
```

```
Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
```

```
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670
```

```
Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
```

```
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065
```

```
Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
```

```
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 703
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 703

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60
```

```
Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Gly Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Ile Tyr Glu
            260                 265                 270
```

```
Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460
```

```
Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670
```

```
Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860
```

```
Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865                 870                 875                 880


Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895


Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910


Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925


Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
    930                 935                 940


Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960


Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975


Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065
```

```
Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245
```

```
Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 704
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 704

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Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60
```

```
Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Ile Tyr Glu
```

```
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460
```

```
Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480


Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495


Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510


Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525


Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540


Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560


Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575


Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590


Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605


Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620


Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640


Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655


Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
```

```
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860
```

```
Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865                 870                 875                 880


Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895


Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910


Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925


Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
    930                 935                 940


Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960


Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975


Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
```

```
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245
```

```
Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 705
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 705

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60
```

```
Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255
```

```
Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Ile Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460
```

```
Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655
```

```
Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860
```

```
Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050
```

```
Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Tyr Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245
```

```
Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Ala  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 706
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 706

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
```

```
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255
```

```
Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Ile Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
```

```
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655
```

```
Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Leu Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
```

```
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Gly Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050
```

```
Lys Lys  Asp Glu Tyr Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Phe  Lys Glu Ser Ile Leu  Pro Lys Gly Asp Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
```

```
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 707
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 707

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45
```

```
Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255
```

```
Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Ile Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445
```

```
Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655
```

```
Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845
```

```
Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050
```

```
Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230
```

```
Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Asn  Lys Leu Gly Gly Asp
    1340                1345


<210>  708
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  708

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45
```

```
Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
```

```
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Ile Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445
```

```
Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
```

```
               645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845
```

```
Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
```

```
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230
```

```
Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Asn  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 709
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 709

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45
```

```
Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240
```

```
Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Ile Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445
```

```
Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640
```

```
Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845
```

```
Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035
```

```
Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230
```

```
Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


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<212>  PRT
<213>  Streptococcus mutans

<400>  710

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
```

```
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240
```

```
Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Ile Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
```

```
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640
```

```
Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
               645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
               725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
               805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
```

```
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035
```

```
Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Tyr Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
```

```
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Ala  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  711
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<400>  711

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30
```

```
Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240
```

```
Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
               245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Ile Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
               325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
               405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430
```

```
Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640
```

```
Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Leu Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830
```

```
Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Gly Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035
```

```
Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu Tyr Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Phe  Lys Glu Ser Ile Leu  Pro Lys Gly Asp Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215
```

```
Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                 1225                 1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                 1240                 1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                 1255                 1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                 1270                 1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                 1285                 1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                 1300                 1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                 1315                 1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                 1330                 1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                 1345


<210>  712
<211>  1345
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<213>  Streptococcus mutans

<400>  712

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30
```

```
Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Lys Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
```

```
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Leu Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430
```

```
Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
```

625 630 635 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
645 650 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
660 665 670

Asn Lys Glu Ser Arg Lys Thr Leu Leu Asp Tyr Leu Ile Asp Asp Gly
675 680 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
690 695 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705 710 715 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
725 730 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
740 745 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
755 760 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
770 775 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785 790 795 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
805 810 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
820 825 830

```
Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
```

```
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu Tyr Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Ile Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215
```

```
Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


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<213>  Streptococcus mutans

<400>  713

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30
```

```
Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Lys Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220
```

```
Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Leu Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430
```

```
Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620
```

```
Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Leu Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830
```

```
Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020
```

```
Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu Tyr Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Ile Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215
```

```
Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  714
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<212>  PRT
<213>  Streptococcus mutans

<400>  714

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
```

```
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220
```

```
Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285

Leu Phe Thr Leu Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
```

```
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620
```

```
Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
```

```
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020
```

```
Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
```

```
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  715
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  715

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15
```

```
Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220
```

```
Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285

Leu Phe Thr Leu Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415
```

```
Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620
```

```
Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815
```

```
Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Pro Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Glu  Glu Asn Lys
    1010                1015                1020
```

```
Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200
```

```
Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                 1210                 1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                 1225                 1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                 1240                 1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                 1255                 1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                 1270                 1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                 1285                 1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                 1300                 1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                 1315                 1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                 1330                 1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                 1345


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Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15
```

```
Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
```

```
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415
```

```
Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
```

```
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Lys Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815
```

```
Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
```

```
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200
```

```
Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


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<400>  717

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15
```

```
Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205
```

```
Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415
```

```
Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605
```

```
Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Lys Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815
```

```
Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005
```

```
Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Arg Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200
```

```
Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                 1210                 1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                 1225                 1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                 1240                 1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                 1255                 1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                 1270                 1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                 1285                 1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                 1300                 1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                 1315                 1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                 1330                 1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                 1345


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<213>  Streptococcus mutans

<400>  718

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
```

```
1               5                   10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205
```

```
Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
```

```
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605
```

```
Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Gln Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
```

```
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Glu Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005
```

```
Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
```

```
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  719
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  719
```

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205
```

```
Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400
```

```
Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605
```

```
Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Gln Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800
```

```
Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Glu Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005
```

```
Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185
```

```
Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 720
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 720

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
```

```
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285

Leu Phe Thr Leu Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400
```

```
Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
```

```
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800
```

```
Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
```

```
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185
```

```
Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 721
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 721

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190
```

```
Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285

Leu Phe Thr Leu Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400
```

```
Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590
```

```
Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800
```

```
Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Pro Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990
```

```
Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Glu  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110


Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125


Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155


Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170


Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185
```

```
Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 722
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 722

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190
```

```
Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
```

```
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590
```

```
Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Lys Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
```

785 790 795 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
805 810 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
820 825 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
835 840 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
850 855 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865 870 875 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
885 890 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
900 905 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
915 920 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
930 935 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945 950 955 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
965 970 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
980 985 990

```
Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110


Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125


Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155


Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170


Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
```

```
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345

<210>  723
<211>  1345
<212>  PRT
```

<213> Streptococcus mutans

<400> 723

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140


Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175


Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190
```

```
Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380
```

```
Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590
```

```
Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Lys Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780
```

```
Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800


Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815


Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830


Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845


Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860


Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880


Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895


Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910


Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925


Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940


Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960


Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975


Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990
```

```
Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Arg Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110


Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125


Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155


Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170
```

```
Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 724
<211> 1345

<212> PRT
<213> Streptococcus mutans

<400> 724

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140


Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175


Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
```

```
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380
```

```
Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
```

```
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Lys Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780
```

```
Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
```

```
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170
```

```
Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 725

<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 725

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140


Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175
```

```
Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380
```

```
Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575
```

```
Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Lys Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780
```

```
Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975
```

```
Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110


Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125


Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155


Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170
```

```
Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 726
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 726

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140


Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175
```

```
Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
```

```
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575
```

```
Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Lys Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
```

```
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975
```

```
Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110


Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125


Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155


Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
```

```
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 727
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 727

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140


Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175
```

```
Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365
```

```
Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575
```

```
Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765
```

```
Phe Thr Lys Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975
```

```
Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Arg Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110


Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125


Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155
```

```
Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 728
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 728

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asn Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140


Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
```

```
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365
```

```
Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
```

```
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765
```

```
Phe Thr Lys Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
```

```
               965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu Tyr Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155
```

```
Asp Pro  Ile Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Ala  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
```

1340 1345

<210> 729
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 729

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
35 40 45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asn Asp Ser
85 90 95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
100 105 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
115 120 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
130 135 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145 150 155 160

```
Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365
```

```
Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560
```

```
Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765
```

```
Phe Thr Lys Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960
```

```
Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu Tyr Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155
```

```
Asp Pro  Ile Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Ala  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335
```

Leu Ser Lys Leu Gly Gly Asp
    1340   1345

<210> 730
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<212> PRT
<213> Streptococcus mutans

<400> 730

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20   25   30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35   40   45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50   55   60

Lys Arg Thr Thr Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65   70   75   80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85   90   95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100   105   110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115   120   125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130   135   140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145   150   155   160

```
Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Cys Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Thr Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
```

```
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Leu Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Ser Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560
```

```
Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
```

```
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960
```

```
Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
               965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
```

```
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335
```

```
Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  731
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<212>  PRT
<213>  Streptococcus mutans

<400>  731

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Thr Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140


Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160
```

```
Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Cys Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Thr Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350
```

```
Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Leu Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Ser Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560
```

```
Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750
```

```
Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960
```

```
Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
               965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
           980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140
```

```
Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335
```

```
Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  732
<211>  1350
<212>  PRT
<213>  Streptococcus mutans

<400>  732

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Thr Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140


Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
```

```
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Thr Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350
```

```
Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
```

```
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750
```

```
Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Glu Asp Val Val Asn Arg Met Arg
865                 870                 875                 880

Pro Phe Trp Asn Lys Leu Leu Ser Ser Gly Leu Ile Ser Gln Arg Lys
                885                 890                 895

Tyr Asn Asn Leu Thr Lys Lys Glu Leu Thr Pro Asp Asp Lys Ala Gly
            900                 905                 910

Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Arg Met Leu Asp Glu Arg Phe Asn Lys Glu Phe Asp Asp Asn Asn
    930                 935                 940

Lys Arg Ile Arg Arg Val Lys Ile Val Thr Leu Lys Ser Asn Leu Val
```

```
945                 950                 955                 960

Ser Ser Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile Asn
                965                 970                 975

Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Val Lys
            980                 985                 990

Ala Leu Leu Val Lys Tyr Pro Lys  Leu Glu Pro Glu Phe  Val Tyr Gly
        995                 1000                1005

Glu Tyr  Pro Lys Tyr Asn Ser  Tyr Arg Glu Arg Lys  Thr Ala Thr
    1010                1015                1020

Gln Lys  Met Phe Phe Tyr Ser  Asn Ile Met Asn Met  Phe Lys Ser
    1025                1030                1035

Lys Val  Lys Leu Ala Asp Asp  Gln Ile Val Glu Arg  Pro Met Ile
    1040                1045                1050

Glu Val  Asn Asp Glu Thr Gly  Glu Ile Ala Trp Asp  Lys Thr Lys
    1055                1060                1065

His Ile  Thr Thr Val Lys Lys  Val Leu Ser Tyr Pro  Gln Val Asn
    1070                1075                1080

Ile Val  Lys Lys Val Glu Glu  Gln Thr Ile Gly Gln  Asn Gly Gly
    1085                1090                1095

Leu Phe  Asp Asp Asn Pro Lys  Ser Pro Leu Glu Val  Ile Pro Ser
    1100                1105                1110

Lys Leu  Val Pro Leu Lys Lys  Ala Leu Asn Pro Glu  Lys Tyr Gly
    1115                1120                1125

Gly Tyr  Gln Lys Pro Thr Thr  Ala Tyr Pro Ile Leu  Leu Ile Val
    1130                1135                1140
```

```
Asp Thr  Lys Gln Leu Ile Pro  Ile Ser Val Met Asp  Lys Lys Arg
    1145                1150                1155

Phe Glu  Gln Asn Pro Val Lys  Phe Leu Lys Asp Lys  Gly Tyr Gln
    1160                1165                1170

Gln Ile  Glu Lys Asn Asn Phe  Val Lys Leu Pro Lys  Tyr Thr Leu
    1175                1180                1185

Val Asp  Ile Gly Asn Gly Ile  Lys Arg Leu Trp Ala  Ser Ser Lys
    1190                1195                1200

Glu Val  His Lys Gly Asn Gln  Leu Val Val Ser Lys  Lys Ser Gln
    1205                1210                1215

Asp Leu  Leu Tyr His Ala His  His Leu Asp Asn Asp  Tyr Ser Asn
    1220                1225                1230

Glu Tyr  Val Lys Asn His Tyr  Gln Gln Phe Asp Ile  Leu Phe Asn
    1235                1240                1245

Glu Ile  Thr Ser Phe Ser Lys  Lys Cys Lys Leu Gly  Lys Glu His
    1250                1255                1260

Ile Gln  Lys Ile Glu Glu Ala  Tyr Ser Lys Glu Arg  Asp Ser Ala
    1265                1270                1275

Ser Ile  Glu Glu Leu Ala Asp  Gly Phe Ile Lys Leu  Leu Gly Phe
    1280                1285                1290

Thr Gln  Leu Gly Ala Thr Ser  Pro Phe Ser Phe Leu  Gly Ile Lys
    1295                1300                1305

Leu Asn  Gln Lys Gln Tyr Thr  Gly Lys Lys Asp Tyr  Leu Leu Pro
    1310                1315                1320

Cys Met  Glu Ala Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
```

```
    1325                1330                1335


Glu Thr  Arg Ile Asp Leu Ser  Lys Leu Gly Gly Asp
    1340                1345                1350


<210>  733
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<212>  PRT
<213>  Streptococcus mutans

<400>  733

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Thr Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140
```

```
Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Thr Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350
```

```
Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540
```

```
Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750
```

```
Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Glu Asp Val Val Asn Arg Met Arg
865                 870                 875                 880

Pro Phe Trp Asn Lys Leu Leu Ser Ser Gly Leu Ile Ser Gln Arg Lys
                885                 890                 895

Tyr Asn Asn Leu Thr Lys Lys Glu Leu Thr Pro Asp Asp Lys Ala Gly
            900                 905                 910

Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Arg Met Leu Asp Glu Arg Phe Asn Lys Glu Phe Asp Asp Asn Asn
    930                 935                 940
```

```
Lys Arg Ile Arg Arg Val Lys Ile Val Thr Leu Lys Ser Asn Leu Val
945                 950                 955                 960


Ser Ser Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile Asn
                965                 970                 975


Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Val Lys
            980                 985                 990


Ala Leu Leu Val Lys Tyr Pro Lys  Leu Glu Pro Glu Phe  Val Tyr Gly
        995                 1000                1005


Glu Tyr  Pro Lys Tyr Asn Ser  Tyr Arg Glu Arg Lys  Thr Ala Thr
    1010                1015                1020


Gln Lys  Met Phe Phe Tyr Ser  Asn Ile Met Asn Met  Phe Lys Ser
    1025                1030                1035


Lys Val  Lys Leu Ala Asp Asp  Gln Ile Val Glu Arg  Pro Met Ile
    1040                1045                1050


Glu Val  Asn Asp Glu Thr Gly  Glu Ile Ala Trp Asp  Lys Thr Lys
    1055                1060                1065


His Ile  Thr Thr Val Lys Lys  Val Leu Ser Tyr Pro  Gln Val Asn
    1070                1075                1080


Ile Val  Lys Lys Val Glu Glu  Gln Thr Ile Gly Gln  Asn Gly Gly
    1085                1090                1095


Leu Phe  Asp Asp Asn Pro Lys  Ser Pro Leu Glu Val  Ile Pro Ser
    1100                1105                1110


Lys Leu  Val Pro Leu Lys Lys  Ala Leu Asn Pro Glu  Lys Tyr Gly
    1115                1120                1125


Gly Tyr  Gln Lys Pro Thr Thr  Ala Tyr Pro Ile Leu  Leu Ile Val
    1130                1135                1140
```

```
Asp Thr  Lys Gln Leu Ile Pro  Ile Ser Val Met Asp  Lys Lys Arg
    1145                1150                1155

Phe Glu  Gln Asn Pro Val Lys  Phe Leu Lys Asp Lys  Gly Tyr Gln
    1160                1165                1170

Gln Ile  Glu Lys Asn Asn Phe  Val Lys Leu Pro Lys  Tyr Thr Leu
    1175                1180                1185

Val Asp  Ile Gly Asn Gly Ile  Lys Arg Leu Trp Ala  Ser Ser Lys
    1190                1195                1200

Glu Val  His Lys Gly Asn Gln  Leu Val Val Ser Lys  Lys Ser Gln
    1205                1210                1215

Asp Leu  Leu Tyr His Ala His  His Leu Asp Asn Asp  Tyr Ser Asn
    1220                1225                1230

Glu Tyr  Val Lys Asn His Tyr  Gln Gln Phe Asp Ile  Leu Phe Asn
    1235                1240                1245

Glu Ile  Thr Ser Phe Ser Lys  Lys Cys Lys Leu Gly  Lys Glu His
    1250                1255                1260

Ile Gln  Lys Ile Glu Glu Ala  Tyr Ser Lys Glu Arg  Asp Ser Ala
    1265                1270                1275

Ser Ile  Glu Glu Leu Ala Asp  Gly Phe Ile Lys Leu  Leu Gly Phe
    1280                1285                1290

Thr Gln  Leu Gly Ala Thr Ser  Pro Phe Ser Phe Leu  Gly Ile Lys
    1295                1300                1305

Leu Asn  Gln Lys Gln Tyr Thr  Gly Lys Lys Asp Tyr  Leu Leu Pro
    1310                1315                1320
```

```
Cys Met  Glu Ala Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1325                1330                1335


Glu Thr  Arg Ile Asp Leu Ser  Lys Leu Gly Gly Asp
    1340                1345                1350
```

<210> 734
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 734

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Asp Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140
```

```
Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Ile Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
```

```
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540
```

```
Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
```

```
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940
```

```
Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960


Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975


Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110


Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125


Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
```

```
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320
```

```
Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  735
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  735

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Ser Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140
```

```
Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335
```

```
Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540
```

```
Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735
```

```
Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu His Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
    930                 935                 940
```

```
Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960


Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975


Glu Ile Asn Asp Tyr His His Thr His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110


Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125
```

```
Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320
```

```
Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                 1330                 1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                 1345


<210>  736
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  736

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Ser Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
```

```
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335
```

```
Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
```

```
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735
```

```
Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu His Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
```

```
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Thr His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125
```

```
Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
```

```
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  737
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  737

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125
```

```
His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Gly Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335
```

```
Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Leu Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525
```

```
Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735
```

```
Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925
```

```
Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Ile  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125
```

```
Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305
```

```
Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 738
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 738

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125
```

```
His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Gly Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
```

```
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Leu Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525
```

```
Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
```

```
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925
```

```
Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Ile  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
```

```
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305
```

```
Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 739
<211> 1355
<212> PRT
<213> Streptococcus mutans

<400> 739

```
Met Lys Lys Ser Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Asp Glu Ser Phe Leu Thr Asp Asp Asp Lys Asn
            100                 105                 110


Phe Asp Ser His Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala Tyr
        115                 120                 125
```

```
His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140

Ser Thr Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Ala
                165                 170                 175

Glu Asn Thr Asp Val Gln Lys Leu Phe Ala Asp Phe Val Gly Val Tyr
            180                 185                 190

Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205

Ser Ser Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu Lys
    210                 215                 220

Leu Ile Asn Asn Tyr Pro Lys Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285

Leu Phe Thr Leu Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320
```

```
Met Ile Lys Arg Tyr Ala Glu His His Glu Asp Leu Glu Lys Leu Lys
                325                 330                 335

Glu Phe Ile Lys Ala Asn Lys Pro Glu Leu Tyr His Asp Ile Phe Lys
            340                 345                 350

Asp Glu Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val Lys
        355                 360                 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Asn Thr Leu Ser Lys Ile Ala
    370                 375                 380

Gly Ser Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Asp Tyr Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Asn Ser Arg Phe Ala Trp
    450                 455                 460

Ala Glu Tyr His Ser Asp Glu Ala Val Met Pro Trp Asn Phe Asp Gln
465                 470                 475                 480

Val Ile Asp Lys Glu Ser Ser Ala Gln Ala Phe Ile Glu His Met Thr
                485                 490                 495

Asn Asn Asp Leu Tyr Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Pro Leu Tyr Glu Lys Tyr Thr Val Tyr Asn Glu Leu Thr Lys Ile Lys
        515                 520                 525
```

```
Tyr Val Thr Glu Ile Gly Glu Ala Lys Phe Phe Asp Ala Asn Leu Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Leu Phe Lys His Glu Arg Lys Val Thr Lys
545                 550                 555                 560

Lys Lys Leu Arg Thr Phe Leu Asp Lys Asn Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Ile Gln Gly Leu Asp Lys Glu Thr Glu Thr Phe Asn Ala Ser
            580                 585                 590

Tyr Ala Thr Tyr Gln Asp Leu Leu Lys Val Ile Lys Asp Lys Val Phe
        595                 600                 605

Met Asp Asn Pro Glu Asn Ala Glu Ile Leu Glu Asn Ile Val Leu Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Lys
625                 630                 635                 640

Tyr Ala Asp Val Phe Asp Lys Lys Val Ile Asp Gln Leu Ala Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu Asn Gly Ile
            660                 665                 670

Arg Asp Lys Gln Ser Cys Lys Thr Ile Met Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Ala Gln Ser Asn Arg Asn Leu Met Gln Leu Ile Thr Asp Asp Asn Leu
    690                 695                 700

Thr Phe Lys Asp Asp Ile Val Lys Ala Gln Tyr Val Asp Asn Ser Asp
705                 710                 715                 720
```

```
Asp Leu His Gln Val Val Gln Ser Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Lys Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Ala Lys Gly Arg Arg Asn Ser Gln Gln Arg Tyr Lys Arg
    770                 775                 780

Leu Lys Glu Ala Ile Lys Ser Leu Asp Arg Asp Leu Asn His Lys Ile
785                 790                 795                 800

Leu Lys Glu His Pro Thr Asp Asn Gln Ala Leu Gln Asn Asn Arg Leu
                805                 810                 815

Phe Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ser
            820                 825                 830

Leu Asp Ile Asn Arg Leu Ser Asp Tyr Asp Ile Asp His Val Ile Pro
        835                 840                 845

Gln Ala Phe Ile Lys Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser
    850                 855                 860

Ser Lys Ala Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Glu Asp Val
865                 870                 875                 880

Val Asn Arg Met Arg Pro Phe Trp Asn Lys Leu Leu Ser Ser Gly Leu
                885                 890                 895

Ile Ser Gln Arg Lys Tyr Asn Asn Leu Thr Lys Lys Glu Leu Thr Pro
            900                 905                 910

Asp Asp Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln
        915                 920                 925
```

```
Ile Thr Lys His Val Ala Arg Met Leu Asp Glu Arg Phe Asn Lys Glu
    930                 935                 940

Phe Asp Asp Asn Asn Lys Arg Ile Arg Arg Val Lys Ile Val Thr Leu
945                 950                 955                 960

Lys Ser Asn Leu Val Ser Ser Phe Arg Lys Glu Phe Glu Leu Tyr Lys
                965                 970                 975

Val Arg Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn
            980                 985                 990

Ala Val Val Val Lys Ala Leu Leu  Val Lys Tyr Pro Lys  Leu Glu Pro
        995                 1000                1005

Glu Phe  Val Tyr Gly Glu Tyr  Pro Lys Tyr Asn Ser  Tyr Arg Glu
    1010                1015                1020

Arg Lys  Thr Ala Thr Gln Lys  Met Phe Phe Tyr Ser  Asn Ile Met
    1025                1030                1035

Asn Met  Phe Lys Ser Lys Val  Lys Leu Ala Asp Asp  Gln Ile Val
    1040                1045                1050

Glu Arg  Pro Met Ile Glu Val  Asn Asp Glu Thr Gly  Glu Ile Ala
    1055                1060                1065

Trp Asp  Lys Thr Lys His Ile  Thr Thr Val Lys Lys  Val Leu Ser
    1070                1075                1080

Tyr Pro  Gln Val Asn Ile Val  Lys Lys Val Glu Glu  Gln Thr Ile
    1085                1090                1095

Gly Gln  Asn Gly Gly Leu Phe  Asp Asp Asn Pro Lys  Ser Pro Leu
    1100                1105                1110
```

```
Glu Val  Ile Pro Ser Lys Leu  Val Pro Leu Lys Lys  Ala Leu Asn
    1115                1120                1125

Pro Glu  Lys Tyr Gly Gly Tyr  Gln Lys Pro Thr Thr  Ala Tyr Pro
    1130                1135                1140

Ile Leu  Leu Ile Val Asp Thr  Lys Gln Leu Ile Pro  Ile Ser Val
    1145                1150                1155

Met Asp  Lys Lys Arg Phe Glu  Gln Asn Pro Val Lys  Phe Leu Lys
    1160                1165                1170

Asp Lys  Gly Tyr Gln Gln Ile  Glu Lys Asn Asn Phe  Val Lys Leu
    1175                1180                1185

Pro Lys  Tyr Thr Leu Val Asp  Ile Gly Asn Gly Ile  Lys Arg Leu
    1190                1195                1200

Trp Ala  Ser Ser Lys Glu Val  His Lys Gly Asn Gln  Leu Val Val
    1205                1210                1215

Ser Lys  Lys Ser Gln Asp Leu  Leu Tyr His Ala His  His Leu Asp
    1220                1225                1230

Asn Asp  Tyr Ser Asn Glu Tyr  Val Lys Asn His Tyr  Gln Gln Phe
    1235                1240                1245

Asp Ile  Leu Phe Asn Glu Ile  Thr Ser Phe Ser Lys  Lys Cys Lys
    1250                1255                1260

Leu Gly  Lys Glu His Ile Gln  Lys Ile Glu Glu Ala  Tyr Ser Lys
    1265                1270                1275

Glu Arg  Asp Ser Ala Ser Ile  Glu Glu Leu Ala Asp  Gly Phe Ile
    1280                1285                1290

Lys Leu  Leu Gly Phe Thr Gln  Leu Gly Ala Thr Ser  Pro Phe Ser
    1295                1300                1305
```

Phe Leu Gly Ile Lys Leu Asn Gln Lys Gln Tyr Thr Gly Lys Lys
    1310   1315   1320

Asp Tyr Leu Leu Pro Cys Met Glu Ala Thr Leu Ile His Gln Ser
    1325   1330   1335

Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp Leu Asn Lys Leu Gly
    1340   1345   1350

Gly Asp
    1355

<210> 740
<211> 1355
<212> PRT
<213> Streptococcus mutans

<400> 740

Met Lys Lys Ser Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20   25   30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35   40   45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50   55   60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65   70   75   80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85   90   95

Phe Phe His Arg Leu Asp Glu Ser Phe Leu Thr Asp Asp Asp Lys Asn

```
            100                 105                 110

Phe Asp Ser His Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala Tyr
        115                 120                 125

His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140

Ser Thr Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Ala
                165                 170                 175

Glu Asn Thr Asp Val Gln Lys Leu Phe Ala Asp Phe Val Gly Val Tyr
            180                 185                 190

Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205

Ser Ser Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu Lys
    210                 215                 220

Leu Ile Asn Asn Tyr Pro Lys Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285

Leu Phe Thr Leu Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300
```

```
Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Ala Glu His His Glu Asp Leu Glu Lys Leu Lys
                325                 330                 335

Glu Phe Ile Lys Ala Asn Lys Pro Glu Leu Tyr His Asp Ile Phe Lys
            340                 345                 350

Asp Glu Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val Lys
        355                 360                 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Asn Thr Leu Ser Lys Ile Ala
    370                 375                 380

Gly Ser Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Asp Tyr Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Asn Ser Arg Phe Ala Trp
    450                 455                 460

Ala Glu Tyr His Ser Asp Glu Ala Val Met Pro Trp Asn Phe Asp Gln
465                 470                 475                 480

Val Ile Asp Lys Glu Ser Ser Ala Gln Ala Phe Ile Glu His Met Thr
                485                 490                 495

Asn Asn Asp Leu Tyr Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
```

```
            500                 505                 510

Pro Leu Tyr Glu Lys Tyr Thr Val Tyr Asn Glu Leu Thr Lys Ile Lys
        515                 520                 525

Tyr Val Thr Glu Ile Gly Glu Ala Lys Phe Phe Asp Ala Asn Leu Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Leu Phe Lys His Glu Arg Lys Val Thr Lys
545                 550                 555                 560

Lys Lys Leu Arg Thr Phe Leu Asp Lys Asn Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Ile Gln Gly Leu Asp Lys Glu Thr Glu Thr Phe Asn Ala Ser
            580                 585                 590

Tyr Ala Thr Tyr Gln Asp Leu Leu Lys Val Ile Lys Asp Lys Val Phe
        595                 600                 605

Met Asp Asn Pro Glu Asn Ala Glu Ile Leu Glu Asn Ile Val Leu Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Lys
625                 630                 635                 640

Tyr Ala Asp Val Phe Asp Lys Lys Val Ile Asp Gln Leu Ala Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu Asn Gly Ile
            660                 665                 670

Arg Asp Lys Gln Ser Cys Lys Thr Ile Met Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Ala Gln Ser Asn Arg Asn Leu Met Gln Leu Ile Thr Asp Asp Asn Leu
    690                 695                 700
```

```
Thr Phe Lys Asp Asp Ile Val Lys Ala Gln Tyr Val Asp Asn Ser Asp
705                 710                 715                 720

Asp Leu His Gln Val Val Gln Ser Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Lys Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Ala Lys Gly Arg Arg Asn Ser Gln Gln Arg Tyr Lys Arg
    770                 775                 780

Leu Lys Glu Ala Ile Lys Ser Leu Asp Arg Asp Leu Asn His Lys Ile
785                 790                 795                 800

Leu Lys Glu His Pro Thr Asp Asn Gln Ala Leu Gln Asn Asn Arg Leu
                805                 810                 815

Phe Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ser
            820                 825                 830

Leu Asp Ile Asn Arg Leu Ser Asp Tyr Asp Ile Asp His Val Ile Pro
        835                 840                 845

Gln Ala Phe Ile Lys Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser
    850                 855                 860

Ser Lys Ala Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Glu Asp Val
865                 870                 875                 880

Val Asn Arg Met Arg Pro Phe Trp Asn Lys Leu Leu Ser Ser Gly Leu
                885                 890                 895

Ile Ser Gln Arg Lys Tyr Asn Asn Leu Thr Lys Lys Glu Leu Thr Pro
```

```
            900                 905                 910

Asp Asp Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln
        915                 920                 925

Ile Thr Lys His Val Ala Arg Met Leu Asp Glu Arg Phe Asn Lys Glu
    930                 935                 940

Phe Asp Asp Asn Asn Lys Arg Ile Arg Arg Val Lys Ile Val Thr Leu
945                 950                 955                 960

Lys Ser Asn Leu Val Ser Ser Phe Arg Lys Glu Phe Glu Leu Tyr Lys
                965                 970                 975

Val Arg Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn
            980                 985                 990

Ala Val Val Val Lys Ala Leu Leu  Val Lys Tyr Pro Lys  Leu Glu Pro
        995                 1000                1005

Glu Phe  Val Tyr Gly Glu Tyr  Pro Lys Tyr Asn Ser  Tyr Arg Glu
    1010                1015                1020

Arg Lys  Thr Ala Thr Gln Lys  Met Phe Phe Tyr Ser  Asn Ile Met
    1025                1030                1035

Asn Met  Phe Lys Ser Lys Val  Lys Leu Ala Asp Asp  Gln Ile Val
    1040                1045                1050

Glu Arg  Pro Met Ile Glu Val  Asn Asp Glu Thr Gly  Glu Ile Ala
    1055                1060                1065

Trp Asp  Lys Thr Lys His Ile  Thr Thr Val Lys Lys  Val Leu Ser
    1070                1075                1080

Tyr Pro  Gln Val Asn Ile Val  Lys Lys Val Glu Glu  Gln Thr Ile
    1085                1090                1095
```

```
Gly Gln  Asn Gly Gly Leu Phe  Asp Asp Asn Pro Lys  Ser Pro Leu
    1100                1105                1110

Glu Val  Ile Pro Ser Lys Leu  Val Pro Leu Lys Lys  Ala Leu Asn
    1115                1120                1125

Pro Glu  Lys Tyr Gly Gly Tyr  Gln Lys Pro Thr Thr  Ala Tyr Pro
    1130                1135                1140

Ile Leu  Leu Ile Val Asp Thr  Lys Gln Leu Ile Pro  Ile Ser Val
    1145                1150                1155

Met Asp  Lys Lys Arg Phe Glu  Gln Asn Pro Val Lys  Phe Leu Lys
    1160                1165                1170

Asp Lys  Gly Tyr Gln Gln Ile  Glu Lys Asn Asn Phe  Val Lys Leu
    1175                1180                1185

Pro Lys  Tyr Thr Leu Val Asp  Ile Gly Asn Gly Ile  Lys Arg Leu
    1190                1195                1200

Trp Ala  Ser Ser Lys Glu Val  His Lys Gly Asn Gln  Leu Val Val
    1205                1210                1215

Ser Lys  Lys Ser Gln Asp Leu  Leu Tyr His Ala His  His Leu Asp
    1220                1225                1230

Asn Asp  Tyr Ser Asn Glu Tyr  Val Lys Asn His Tyr  Gln Gln Phe
    1235                1240                1245

Asp Ile  Leu Phe Asn Glu Ile  Thr Ser Phe Ser Lys  Lys Cys Lys
    1250                1255                1260

Leu Gly  Lys Glu His Ile Gln  Lys Ile Glu Glu Ala  Tyr Ser Lys
    1265                1270                1275

Glu Arg  Asp Ser Ala Ser Ile  Glu Glu Leu Ala Asp  Gly Phe Ile
```

```
    1280                1285                1290

Lys Leu  Leu Gly Phe Thr Gln  Leu Gly Ala Thr Ser  Pro Phe Ser
    1295                1300                1305

Phe Leu  Gly Ile Lys Leu Asn  Gln Lys Gln Tyr Thr  Gly Lys Lys
    1310                1315                1320

Asp Tyr  Leu Leu Pro Cys Met  Glu Ala Thr Leu Ile  His Gln Ser
    1325                1330                1335

Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Asn  Lys Leu Gly
    1340                1345                1350

Gly Asp
    1355
```

<210> 741
<211> 1125
<212> PRT
<213> Streptococcus mutans

<400> 741

```
Met Thr Asn Gly Lys Ile Leu Gly Leu Asp Ile Gly Ile Ala Ser Val
1               5                   10                  15

Gly Val Gly Ile Ile Asn Ala Lys Thr Gly Asn Val Glu His Ala Ser
            20                  25                  30

Ser Arg Ile Phe Pro Ala Ala Asn Ala Asp Asn Asn Val Glu Arg Arg
        35                  40                  45

Ser Ala Arg Gly Gly Arg Arg Leu Ile Arg Arg Lys Lys His Arg Leu
    50                  55                  60

Lys Arg Val Glu Asp Leu Phe Glu Lys Tyr Asn Ile Asp Thr Asp Phe
65                  70                  75                  80
```

```
Ser Asn Leu Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly Leu Asn
                85                  90                  95

Glu Gln Leu Ser Asn Glu Glu Leu Phe Ala Ile Leu Lys Asn Ile Ala
            100                 105                 110

Lys Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Glu Asp Asp Ser Val
        115                 120                 125

Gly Ser Ser Asp Tyr Ala Lys Ala Ile Asp Glu Asn Arg Lys Leu Leu
    130                 135                 140

Lys Lys Gln Thr Pro Gly Glu Ile Gln Leu Lys Arg Leu Glu Lys Tyr
145                 150                 155                 160

Gly Gln Leu Arg Gly Asn Phe Thr Ile Gln Asp Glu Asn Gly Glu Tyr
                165                 170                 175

His Arg Leu Ile Asn Val Phe Ser Thr Ser Asp Tyr Val Lys Glu Ala
            180                 185                 190

Arg Arg Ile Leu Glu Thr Gln Ser Tyr Tyr Asn Lys Phe Ile Thr Glu
        195                 200                 205

Ser Phe Val Glu Asp Tyr Ile Lys Ile Leu Gln Gly Lys Arg Lys Tyr
    210                 215                 220

Tyr Val Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Ile Tyr
225                 230                 235                 240

Arg Thr Asp Gly Glu Thr Leu Asp Asn Leu Phe Gly Ile Leu Ile Gly
                245                 250                 255

Lys Cys Gly Phe Tyr Pro Glu Glu Tyr Arg Ala Ala Lys Ala Ser Tyr
            260                 265                 270

Thr Ala Gln Glu Tyr Asn Phe Leu Asn Asp Leu Asn Asn Leu Thr Val
        275                 280                 285
```

```
Pro Thr Glu Thr Lys Lys Leu Ser Thr Glu Gln Lys Tyr Gln Leu Val
    290                 295                 300

Asp Phe Ala Lys Thr Ala Ser Thr Leu Glu Ala Ala Lys Leu Leu Lys
305                 310                 315                 320

Glu Ile Ala Lys Leu Val Gly Cys Gln Val Glu Glu Ile Lys Gly Tyr
                325                 330                 335

Arg Leu Asp Asn Lys Asp Lys Pro Asp Leu His Thr Phe Glu Pro Phe
            340                 345                 350

Arg Lys Leu Lys Ser Asn Leu Thr Thr Ile Ala Val Glu Asn Leu Ser
        355                 360                 365

Ile Thr Thr Leu Asp Thr Leu Ala His Ile Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Glu Glu Ala Ile Gln Lys Glu Leu Pro Asn Ile Phe
385                 390                 395                 400

Ser Asp Glu Gln Ile Thr Gly Ile Ile Ala Val Arg Lys Lys Asn Ser
                405                 410                 415

Gln Ile Phe Gly Lys Gly Trp His Ser Phe Ser Ile Lys Leu Met Lys
            420                 425                 430

Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr Ile
        435                 440                 445

Leu Ile Arg Leu Lys Lys Val Lys Thr Asn Ser Lys Ile Thr Asn Arg
    450                 455                 460

Thr Lys Tyr Ile Asn Glu Gln Glu Val Thr Asp Glu Ile Tyr Asn Pro
465                 470                 475                 480
```

```
Val Val Ser Lys Ser Ile Arg Gln Thr Val Lys Ile Ile Asn Ala Ala
                485                 490                 495

Ile Lys Lys Tyr Gly Ala Phe Asp Gln Ile Val Ile Glu Met Pro Arg
            500                 505                 510

Glu Ser Asn Glu Glu Asp Glu Arg Lys Phe Ile Ala Asp Leu Gln Lys
        515                 520                 525

Ser Asn Ala Lys Glu Lys Asp Asp Ala Met Lys Gln Ala Ala Leu Leu
    530                 535                 540

Tyr Asn Gly Lys Ala Glu Leu Pro His Gly Val Phe His Gly His Lys
545                 550                 555                 560

Glu Leu Ala Thr Lys Ile Arg Leu Trp Tyr Gln Gln Gly Glu Arg Cys
                565                 570                 575

Leu Tyr Ser Gly Lys His Ile Asp Ile His Asp Leu Ile His Asn Gln
            580                 585                 590

His Met Phe Glu Ile Asp His Val Leu Pro Leu Ser Leu Ser Phe Asp
        595                 600                 605

Asp Ser Leu Ala Asn Lys Val Leu Val Tyr Ser Trp Ala Asn Gln Glu
    610                 615                 620

Lys Gly Gln Arg Thr Pro Phe Gln Ala Leu Pro Gln Met Ala Ser Ala
625                 630                 635                 640

Trp Ser Phe Arg Glu Leu Arg Asp Tyr Ile Ser Lys Gln Lys Gly Ile
                645                 650                 655

Ser Lys Lys Lys Arg Asp Tyr Leu Leu Thr Glu Gln Asp Ile Asn Lys
            660                 665                 670

Val Glu Val Lys Gln Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg
        675                 680                 685
```

```
Tyr Val Ser Arg Val Val Leu Asn Thr Leu Gln Asp Ala Leu Lys Val
    690                 695                 700

Met Asn Lys Glu Thr Lys Ile Ser Val Ile Arg Gly Gln Phe Thr Ser
705                 710                 715                 720

Gln Leu Arg Arg Gln Trp Arg Ile Asp Lys Ser Arg Glu Thr Tyr His
                725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Arg
            740                 745                 750

Leu Trp Lys Lys Gln Asn Asn Pro Met Phe Ala Glu Asp Lys His Gly
        755                 760                 765

Gln Lys Ile Asn Leu Asp Thr Gly Glu Val Leu Ser Asp Asp Ala Tyr
    770                 775                 780

Lys Glu Leu Val Tyr Gln Ala Pro Tyr Gln Gly Phe Val Asn Thr Ile
785                 790                 795                 800

Ser Ser Lys Ser Phe Glu Asp Glu Ile Leu Phe Ser Tyr Gln Val Asp
                805                 810                 815

Ser Lys Val Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg
            820                 825                 830

Gln Ala Gln Leu Gly Lys Asp Lys Lys Glu Glu Thr Tyr Val Leu Gly
        835                 840                 845

Lys Ile Lys Asp Ile Tyr Ser Gln Ala Gly Tyr Asp Ala Phe Arg Lys
    850                 855                 860

Lys Tyr Asp Lys Asp Lys Ala Val Phe Leu Met Tyr Gln Lys Asp Pro
865                 870                 875                 880
```

```
Glu Thr Trp Glu Lys Val Ile Glu Val Ile Leu Arg Asp Tyr Lys Glu
                885                 890                 895

Leu Asp Asp Lys Gly Lys Glu Ile Gly Asn Pro Phe Glu Arg Tyr Lys
            900                 905                 910

Val Lys His Gly Phe Val Arg Lys Tyr Ser Arg Lys Asn Lys Gly Thr
        915                 920                 925

Glu Ile Lys Ser Leu Lys Tyr Tyr Asp Asn Lys Leu Gly Asn His Ile
    930                 935                 940

Asp Ile Thr Pro Asn Asn Ser Lys His Ser Val Val Leu Gln Ser Ile
945                 950                 955                 960

Asn Pro Trp Arg Ala Asp Leu Tyr Phe Asn Pro Glu Thr Thr Lys Tyr
                965                 970                 975

Glu Leu Met Gly Leu Lys Tyr Ala Asp Leu Ser Phe Glu Lys Gly Thr
            980                 985                 990

Gly Lys Tyr Ser Ile Ser Arg Glu  Lys Tyr Asp Glu Ile  Lys Glu Arg
        995                 1000                1005

Glu Gly  Ile Ser Ser Lys Ser  Glu Phe Lys Phe Thr  Leu Tyr Lys
    1010                1015                1020

Asn Asp  Leu Ile Leu Val Lys  Asp Ile Gly Asn His  Lys Glu Leu
    1025                1030                1035

Ile Ala  Arg Phe Asn Ser Lys  Asn Asp Thr Ser Lys  His Tyr Val
    1040                1045                1050

Glu Leu  Lys Pro Trp Asn Lys  Ala Lys Phe Asp Ser  Glu Glu Glu
    1055                1060                1065

Leu Ile  Pro Ala Phe Gly Lys  Val Ala Lys Ser Gly  Gln Phe Ile
    1070                1075                1080
```

Lys Gly Leu Asn Lys Pro Asp Leu Ser Ile Tyr Lys Val Lys Thr
    1085   1090   1095

Asp Ile Leu Gly His Lys Tyr Tyr Ile Lys Lys Glu Gly Asp Lys
    1100   1105   1110

Pro Lys Leu Asn Phe Glu Asn Lys Ile Lys Asn Lys
    1115   1120   1125

<210> 742
<211> 1125
<212> PRT
<213> Streptococcus mutans

<400> 742

Met Thr Asn Gly Lys Ile Leu Gly Leu Asp Ile Gly Ile Ala Ser Val
1   5   10   15

Gly Val Gly Ile Ile Asn Ala Lys Thr Gly Asn Val Glu His Ala Ser
            20   25   30

Ser Arg Ile Phe Pro Ala Ala Asn Ala Asp Asn Asn Val Glu Arg Arg
        35   40   45

Ser Ala Arg Gly Gly Arg Arg Leu Ile Arg Arg Lys Lys His Arg Leu
    50   55   60

Lys Arg Val Glu Asp Leu Phe Glu Lys Tyr Asn Ile Asp Thr Asp Phe
65   70   75   80

Ser Asn Leu Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly Leu Asn
                85   90   95

Glu Gln Leu Ser Asn Glu Glu Leu Phe Ala Ile Leu Lys Asn Ile Ala
            100   105   110

Lys Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Glu Asp Asp Ser Val

```
        115                 120                 125

Gly Ser Ser Asp Tyr Ala Lys Ala Ile Asp Glu Asn Arg Lys Leu Leu
    130                 135                 140

Lys Lys Gln Thr Pro Gly Glu Ile Gln Leu Lys Arg Leu Glu Lys Tyr
145                 150                 155                 160

Gly Gln Leu Arg Gly Asn Phe Thr Ile Gln Asp Glu Asn Gly Glu Tyr
                165                 170                 175

His Arg Leu Ile Asn Val Phe Ser Thr Ser Asp Tyr Val Lys Glu Ala
            180                 185                 190

Arg Arg Ile Leu Glu Thr Gln Ser Tyr Tyr Asn Lys Phe Ile Thr Glu
        195                 200                 205

Ser Phe Val Glu Asp Tyr Ile Lys Ile Leu Gln Gly Lys Arg Lys Tyr
    210                 215                 220

Tyr Val Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Ile Tyr
225                 230                 235                 240

Arg Thr Asp Gly Glu Thr Leu Asp Asn Leu Phe Gly Ile Leu Ile Gly
                245                 250                 255

Lys Cys Gly Phe Tyr Pro Glu Glu Tyr Arg Ala Ala Lys Ala Ser Tyr
            260                 265                 270

Thr Ala Gln Glu Tyr Asn Phe Leu Asn Asp Leu Asn Asn Leu Thr Val
        275                 280                 285

Pro Thr Glu Thr Lys Lys Leu Ser Thr Glu Gln Lys Tyr Gln Leu Val
    290                 295                 300

Asp Phe Ala Lys Thr Ala Ser Thr Leu Gly Ala Ala Lys Leu Leu Lys
305                 310                 315                 320
```

```
Glu Ile Ala Lys Leu Val Gly Cys Gln Val Glu Glu Ile Lys Gly Tyr
                325                 330                 335

Arg Leu Asp Asn Lys Asp Lys Pro Asp Leu His Thr Phe Glu Pro Phe
            340                 345                 350

Arg Lys Leu Lys Ser Asn Leu Thr Thr Ile Ala Val Glu Asn Leu Ser
        355                 360                 365

Ile Thr Thr Leu Asp Thr Leu Ala His Ile Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Glu Glu Ala Ile Gln Lys Glu Leu Pro Asn Ile Phe
385                 390                 395                 400

Ser Asp Glu Gln Ile Thr Glu Ile Ile Ala Val Arg Lys Lys Asn Ser
                405                 410                 415

Gln Ile Phe Gly Lys Gly Trp His Ser Phe Ser Ile Lys Leu Met Lys
            420                 425                 430

Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr Ile
        435                 440                 445

Leu Thr Arg Leu Lys Lys Val Lys Thr Asn Ser Lys Ile Thr Asn Arg
    450                 455                 460

Thr Lys Tyr Ile Asn Glu Glu Glu Ile Thr Asp Glu Ile Tyr Asn Pro
465                 470                 475                 480

Val Val Ser Lys Ser Ile Arg Gln Thr Val Lys Ile Ile Asn Ala Thr
                485                 490                 495

Ile Lys Lys Tyr Gly Ala Phe Asp Gln Ile Ile Ile Glu Met Pro Arg
            500                 505                 510

Glu Ser Asn Glu Glu Asp Glu Arg Lys Phe Ile Ala Asp Leu Gln Lys
```

```
        515                 520                 525

Ser Asn Ala Lys Glu Lys Asp Asp Ala Met Lys Gln Ala Ala Leu Leu
    530                 535                 540

Tyr Asn Gly Lys Asp Glu Leu Pro His Asp Val Phe His Gly His Lys
545                 550                 555                 560

Glu Leu Ala Thr Lys Ile Arg Leu Trp Tyr Gln Gln Gly Glu Arg Cys
                565                 570                 575

Leu Tyr Ser Gly Lys His Ile Asp Ile His Asp Leu Ile His Asn Gln
            580                 585                 590

His Met Phe Glu Ile Asp His Val Leu Pro Leu Ser Leu Ser Phe Asp
        595                 600                 605

Asp Ser Leu Ala Asn Lys Val Leu Val Tyr Ser Trp Ala Asn Gln Glu
    610                 615                 620

Lys Gly Gln Arg Thr Pro Phe Gln Ala Leu Pro Gln Met Ala Ser Ala
625                 630                 635                 640

Trp Ser Phe Arg Glu Leu Arg Asp Tyr Ile Ser Lys Gln Lys Gly Ile
                645                 650                 655

Ser Lys Lys Lys Arg Asp Tyr Leu Leu Thr Glu Gln Asp Ile Asn Lys
            660                 665                 670

Val Glu Val Lys Gln Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Val Ser Arg Val Val Leu Asn Thr Leu Gln Asp Ala Leu Lys Val
    690                 695                 700

Met Asn Lys Glu Thr Lys Ile Ser Val Ile Arg Gly Gln Phe Thr Ser
705                 710                 715                 720
```

```
Gln Leu Arg Arg Gln Trp Arg Ile Asp Lys Ser Arg Glu Thr Tyr His
               725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Arg
            740                 745                 750

Leu Trp Lys Lys Gln Asn Asn Pro Met Phe Ala Glu Asp Lys His Gly
        755                 760                 765

Gln Lys Ile Asn Leu Asp Thr Gly Glu Val Leu Ser Asp Asp Ala Tyr
    770                 775                 780

Lys Glu Leu Val Tyr Gln Ala Pro Tyr Gln Gly Phe Val Asn Thr Ile
785                 790                 795                 800

Ser Ser Lys Ser Phe Glu Asp Glu Ile Leu Phe Ser Tyr Gln Val Asp
               805                 810                 815

Ser Lys Val Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg
            820                 825                 830

Gln Ala Gln Leu Gly Lys Asp Lys Lys Glu Glu Thr Tyr Val Leu Gly
        835                 840                 845

Lys Ile Lys Asp Ile Tyr Ser Gln Ala Gly Tyr Asp Ala Phe Arg Lys
    850                 855                 860

Lys Tyr Asp Lys Asp Lys Ala Val Phe Leu Met Tyr Gln Lys Asp Pro
865                 870                 875                 880

Glu Thr Trp Glu Lys Val Ile Glu Val Ile Leu Arg Asp Tyr Lys Glu
               885                 890                 895

Leu Asp Asp Lys Gly Lys Glu Ile Gly Asn Pro Phe Glu Arg Tyr Lys
            900                 905                 910

Val Lys His Gly Phe Val Arg Lys Tyr Ser Arg Lys Asn Lys Gly Thr
```

```
        915                 920                 925

Glu Ile Lys Ser Leu Lys Tyr Tyr Asp Asn Lys Leu Gly Asn His Ile
    930                 935                 940

Asp Ile Thr Pro Asn Asn Ser Lys His Ser Val Val Leu Gln Ser Ile
945                 950                 955                 960

Asn Pro Trp Arg Ala Asp Leu Tyr Phe Asn Pro Glu Thr Thr Lys Tyr
                965                 970                 975

Glu Leu Met Gly Leu Lys Tyr Ala Asp Leu Ser Phe Glu Lys Gly Thr
            980                 985                 990

Gly Lys Tyr Ser Ile Ser Arg Glu  Lys Tyr Asp Glu Ile  Lys Glu Arg
        995                 1000                1005

Glu Gly  Ile Ser Ser Lys Ser  Glu Phe Lys Phe Thr  Leu Tyr Lys
    1010                1015                1020

Asn Asp  Leu Ile Leu Val Lys  Asp Ile Gly Asn His  Lys Glu Leu
    1025                1030                1035

Ile Ala  Arg Phe Asn Ser Lys  Asn Asp Thr Ser Lys  His Tyr Val
    1040                1045                1050

Glu Leu  Lys Pro Trp Asn Lys  Ala Lys Phe Asp Ser  Glu Glu Glu
    1055                1060                1065

Leu Ile  Pro Ala Phe Gly Lys  Val Ala Lys Ser Gly  Gln Phe Ile
    1070                1075                1080

Lys Gly  Leu Asn Lys Pro Asp  Leu Ser Ile Tyr Lys  Val Lys Thr
    1085                1090                1095

Asp Ile  Leu Gly His Lys Tyr  Tyr Ile Lys Lys Glu  Gly Asp Lys
    1100                1105                1110
```

```
Pro Lys  Leu Asn Phe Glu Asn  Lys Ile Lys Asn Lys
    1115                1120                1125
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<210> 743
<211> 1125
<212> PRT
<213> Streptococcus mutans

<400> 743

```
Met Thr Asn Gly Lys Ile Leu Gly Leu Asp Ile Gly Ile Ala Ser Val
1               5                   10                  15

Gly Val Gly Ile Ile Asn Ala Lys Thr Gly Asn Val Glu His Ala Ser
            20                  25                  30

Ser Arg Ile Phe Pro Ala Ala Asn Ala Asp Asn Asn Val Glu Arg Arg
        35                  40                  45

Ser Ala Arg Gly Gly Arg Arg Leu Ile Arg Arg Lys Lys His Arg Leu
    50                  55                  60

Lys Arg Val Glu Asp Leu Phe Glu Lys Tyr Asn Ile Asp Thr Asp Phe
65                  70                  75                  80

Ser Asn Leu Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly Leu Asn
                85                  90                  95

Glu Gln Leu Ser Asn Glu Glu Leu Phe Ala Ile Leu Lys Asn Ile Ala
            100                 105                 110

Lys Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Glu Asp Asp Ser Val
        115                 120                 125

Gly Ser Ser Asp Tyr Ala Lys Ala Ile Asp Glu Asn Arg Lys Leu Leu
    130                 135                 140

Lys Lys Gln Thr Pro Gly Glu Ile Gln Leu Lys Arg Leu Glu Lys Tyr
145                 150                 155                 160
```

```
Gly Gln Leu Arg Gly Asn Phe Thr Ile Gln Asp Glu Asn Gly Glu Tyr
                165                 170                 175

His Arg Leu Ile Asn Val Phe Ser Thr Ser Asp Tyr Val Lys Glu Ala
            180                 185                 190

Arg Arg Ile Leu Glu Thr Gln Ser Tyr Tyr Asn Lys Phe Ile Thr Glu
        195                 200                 205

Ser Phe Val Glu Asp Tyr Ile Lys Ile Leu Gln Gly Lys Arg Lys Tyr
    210                 215                 220

Tyr Val Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Ile Tyr
225                 230                 235                 240

Arg Thr Asp Gly Glu Thr Leu Asp Asn Leu Phe Gly Ile Leu Ile Gly
                245                 250                 255

Lys Cys Gly Phe Tyr Pro Glu Glu Tyr Arg Ala Ala Lys Ala Ser Tyr
            260                 265                 270

Thr Ala Gln Glu Tyr Asn Phe Leu Asn Asp Leu Asn Asn Leu Thr Val
        275                 280                 285

Pro Thr Glu Thr Lys Lys Leu Ser Thr Glu Gln Lys Tyr Gln Leu Val
    290                 295                 300

Asp Phe Ala Lys Thr Ala Ser Thr Leu Gly Ala Ala Lys Leu Leu Lys
305                 310                 315                 320

Glu Ile Ala Lys Leu Val Gly Cys Gln Val Glu Glu Ile Lys Gly Tyr
                325                 330                 335

Arg Leu Asp Asn Lys Asp Lys Pro Asp Leu His Thr Phe Glu Pro Phe
            340                 345                 350
```

```
Arg Lys Leu Lys Ser Asn Leu Thr Thr Ile Ala Val Glu Asn Leu Ser
        355                 360                 365

Ile Thr Thr Leu Asp Thr Leu Ala His Ile Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Glu Glu Ala Ile Gln Lys Glu Leu Pro Asn Ile Phe
385                 390                 395                 400

Ser Asp Glu Gln Ile Thr Glu Ile Ile Ala Val Arg Lys Lys Asn Ser
                405                 410                 415

Gln Ile Phe Gly Lys Gly Trp His Ser Phe Ser Ile Lys Leu Met Lys
            420                 425                 430

Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr Ile
        435                 440                 445

Leu Thr Arg Leu Lys Lys Val Lys Thr Asn Ser Lys Ile Thr Asn Arg
    450                 455                 460

Thr Lys Tyr Ile Asn Glu Glu Glu Ile Thr Asp Glu Ile Tyr Asn Pro
465                 470                 475                 480

Val Val Ser Lys Ser Ile Arg Gln Thr Val Lys Ile Ile Asn Ala Thr
                485                 490                 495

Ile Lys Lys Tyr Gly Ala Phe Asp Gln Ile Ile Ile Glu Met Pro Arg
            500                 505                 510

Glu Ser Asn Glu Glu Asp Glu Arg Lys Phe Ile Ala Asp Leu Gln Lys
        515                 520                 525

Ser Asn Ala Lys Glu Lys Asp Asp Ala Met Lys Gln Ala Ala Leu Leu
    530                 535                 540

Tyr Asn Gly Lys Asp Glu Leu Pro His Asp Val Phe His Gly His Lys
545                 550                 555                 560
```

```
Glu Leu Ala Thr Lys Ile Arg Leu Trp Tyr Gln Gln Gly Glu Arg Cys
                565                 570                 575

Leu Tyr Ser Gly Lys His Ile Asp Ile His Asp Leu Ile His Asn Gln
            580                 585                 590

His Met Phe Glu Ile Asp His Val Leu Pro Leu Ser Leu Ser Phe Asp
        595                 600                 605

Asp Ser Leu Ala Asn Lys Val Leu Val Tyr Ser Trp Ala Asn Gln Glu
    610                 615                 620

Lys Gly Gln Arg Thr Pro Phe Gln Ala Leu Pro Gln Met Ala Ser Ala
625                 630                 635                 640

Trp Ser Phe Arg Glu Leu Arg Asp Tyr Ile Ser Lys Gln Lys Gly Ile
                645                 650                 655

Ser Lys Lys Lys Arg Asp Tyr Leu Leu Thr Glu Gln Asp Ile Asn Lys
            660                 665                 670

Val Glu Val Lys Gln Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Val Ser Arg Val Val Leu Asn Thr Leu Gln Asp Ala Leu Lys Val
    690                 695                 700

Met Asn Lys Glu Thr Lys Ile Ser Val Ile Arg Gly Gln Phe Thr Ser
705                 710                 715                 720

Gln Leu Arg Arg Gln Trp Arg Ile Asp Lys Ser Arg Glu Thr Tyr His
                725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Arg
            740                 745                 750
```

```
Leu Trp Lys Lys Gln Asn Asn Pro Met Phe Ala Glu Asp Lys His Gly
        755                 760                 765

Gln Lys Ile Asn Leu Asp Thr Gly Glu Val Leu Ser Asp Asp Ala Tyr
    770                 775                 780

Lys Glu Leu Val Tyr Gln Ala Pro Tyr Gln Gly Phe Val Asn Thr Ile
785                 790                 795                 800

Ser Ser Lys Ser Phe Glu Asp Glu Ile Leu Phe Ser Tyr Gln Val Asp
                805                 810                 815

Ser Lys Val Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg
            820                 825                 830

Gln Ala Gln Leu Gly Lys Asp Lys Lys Glu Glu Thr Tyr Val Leu Gly
        835                 840                 845

Lys Ile Lys Asp Ile Tyr Ser Gln Ala Gly Tyr Asp Ala Phe Arg Lys
    850                 855                 860

Lys Tyr Asp Lys Asp Lys Ala Val Phe Leu Met Tyr Gln Lys Asp Pro
865                 870                 875                 880

Glu Thr Trp Glu Lys Val Ile Glu Val Ile Leu Arg Asp Tyr Lys Glu
                885                 890                 895

Leu Asp Asp Lys Gly Lys Glu Ile Gly Asn Pro Phe Glu Arg Tyr Lys
            900                 905                 910

Val Lys His Gly Phe Val Arg Lys Tyr Ser Arg Lys Asn Lys Gly Thr
        915                 920                 925

Glu Ile Lys Ser Leu Lys Tyr Tyr Asp Asn Lys Leu Gly Asn His Ile
    930                 935                 940

Asp Ile Thr Pro Asn Asn Ser Lys His Ser Val Val Leu Gln Ser Ile
945                 950                 955                 960
```

```
Asn Pro Trp Arg Ala Asp Leu Tyr Phe Asn Pro Glu Thr Thr Lys Tyr
               965                 970                 975

Glu Leu Met Gly Leu Lys Tyr Ala Asp Leu Ser Phe Glu Lys Gly Thr
           980                 985                 990

Gly Lys Tyr Ser Ile Ser Arg Glu  Lys Tyr Asp Glu Ile  Lys Glu Arg
        995                 1000                1005

Glu Gly  Ile Ser Ser Lys Ser  Glu Phe Lys Phe Thr  Leu Tyr Lys
    1010                1015                1020

Asn Asp  Leu Ile Leu Val Lys  Asp Ile Gly Asn His  Lys Glu Leu
    1025                1030                1035

Ile Ala  Arg Phe Asn Ser Lys  Asn Asp Thr Ser Lys  His Tyr Val
    1040                1045                1050

Glu Leu  Lys Pro Trp Asn Lys  Ala Lys Phe Asp Ser  Glu Glu Glu
    1055                1060                1065

Leu Ile  Pro Ala Phe Gly Lys  Val Ala Lys Ser Gly  Gln Phe Ile
    1070                1075                1080

Lys Gly  Leu Asn Lys Pro Asp  Leu Ser Ile Tyr Lys  Val Lys Thr
    1085                1090                1095

Asp Ile  Leu Gly His Lys Tyr  Tyr Ile Lys Lys Glu  Gly Asp Lys
    1100                1105                1110

Pro Lys  Leu Asn Phe Glu Asn  Lys Ile Lys Asn Lys
    1115                1120                1125
```

<210> 744
<211> 1125
<212> PRT
<213> Streptococcus mutans

<400> 744

```
Met Thr Asn Gly Lys Ile Leu Gly Leu Asp Ile Gly Ile Ala Ser Val
1               5                  10                  15

Gly Val Gly Ile Ile Asn Ala Lys Thr Gly Asn Val Glu His Ala Ser
            20                  25                  30

Ser Arg Ile Phe Pro Ala Ala Asn Ala Asp Asn Asn Val Glu Arg Arg
        35                  40                  45

Ser Ala Arg Gly Gly Arg Arg Leu Ile Arg Arg Lys Lys His Arg Leu
    50                  55                  60

Lys Arg Val Glu Asp Leu Phe Glu Lys Tyr Asn Ile Asp Thr Asp Phe
65                  70                  75                  80

Ser Asn Leu Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly Leu Asn
                85                  90                  95

Glu Gln Leu Ser Asn Glu Glu Leu Phe Ala Ile Leu Lys Asn Ile Ala
            100                 105                 110

Lys Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Glu Asp Asp Ser Val
        115                 120                 125

Gly Ser Ser Asp Tyr Ala Lys Ala Ile Asp Glu Asn Arg Lys Leu Leu
    130                 135                 140

Lys Lys Gln Thr Pro Gly Glu Ile Gln Leu Lys Arg Leu Glu Lys Tyr
145                 150                 155                 160

Gly Gln Leu Arg Gly Asn Phe Thr Ile Gln Asp Glu Asn Gly Glu Tyr
                165                 170                 175

His Arg Leu Ile Asn Val Phe Ser Thr Ser Asp Tyr Val Lys Glu Ala
            180                 185                 190
```

```
Arg Arg Ile Leu Glu Thr Gln Ser Tyr Tyr Asn Lys Phe Ile Thr Glu
        195                 200                 205

Ser Phe Val Glu Asp Tyr Ile Lys Ile Leu Gln Gly Lys Arg Lys Tyr
    210                 215                 220

Tyr Val Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Ile Tyr
225                 230                 235                 240

Arg Thr Asp Gly Glu Thr Leu Asp Asn Leu Phe Gly Ile Leu Ile Gly
                245                 250                 255

Lys Cys Gly Phe Tyr Pro Glu Glu Tyr Arg Ala Ala Lys Ala Ser Tyr
            260                 265                 270

Thr Ala Gln Glu Tyr Asn Phe Leu Asn Asp Leu Asn Asn Leu Thr Val
        275                 280                 285

Pro Thr Glu Thr Lys Lys Leu Ser Thr Glu Gln Lys Tyr Gln Leu Val
    290                 295                 300

Asp Phe Ala Lys Thr Ala Ser Thr Leu Glu Ala Ala Lys Leu Leu Lys
305                 310                 315                 320

Glu Ile Ala Lys Leu Val Gly Cys Gln Val Glu Glu Ile Lys Gly Tyr
                325                 330                 335

Arg Leu Asp Asn Lys Asp Lys Pro Asp Leu His Thr Phe Glu Pro Phe
            340                 345                 350

Arg Lys Leu Lys Ser Asn Leu Thr Thr Ile Ala Val Glu Asn Leu Ser
        355                 360                 365

Ile Thr Thr Leu Asp Thr Leu Ala His Ile Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Glu Glu Ala Ile Gln Lys Glu Leu Pro Asn Ile Phe
```

385 390 395 400

Ser Asp Glu Gln Ile Thr Gly Ile Ile Ala Val Arg Lys Lys Asn Ser
405 410 415

Gln Ile Phe Gly Lys Gly Trp His Ser Phe Ser Ile Lys Leu Met Lys
420 425 430

Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr Ile
435 440 445

Leu Ile Arg Leu Lys Lys Val Lys Thr Asn Ser Lys Ile Thr Asn Arg
450 455 460

Thr Lys Tyr Ile Asn Glu Gln Glu Val Thr Asp Glu Ile Tyr Asn Pro
465 470 475 480

Val Val Ser Lys Ser Ile Arg Gln Thr Val Lys Ile Ile Asn Ala Ala
485 490 495

Ile Lys Lys Tyr Gly Ala Phe Asp Gln Ile Val Ile Glu Met Pro Arg
500 505 510

Glu Ser Asn Glu Glu Asp Glu Arg Lys Phe Ile Ala Asp Leu Gln Lys
515 520 525

Ser Asn Ala Lys Glu Lys Asp Asp Ala Met Lys Gln Ala Ala Leu Leu
530 535 540

Tyr Asn Gly Lys Ala Glu Leu Pro His Gly Val Phe His Gly His Lys
545 550 555 560

Glu Leu Ala Thr Lys Ile Arg Leu Trp Tyr Gln Gln Gly Glu Arg Cys
565 570 575

Leu Tyr Ser Gly Lys His Ile Asp Ile His Asp Leu Ile His Asn Gln
580 585 590

```
His Met Phe Glu Ile Asp His Val Leu Pro Leu Ser Leu Ser Phe Asp
        595                 600                 605

Asp Ser Leu Ala Asn Lys Val Leu Val Tyr Ser Trp Ala Asn Gln Glu
    610                 615                 620

Lys Gly Gln Arg Thr Pro Phe Gln Ala Leu Pro Gln Met Ala Ser Ala
625                 630                 635                 640

Trp Ser Phe Arg Glu Leu Arg Asp Tyr Ile Ser Lys Gln Lys Gly Ile
                645                 650                 655

Ser Lys Lys Lys Arg Asp Tyr Leu Leu Thr Glu Gln Asp Ile Asn Lys
            660                 665                 670

Val Glu Val Lys Gln Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Val Ser Arg Val Val Leu Asn Thr Leu Gln Asp Ala Leu Lys Val
    690                 695                 700

Met Asn Lys Glu Thr Lys Ile Ser Val Ile Arg Gly Gln Phe Thr Ser
705                 710                 715                 720

Gln Leu Arg Arg Gln Trp Arg Ile Asp Lys Ser Arg Glu Thr Tyr His
                725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Arg
            740                 745                 750

Leu Trp Lys Lys Gln Asn Asn Pro Met Phe Ala Glu Asp Lys His Gly
        755                 760                 765

Gln Lys Ile Asn Leu Asp Thr Gly Glu Val Leu Ser Asp Asp Ala Tyr
    770                 775                 780

Lys Glu Leu Val Tyr Gln Ala Pro Tyr Gln Gly Phe Val Asn Thr Ile
```

```
785                 790                 795                 800

Ser Ser Lys Ser Phe Glu Asp Glu Ile Leu Phe Ser Tyr Gln Val Asp
                805                 810                 815

Ser Lys Val Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg
            820                 825                 830

Gln Ala Gln Leu Gly Lys Asp Lys Lys Glu Glu Thr Tyr Val Leu Gly
        835                 840                 845

Lys Ile Lys Asp Ile Tyr Ser Gln Ala Gly Tyr Asp Ala Phe Arg Lys
    850                 855                 860

Lys Tyr Asp Lys Asp Lys Ala Val Phe Leu Met Tyr Gln Lys Asp Pro
865                 870                 875                 880

Glu Thr Trp Glu Lys Val Ile Glu Val Ile Leu Arg Asp Tyr Lys Glu
                885                 890                 895

Leu Asp Asp Lys Gly Lys Glu Ile Gly Asn Pro Phe Glu Arg Tyr Lys
            900                 905                 910

Val Lys His Gly Phe Val Arg Lys Tyr Ser Arg Lys Asn Lys Gly Thr
        915                 920                 925

Glu Ile Lys Ser Leu Lys Tyr Tyr Asp Asn Lys Leu Gly Asn His Ile
    930                 935                 940

Asp Ile Thr Pro Asn Asn Ser Lys His Ser Val Val Leu Gln Ser Ile
945                 950                 955                 960

Asn Pro Trp Arg Ala Asp Leu Tyr Phe Asn Pro Glu Thr Thr Lys Tyr
                965                 970                 975

Glu Leu Met Gly Leu Lys Tyr Ala Asp Leu Ser Phe Glu Lys Gly Thr
            980                 985                 990
```

```
Gly Lys Tyr Ser Ile Ser Arg Glu  Lys Tyr Asp Glu Ile  Lys Glu Arg
        995                 1000                1005


Glu Gly  Ile Ser Ser Lys Ser  Glu Phe Lys Phe Thr  Leu Tyr Lys
    1010                1015                1020


Asn Asp  Leu Ile Leu Val Lys  Asp Ile Gly Asn His  Lys Glu Leu
    1025                1030                1035


Ile Ala  Arg Phe Asn Ser Lys  Asn Asp Thr Ser Lys  His Tyr Val
    1040                1045                1050


Glu Leu  Lys Pro Trp Asn Lys  Ala Lys Phe Asp Ser  Glu Glu Glu
    1055                1060                1065


Leu Ile  Pro Ala Phe Gly Lys  Val Ala Lys Ser Gly  Gln Phe Ile
    1070                1075                1080


Lys Gly  Leu Asn Lys Pro Asp  Leu Ser Ile Tyr Lys  Val Lys Thr
    1085                1090                1095


Asp Ile  Leu Gly His Lys Tyr  Tyr Ile Lys Lys Glu  Gly Asp Lys
    1100                1105                1110


Pro Lys  Leu Asn Phe Glu Asn  Lys Ile Lys Asn Lys
    1115                1120                1125


<210>  745
<211>  670
<212>  PRT
<213>  Streptococcus oralis

<400>  745

Met Ala Lys Phe Asn Lys Asn Tyr Ser Ile Gly Leu Asp Ile Gly Val
1               5                   10                  15


Ser Ser Val Gly Tyr Ala Val Val Thr Glu Asp Tyr Arg Val Pro Ala
            20                  25                  30
```

```
Phe Lys Phe Lys Val Leu Gly Asn Thr Glu Lys Glu Lys Ile Lys Lys
        35                  40                  45

Asn Leu Ile Gly Ser Thr Thr Phe Val Pro Ala Gln Ser Ala Gln Gly
    50                  55                  60

Thr Arg Val Phe Arg Val Asn Arg Arg Arg Ile Asp Arg Arg Asn His
65                  70                  75                  80

Arg Ile Ala Tyr Leu Arg Asp Ile Phe Gln Lys Glu Ile Gly Lys Ile
                85                  90                  95

Asp Lys Asn Phe Tyr Arg Arg Leu Asp Glu Ser Phe Arg Val Leu Gly
            100                 105                 110

Asp Lys Ser Glu Asp Ile Gln Ile Lys Gln Pro Phe Phe Gly Asn Lys
        115                 120                 125

Glu Leu Glu Thr Ala Tyr His Lys Lys Tyr Pro Thr Ile Tyr His Leu
    130                 135                 140

Arg Lys His Leu Ala Asp Ala Asp Lys Asn Ser Pro Val Ala Asp Ile
145                 150                 155                 160

Arg Glu Val Tyr Met Ala Leu Ser His Ile Phe Lys Tyr Arg Gly His
                165                 170                 175

Phe Leu Thr Leu Gly Lys Ile Asp Pro Asn Asn Ile Asn Met Gln Asn
            180                 185                 190

Ser Trp Ile Asp Phe Ile Glu Ser Cys Gln Asp Ala Phe Asp Leu Glu
        195                 200                 205

Ile Ser Asp Glu Ser Lys Thr Ile Ala Ala Ile Phe Lys Ser Ser Asp
    210                 215                 220
```

```
Asn Arg Gln Glu Lys Val Lys Gly Ile Leu Ser Tyr Phe Gln Pro Glu
225                 230                 235                 240

Leu Ala Lys Lys Asp Lys Ser Ile Phe Lys Gln Leu Leu Gln Leu Leu
                245                 250                 255

Phe Gly Leu Lys Thr Lys Phe Lys Glu Cys Phe Glu Leu Glu Glu Glu
            260                 265                 270

Pro Asp Leu Asn Phe Ser Lys Glu Asn Tyr Asp Glu Asn Leu Glu Asn
        275                 280                 285

Leu Leu Gly Thr Leu Glu Glu Asp Phe Pro Asp Val Phe Ala Lys Leu
    290                 295                 300

Lys Ile Leu Arg Asp Thr Ile Leu Leu Ser Asp Met Leu Thr Tyr Thr
305                 310                 315                 320

Gly Ala Thr His Ala Arg Phe Ser Ala Thr Met Val Glu Arg Tyr Glu
                325                 330                 335

Glu His Arg Lys Asp Leu Gln Arg Phe Lys Ser Phe Val Lys Gln Asn
            340                 345                 350

Leu Ser Glu Gln Asp Tyr Leu Asp Ile Phe Gly Arg Lys Thr Pro Asn
        355                 360                 365

Gly Phe Asp Val Asp Lys Glu Thr Lys Gly Tyr Val Gly Tyr Ile Ser
    370                 375                 380

Asn Lys Met Val Leu Thr Asn Lys Gln Lys Thr Ile Gln Gln Asn Phe
385                 390                 395                 400

Tyr Asp Tyr Ile Ser Gly Lys Ile Thr Gly Ile Glu Gly Ala Glu Tyr
                405                 410                 415

Phe Leu Asn Lys Ile Ser Asp Gly Thr Phe Leu Arg Lys Leu Arg Thr
            420                 425                 430
```

```
Thr Asp Asn Gly Thr Ile Pro Asn Gln Ile His Ala Tyr Glu Leu Glu
        435                 440                 445

Lys Ile Ile Glu Arg Gln Gly Arg Asp Tyr Pro Phe Leu Leu Glu Asn
    450                 455                 460

Lys Asp Lys Leu Leu Ser Ile Leu Thr Phe Lys Ile Pro Tyr Tyr Val
465                 470                 475                 480

Gly Pro Leu Ala Lys Gly Asn Asn Ser Arg Phe Ala Trp Ile Lys Arg
                485                 490                 495

Thr Thr Ser Gln Asp Val Leu Asp Asn Asn Asp Glu Asp Thr Lys Asn
            500                 505                 510

Gly Lys Ile Arg Pro Trp Asn Tyr His Lys Leu Ile Asn Met Asp Glu
        515                 520                 525

Thr Arg Asp Ala Phe Ile Thr Asn Leu Ile Gly Asn Asp Ile Ile Leu
    530                 535                 540

Leu Asn Glu Lys Val Leu Pro Lys Arg Ser Leu Ile Tyr Glu Glu Val
545                 550                 555                 560

Met Leu Gln Asn Glu Leu Thr Arg Ile Lys Tyr Lys Asp Lys Tyr Gly
                565                 570                 575

Lys Ile His Phe Phe Asp Ser Glu Leu Arg Gln Glu Ile Ile Asn Asn
            580                 585                 590

Leu Phe Lys Thr Asn Ser Lys Arg Val Ser Ser Ala Met Leu Leu Ala
        595                 600                 605

Tyr Leu Glu Asn Phe Thr Asn Leu Gln Ala Val Glu Ile Val Ser Gly
    610                 615                 620
```

```
Ile Glu Lys Gly Lys Ser Leu Asn Ser Thr Leu Lys Thr Tyr Asn Asp
625                 630                 635                 640


Leu Lys Thr Ile Phe Ser Glu Asp Leu Leu Asp Ser Glu Ile Tyr Gln
                645                 650                 655


Lys Glu Leu Glu Glu Ile Ile Lys Val Ile Thr Val Phe Val
            660                 665                 670
```

<210> 746
<211> 1373
<212> PRT
<213> Streptococcus oralis

<400> 746

```
Met Glu Asn Lys Asn Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser
1               5                   10                  15


Val Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys
            20                  25                  30


Met Lys Val Leu Gly Asn Thr Asp Lys Arg Phe Ile Lys Lys Asn Leu
        35                  40                  45


Ile Gly Ala Leu Leu Phe Asp Glu Gly Thr Thr Ala Glu Ala Arg Arg
    50                  55                  60


Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu
65                  70                  75                  80


Arg Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Ser
                85                  90                  95


Ser Phe Phe His Arg Leu Asp Asp Ser Phe Leu Ile Pro Glu Asp Lys
            100                 105                 110


Lys Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Ile Glu Glu Lys Glu
        115                 120                 125
```

```
Tyr His Lys Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Gln Leu Ala
    130                 135                 140

Asp Ser Lys Glu Lys Thr Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala
145                 150                 155                 160

His Met Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Asp Thr Phe Asp
                165                 170                 175

Ile Lys Asn Asn Asp Ile Gln Lys Ile Phe Asn Glu Phe Ile Ser Ile
            180                 185                 190

Tyr Asn Asn Thr Phe Glu Gly Asn Ser Leu Ser Gly Gln Asn Val Gln
        195                 200                 205

Val Glu Ala Ile Phe Thr Asp Lys Ile Ser Lys Ser Ala Lys Arg Glu
    210                 215                 220

Arg Val Leu Lys Leu Phe Pro Asp Glu Lys Ser Thr Gly Leu Phe Ser
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asp Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Arg Asp Thr Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Asp Phe Ala
        275                 280                 285

Asp Leu Phe Val Ala Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Pro Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Glu Arg Tyr Glu Asn His Gln Lys Asp Leu Ala Thr Leu
```

```
                325                 330                 335

Lys Gln Phe Ile Lys Thr Asn Leu Pro Glu Lys Tyr Asp Glu Val Phe
            340                 345                 350

Ser Asp Gln Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr
        355                 360                 365

Thr Gln Glu Ser Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Phe
    370                 375                 380

Glu Gly Ala Asp Tyr Phe Leu Glu Lys Ile Glu Arg Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His
                405                 410                 415

Leu Gln Glu Met Asn Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Lys Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Arg Asp Phe Ala
    450                 455                 460

Trp Leu Thr Arg Asn Ser Asp Gln Ala Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Glu Ile Val Asp Lys Ala Ser Ser Ala Glu Ser Phe Ile Asn Lys Met
                485                 490                 495

Thr Asn Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525
```

```
Lys Phe Ile Ala Glu Gly Leu Arg Asp Tyr Gln Phe Leu Asp Ser Arg
    530                 535                 540

Gln Lys Lys Asp Ile Phe Tyr Thr Leu Phe Lys Ala Glu Asp Lys Arg
545                 550                 555                 560

Lys Val Thr Glu Lys Asp Ile Ile Gln Tyr Leu His Thr Val Asp Gly
                565                 570                 575

Tyr Asp Gly Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser
            580                 585                 590

Leu Ser Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Glu Phe
        595                 600                 605

Met Asp Asp Pro Asn Asn Glu Glu Ile Leu Glu Asn Ile Val His Thr
    610                 615                 620

Leu Thr Ile Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln
625                 630                 635                 640

Tyr Asp Ser Leu Phe Asp Glu Lys Val Ile Lys Ala Leu Thr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Lys Leu Ser Ser Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Gln Thr Gly Lys Thr Ile Leu Asp Tyr Leu Met Asp Asp
        675                 680                 685

Gly Tyr Asn Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Glu Leu
    690                 695                 700

Ser Phe Lys Glu Ile Ile Lys Lys Ala Gln Val Val Gly Lys Thr Asp
705                 710                 715                 720

Asp Val Lys Gln Val Val Gln Glu Leu Pro Gly Ser Pro Ala Ile Lys
```

```
                725                 730                 735

Lys Gly Ile Leu Gln Ser Ile Lys Leu Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly His Glu Pro Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Ala Arg Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg
    770                 775                 780

Ile Glu Asp Ser Leu Lys Ile Leu Ala Ser Gly Leu Asn Ala Lys Ile
785                 790                 795                 800

Leu Lys Glu His Pro Thr Asp Asn Ile Gln Leu Gln Asn Asp Arg Leu
                805                 810                 815

Phe Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Lys Pro
            820                 825                 830

Leu Asp Ile Asn Gln Leu Ser Ser Tyr Asp Ile Asp His Ile Val Pro
        835                 840                 845

Gln Ala Phe Ile Lys Asp Asp Ser Leu Asp Asn Arg Val Leu Thr Ser
    850                 855                 860

Leu Lys Asp Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Leu Glu Val
865                 870                 875                 880

Val Glu Lys Met Lys Thr Phe Trp Gln Gln Leu Leu Asp Ser Lys Leu
                885                 890                 895

Ile Ser Tyr Arg Lys Phe Asn Asn Leu Thr Lys Ala Glu Arg Gly Gly
            900                 905                 910

Leu Asp Glu Arg Asp Lys Val Gly Phe Ile Lys Arg Gln Leu Val Glu
        915                 920                 925
```

```
Thr Arg Gln Ile Thr Lys His Val Ala Gln Ile Leu Asp Ala Arg Tyr
    930                 935                 940

Asn Thr Glu Val Asn Glu Lys Asp Lys Lys Asn Arg Thr Val Lys Ile
945                 950                 955                 960

Ile Thr Leu Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Arg
                965                 970                 975

Leu Tyr Lys Ile Arg Glu Ile Asn Asp Tyr His His Ala His Asp Ala
            980                 985                 990

Tyr Leu Asn Ala Val Val Ala Lys  Ala Ile Leu Lys Lys  Tyr Pro Lys
        995                 1000                1005

Leu Glu  Pro Glu Phe Val Tyr  Gly Asp Tyr Gln Lys  Tyr Asp Leu
    1010                1015                1020

Lys Arg  Tyr Ile Ser Arg Ser  Lys Asp Pro Lys Glu  Ile Glu Lys
    1025                1030                1035

Ala Thr  Glu Lys Tyr Phe Phe  Tyr Ser Asn Leu Leu  Asn Phe Phe
    1040                1045                1050

Lys Glu  Glu Val His Tyr Ala  Asp Gly Thr Ile Val  Lys Arg Glu
    1055                1060                1065

Asn Ile  Glu Tyr Ser Lys Asp  Thr Gly Glu Ile Ala  Trp Asn Lys
    1070                1075                1080

Glu Lys  Asp Phe Ala Thr Ile  Lys Lys Val Leu Ser  Leu Pro Gln
    1085                1090                1095

Val Asn  Ile Val Lys Lys Arg  Glu Val Gln Thr Gly  Gly Phe Ser
    1100                1105                1110

Lys Glu  Ser Ile Leu Pro Lys  Gly Asn Ser Asp Lys  Leu Ile Pro
```

```
    1115                1120                1125

Arg Lys  Thr Lys Asp Ile Leu  Trp Asp Thr Thr Lys  Tyr Gly Gly
    1130                1135                1140

Phe Asp  Ser Pro Val Ile Ala  Tyr Ser Ile Leu Leu  Ile Ala Asp
    1145                1150                1155

Ile Glu  Lys Gly Lys Ala Lys  Arg Leu Lys Thr Val  Lys Thr Leu
    1160                1165                1170

Val Gly  Ile Thr Ile Met Glu  Lys Ala Thr Phe Glu  Lys Ser Pro
    1175                1180                1185

Ile Ala  Phe Leu Glu Asn Lys  Gly Tyr His Asn Val  Arg Lys Glu
    1190                1195                1200

Asn Ile  Leu Cys Leu Pro Lys  Tyr Ser Leu Phe Glu  Leu Lys Asn
    1205                1210                1215

Gly Arg  Arg Arg Met Leu Ala  Ser Ala Lys Glu Leu  Gln Lys Gly
    1220                1225                1230

Asn Glu  Ile Val Leu Pro Val  His Leu Thr Thr Leu  Leu Tyr His
    1235                1240                1245

Ala Lys  Asn Ile His Arg Leu  Asp Glu Pro Glu His  Leu Glu Tyr
    1250                1255                1260

Ile Gln  Lys His Arg Asn Glu  Phe Lys Gly Leu Leu  Asn Leu Val
    1265                1270                1275

Ser Glu  Phe Ser Gln Lys Tyr  Val Leu Ala Asp Ala  Asn Leu Glu
    1280                1285                1290

Lys Ile  Lys Asn Leu Tyr Ala  Asp Asn Glu Gln Ala  Asp Ile Glu
    1295                1300                1305
```

```
Ile Leu  Ala Asn Ser Phe Ile  Asn Leu Leu Thr Phe  Thr Ala Leu
    1310                1315                1320


Gly Ala  Pro Ala Ala Phe Lys  Phe Phe Gly Lys Asp  Val Asp Arg
    1325                1330                1335


Lys Arg  Tyr Thr Thr Val Ser  Glu Ile Leu Asn Ala  Thr Leu Ile
    1340                1345                1350


His Gln  Ser Ile Thr Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser
    1355                1360                1365


Lys Leu  Gly Glu Asp
    1370
```

<210> 747
<211> 1371
<212> PRT
<213> Streptococcus oralis

<400> 747

```
Met Glu Asn Lys Asn Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser
1               5                   10                  15


Val Gly Trp Ser Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys
            20                  25                  30


Met Lys Val Leu Gly Asn Thr Asp Lys Arg Phe Ile Lys Lys Asn Leu
        35                  40                  45


Ile Gly Ala Leu Leu Phe Asp Glu Gly Thr Thr Ala Glu Ala Arg Arg
    50                  55                  60


Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu
65                  70                  75                  80


Arg Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Ser
                85                  90                  95
```

```
Ser Phe Phe His Arg Leu Asp Asp Ser Phe Leu Ile Pro Glu Asp Lys
            100                 105                 110

Arg Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Ala Glu Glu Lys Glu
        115                 120                 125

Tyr His Lys Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Gln Leu Ala
    130                 135                 140

Asp Ser Lys Glu Lys Thr Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala
145                 150                 155                 160

His Met Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Asp Thr Phe Asp
                165                 170                 175

Ile Lys Asn Asn Asp Ile Gln Lys Ile Phe Ser Glu Phe Ile Ser Ile
            180                 185                 190

Tyr Asp Asn Thr Phe Glu Gly Ser Ser Leu Ser Gly Gln Asn Ala Gln
        195                 200                 205

Val Glu Ala Ile Phe Thr Asp Lys Ile Ser Lys Ser Ala Lys Arg Glu
    210                 215                 220

Arg Val Leu Lys Leu Phe Pro Asp Glu Lys Ser Thr Gly Leu Phe Ser
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asp Leu Gly Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Asp Phe Ala
        275                 280                 285
```

```
Asp Leu Phe Leu Val Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Pro Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Glu Arg Tyr Glu Asn His Gln Lys Asp Leu Ala Val Leu
                325                 330                 335

Lys Gln Phe Ile Lys Asn Asn Leu Pro Glu Lys Tyr Asp Glu Val Phe
            340                 345                 350

Ser Asp Gln Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr
        355                 360                 365

Thr Gln Glu Ala Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Phe
    370                 375                 380

Glu Gly Thr Asp Tyr Phe Leu Glu Lys Ile Glu Arg Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His
                405                 410                 415

Leu Gln Glu Met Asn Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro
            420                 425                 430

Phe Leu Lys Asp Asn Lys Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Arg Asp Phe Ala
    450                 455                 460

Trp Leu Thr Arg Asn Ser Asp Glu Ala Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Glu Ile Val Asp Lys Ala Ser Ser Ala Glu Asp Phe Ile Asn Lys Met
                485                 490                 495
```

```
Thr Asn Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Lys Phe Ile Ala Glu Gly Leu Arg Asp Tyr Gln Phe Leu Asp Ser Gly
    530                 535                 540

Gln Lys Lys Gln Ile Val Thr Gln Leu Phe Lys Glu Lys Arg Lys Val
545                 550                 555                 560

Thr Glu Lys Asp Ile Ile Gln Phe Leu His Asn Val Asp Gly Tyr Asp
                565                 570                 575

Gly Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Glu Phe Met Asp
        595                 600                 605

Asp Ser Lys Asn Glu Glu Ile Leu Glu Asn Ile Val His Thr Leu Thr
    610                 615                 620

Ile Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln Tyr Asp
625                 630                 635                 640

Ser Leu Phe Asp Glu Lys Val Ile Lys Ala Leu Ile Arg Arg His Tyr
                645                 650                 655

Thr Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asp Gly Ile Cys Asp
            660                 665                 670

Lys Gln Thr Gly Asn Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Lys
        675                 680                 685
```

```
Asn Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu Ser Phe
    690                 695                 700

Lys Glu Ile Thr Gln Lys Ala Gln Val Val Gly Lys Thr Asp Asp Val
705                 710                 715                 720

Lys Gln Val Val Gln Glu Leu Pro Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

His Thr Pro Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
        755                 760                 765

Thr Ala Arg Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile Glu
    770                 775                 780

Asp Ala Leu Lys Asn Leu Ala Ser Gly Leu Asp Ser Asn Ile Leu Lys
785                 790                 795                 800

Glu His Pro Thr Asn Asn Ile Gln Leu Gln Asn Asp Arg Leu Phe Leu
                805                 810                 815

Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Lys Pro Leu Asp
            820                 825                 830

Ile Asn Gln Leu Ser Ser Tyr Asp Ile Asp His Ile Val Pro Gln Ala
        835                 840                 845

Phe Ile Lys Asp Asp Ser Leu Asp Asn Arg Val Leu Thr Ser Leu Lys
    850                 855                 860

Asp Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Ile Glu Val Val Gln
865                 870                 875                 880

Lys Arg Lys Ala Phe Trp Gln Gln Leu Leu Asp Ser Lys Leu Ile Ser
                885                 890                 895
```

```
Glu Arg Lys Phe Asn Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Asp
            900                 905                 910

Glu Arg Asp Lys Val Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg
        915                 920                 925

Gln Ile Thr Lys His Val Ala Gln Ile Leu Asp Ala Arg Phe Asn Lys
    930                 935                 940

Glu Val Asn Glu Lys Asp Lys Lys Asn Arg Thr Val Lys Ile Ile Thr
945                 950                 955                 960

Leu Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Arg Leu Tyr
                965                 970                 975

Lys Val Arg Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu
            980                 985                 990

Asn Ala Val Val Ala Lys Ala Ile  Leu Lys Lys Tyr Pro  Lys Leu Glu
        995                 1000                1005

Pro Glu  Phe Val Tyr Gly Asp  Tyr Gln Lys Tyr Asp  Leu Lys Arg
    1010                1015                1020

Tyr Ile  Ser Arg Ser Arg Asn  Pro Lys Glu Val Glu  Lys Ala Thr
    1025                1030                1035

Glu Lys  Tyr Phe Phe Tyr Ser  Asn Leu Leu Asn Phe  Phe Lys Glu
    1040                1045                1050

Glu Val  His Tyr Ala Asp Gly  Thr Ile Val Lys Arg  Glu Asn Ile
    1055                1060                1065

Glu Tyr  Ser Lys Asp Thr Gly  Glu Ile Ala Trp Asn  Lys Glu Lys
    1070                1075                1080
```

```
Asp Phe  Ala Thr Ile Lys Lys  Val Leu Ser Tyr Pro  Gln Val Asn
    1085                1090                1095

Ile Val  Lys Lys Arg Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu
    1100                1105                1110

Ser Ile  Leu Pro Lys Gly Asn  Ser Asp Lys Leu Ile  Pro Arg Lys
    1115                1120                1125

Thr Lys  Asp Ile Leu Trp Glu  Thr Thr Lys Tyr Gly  Gly Phe Asp
    1130                1135                1140

Ser Pro  Val Ile Ala Tyr Ser  Ile Leu Leu Ile Ala  Asp Ile Glu
    1145                1150                1155

Lys Gly  Lys Ala Lys Lys Leu  Lys Thr Val Lys Thr  Leu Val Gly
    1160                1165                1170

Ile Thr  Ile Met Glu Lys Ala  Ala Phe Glu Glu Asn  Pro Ile Thr
    1175                1180                1185

Phe Leu  Glu Asn Lys Gly Tyr  His Asn Val Arg Lys  Glu Asn Ile
    1190                1195                1200

Leu Cys  Leu Pro Lys Tyr Ser  Leu Phe Glu Leu Glu  Asn Gly Arg
    1205                1210                1215

Arg Arg  Leu Leu Ala Ser Ala  Lys Glu Leu Gln Lys  Gly Asn Glu
    1220                1225                1230

Ile Val  Leu Pro Val Tyr Leu  Thr Thr Leu Leu Tyr  His Ser Lys
    1235                1240                1245

Asn Val  His Lys Leu Asp Glu  Pro Glu His Leu Glu  Tyr Ile Gln
    1250                1255                1260

Lys His  Arg Asn Glu Phe Lys  Asp Leu Leu Asn Leu  Val Ser Glu
    1265                1270                1275
```

```
Phe Ser  Gln Lys Tyr Val Leu  Ala Asp Ala Asn Leu  Glu Lys Ile
    1280                1285                1290


Gln Asn  Leu Tyr Ala Asp Asn  Glu Gln Ala Asp Ile  Glu Ile Leu
    1295                1300                1305


Ala Asn  Ser Phe Ile Asn Leu  Leu Thr Phe Thr Ala  Leu Gly Ala
    1310                1315                1320


Pro Ala  Ala Phe Lys Phe Phe  Gly Lys Asp Ile Asp  Arg Lys Arg
    1325                1330                1335


Tyr Thr  Thr Val Ser Glu Ile  Leu Asn Ala Thr Leu  Ile His Gln
    1340                1345                1350


Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile Asp Leu  Ser Lys Leu
    1355                1360                1365


Gly Glu  Asp
    1370
```

<210> 748
<211> 1121
<212> PRT
<213> Streptococcus oralis

<400> 748

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Met Asn Gly Leu Val Leu Gly Leu Asp Ile Gly Ile Ala Ser Val Gly
1               5                  10                  15


Val Gly Ile Leu Glu Lys Asn Ser Gly Lys Ile Ile His Ala Asn Ser
            20                  25                  30


Arg Leu Phe Pro Ala Ala Thr Ala Asp Asn Asn Val Glu Arg Arg Lys
        35                  40                  45


Asn Arg Gln Ala Arg Arg Leu Asn Arg Arg Lys Lys His Arg Gly Val
```

```
    50                  55                  60

Arg Phe Gln Asp Leu Phe Glu Asp Tyr Gly Leu Leu Thr Asp Phe Ser
65                  70                  75                  80

Lys Val Ser Ile Asn Leu Asn Pro Tyr Arg Leu Arg Val Asp Gly Leu
                85                  90                  95

Asn Gln Gln Leu Thr Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Ile
            100                 105                 110

Val Lys Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Glu Asp Gly
        115                 120                 125

Gly Ala Val Ser Ser Asp Tyr Gly Lys Ala Val Glu Glu Asn Arg Lys
    130                 135                 140

Leu Leu Ala Glu Gln Thr Pro Gly Gln Ile Gln Leu Glu Arg Phe Glu
145                 150                 155                 160

Lys Tyr Gly Gln Val Arg Gly Asp Phe Thr Val Val Glu Asn Gly Glu
                165                 170                 175

Lys Cys Arg Leu Ile Asn Val Phe Ser Thr Ser Ala Tyr Arg Lys Glu
            180                 185                 190

Ala Glu Lys Ile Leu Arg Lys Gln Gln Glu Phe Asn Asn Gln Ile Thr
        195                 200                 205

Asp Glu Phe Ile Glu Asp Tyr Leu Lys Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240

Phe Arg Thr Asp Gly Thr Thr Leu Asp Asn Ile Phe Gly Val Leu Ile
                245                 250                 255
```

```
Gly Lys Cys Thr Phe Tyr Pro Asn Glu Tyr Arg Ala Ser Lys Ser Ser
            260                 265                 270

Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285

Val Pro Thr Glu Thr Lys Lys Leu Ser Glu Glu Gln Lys Lys Val Ile
    290                 295                 300

Val Glu Tyr Ala Lys Glu Ala Lys Thr Leu Gly Ala Ser Thr Leu Leu
305                 310                 315                 320

Lys Tyr Ile Val Lys Met Ile Asp Ala Ser Val Asp Gln Ile Ser Gly
                325                 330                 335

Tyr Arg Val Asp Val Asn Asn Lys Pro Glu Met His Thr Phe Glu Val
            340                 345                 350

Tyr Arg Lys Met Gln Ser Leu Glu Thr Ile Ser Val Gly Glu Leu Ser
        355                 360                 365

Arg Asn Val Leu Asp Glu Leu Ala His Ile Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Glu Glu Ala Ile Asn Ser Lys Leu Met Gly Val Phe
385                 390                 395                 400

Ser Gln Asp Gln Val Leu Glu Leu Val Gln Phe Arg Lys Asn Asn Ser
                405                 410                 415

Ser Leu Phe Ser Lys Gly Trp His Asn Phe Ser Leu Lys Leu Met Met
            420                 425                 430

Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr Ile
        435                 440                 445

Leu Thr Arg Leu Gly Lys Gln Lys Ser Lys Glu Thr Ser Lys Arg Thr
```

```
    450                 455                 460

Lys Tyr Ile Asp Glu Lys Glu Leu Thr Glu Glu Ile Tyr Asn Pro Val
465                 470                 475                 480

Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Ile Asn Glu Ala Thr
                485                 490                 495

Lys Lys His Gly Ile Phe Asp Asn Ile Val Ile Glu Met Ala Arg Glu
            500                 505                 510

Asn Asn Glu Glu Asp Ala Lys Lys Asp Tyr Ile Lys Arg Gln Lys Ala
        515                 520                 525

Asn Gln Asp Glu Lys Asn Ala Ala Met Glu Lys Ala Ala Phe Gln Tyr
    530                 535                 540

Asn Gly Lys Lys Glu Leu Pro Gly Asn Ile Phe Asn Gly His Lys Glu
545                 550                 555                 560

Leu Ala Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Lys Cys Leu
                565                 570                 575

Tyr Thr Gly Lys Thr Ile Pro Ile Ser Asp Leu Ile His Asn Gln Tyr
            580                 585                 590

Lys Tyr Glu Ile Asp His Ile Leu Pro Leu Ser Leu Ser Phe Asp Asp
        595                 600                 605

Ser Leu Ser Asn Lys Val Leu Val His Ala Thr Ala Asn Gln Glu Lys
    610                 615                 620

Gly Gln Arg Thr Pro Phe Gln Ala Leu Asp Ser Met Asp Asp Ala Trp
625                 630                 635                 640

Ser Tyr Arg Glu Phe Lys Ser Tyr Val Lys Asp Leu Lys Ser Leu Ser
                645                 650                 655
```

```
Asn Lys Lys Lys Asp Tyr Leu Leu Thr Glu Glu Asp Ile Ser Lys Ile
            660                 665                 670

Glu Val Lys Gln Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg Tyr
        675                 680                 685

Ser Ser Arg Val Val Leu Asn Ala Leu Gln Asp Phe Tyr Lys Ser His
    690                 695                 700

Gln Phe Asp Thr Thr Ile Ser Val Val Arg Gly Gln Phe Thr Ser Gln
705                 710                 715                 720

Leu Arg Arg Lys Trp Gly Leu Glu Lys Ser Arg Glu Thr Tyr His His
                725                 730                 735

His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Arg Leu
            740                 745                 750

Trp Lys Lys Gln Asn Asn Pro Leu Ile Thr Tyr Lys Glu Gly Gln Phe
        755                 760                 765

Val Asp Ser Gln Thr Gly Glu Ile Ile Ser Leu Thr Asp Asp Glu Tyr
    770                 775                 780

Lys Glu Leu Val Phe Lys Ala Pro Tyr Asp His Phe Val Asp Thr Leu
785                 790                 795                 800

His Ser Lys Thr Phe Glu Asp Gly Ile Leu Phe Ser Tyr Gln Val Asp
                805                 810                 815

Ser Lys Tyr Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg
            820                 825                 830

Lys Ala Lys Leu Asp Lys Asp Lys Ser Glu Glu Thr Tyr Val Leu Gly
        835                 840                 845

Lys Ile Lys Asp Ile Tyr Ser Gln Ala Gly Tyr Asp Ala Phe Ile Lys
```

```
    850                 855                 860

Ile Tyr Asn Lys Asp Lys Arg Lys Phe Leu Met Tyr His Lys Asp Pro
865                 870                 875                 880

Gln Thr Phe Glu Lys Val Ile Glu Glu Ile Leu Arg Thr Tyr Pro Ser
                885                 890                 895

Lys Glu Arg Asn Asp Lys Asn Lys Glu Val Pro Cys Asn Pro Phe Glu
            900                 905                 910

Lys Tyr Arg Gln Glu Asn Gly Pro Ile Arg Lys Tyr Ser Lys Lys Gly
        915                 920                 925

Asn Gly Pro Glu Ile Lys Cys Leu Lys Tyr Tyr Asp Asn Lys Leu Gly
    930                 935                 940

Asn Tyr Ile Asp Ile Ser Pro Asp Gly Ser Asp Asn Gln Val Val Leu
945                 950                 955                 960

Gln Ser Leu Lys Pro Trp Arg Thr Asp Val Tyr Phe Asn His Gln Thr
                965                 970                 975

Lys Glu Tyr Glu Leu Met Gly Leu Lys Tyr Ser Asp Leu Ser Phe Glu
            980                 985                 990

Lys Gly Ser Gly Lys Tyr Ser Ile  Ser Asn Glu Lys Tyr  Asn Ser Ile
        995                 1000                1005

Lys Arg  Ile Glu Gly Val Asn  Glu Gln Ser Glu Phe  Lys Phe Thr
    1010                1015                1020

Leu Tyr  Lys Asn Asp Leu Ile  Leu Ile Lys Asp Ser  Glu Asn Asn
    1025                1030                1035

Glu Gln  Lys Leu Phe Arg Phe  Asn Ser Arg Asn Asp  Thr Ala Lys
    1040                1045                1050
```

```
His Tyr  Val Glu Leu Lys Pro  Tyr Asp Lys Ala Arg  Phe Asp Gly
    1055                1060                1065


Gln Gln  Glu Leu Ile Thr Ile  Leu Gly Asn Val Ala  Lys Gly Gly
    1070                1075                1080


Gln Cys  Leu Lys Gly Leu Asn  Lys Ser Asn Ile Ser  Ile Phe Lys
    1085                1090                1095


Val Lys  Thr Asp Val Leu Gly  Lys Lys His Ile Ile  Lys Lys Glu
    1100                1105                1110


Gly Asp  Glu Pro Lys Leu Lys  Phe
    1115                1120


<210>  749
<211>  1134
<212>  PRT
<213>  Streptococcus oralis

<400>  749

Met Asn Gly Leu Val Leu Gly Leu Asp Ile Gly Ile Ala Ser Val Gly
1               5                   10                  15


Val Gly Ile Leu Glu Lys Asn Ser Gly Lys Ile Val His Ala Ser Ser
            20                  25                  30


Arg Ile Phe Pro Ala Ala Thr Ala Asp Asn Asn Val Glu Arg Arg Lys
        35                  40                  45


Asn Arg Gln Ala Arg Arg Leu His Arg Arg Lys Lys His Arg Gly Ala
    50                  55                  60


Arg Leu Lys Asp Leu Phe Glu Tyr Tyr Gly Leu Leu Thr Asp Phe Ser
65                  70                  75                  80


Lys Val Ser Ile Asn Leu Asn Pro Tyr Arg Leu Arg Val Asp Gly Leu
                85                  90                  95
```

```
Asp Gln Gln Leu Thr Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Ile
            100                 105                 110

Val Lys Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Glu Asp Gly
        115                 120                 125

Gly Thr Val Ser Ser Asp Tyr Gly Lys Ala Val Glu Glu Asn Arg Lys
    130                 135                 140

Leu Leu Ala Glu Gln Thr Pro Gly Gln Ile Gln Leu Glu Arg Phe Glu
145                 150                 155                 160

Lys Tyr Gly Gln Leu Arg Gly Asp Phe Thr Val Val Glu Asn Ser Glu
                165                 170                 175

Lys Cys Arg Leu Ile Asn Val Phe Ser Thr Ser Ala Tyr Lys Lys Glu
            180                 185                 190

Ala Glu Arg Ile Leu Arg Lys Gln Gln Glu Phe Asn Asn Gln Ile Thr
        195                 200                 205

Asp Glu Phe Ile Glu Asp Tyr Leu Lys Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240

Phe Arg Thr Asp Gly Ala Thr Leu Asp Asn Ile Phe Gly Ile Leu Ile
                245                 250                 255

Gly Lys Cys Thr Phe Tyr Pro Asn Glu Tyr Arg Ala Ser Lys Ala Ser
            260                 265                 270

Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285
```

```
Val Pro Thr Glu Thr Lys Lys Leu Ser Glu Glu Gln Lys Lys Thr Ile
    290                 295                 300

Ile Glu Tyr Ala Lys Ser Ala Lys Thr Leu Gly Ala Ser Thr Leu Leu
305                 310                 315                 320

Lys Tyr Ile Ala Lys Met Ile Asp Ala Ser Val Asp Gln Ile Arg Gly
                325                 330                 335

Tyr Arg Val Asp Val Asn Asn Lys Pro Glu Met His Thr Phe Glu Val
            340                 345                 350

Tyr Arg Lys Met Gln Ser Leu Glu Thr Ile Ser Val Gly Glu Leu Ser
        355                 360                 365

Arg Asn Ile Leu Asp Glu Leu Ala His Ile Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Glu Glu Ala Ile Asn Thr Lys Leu Arg Asp Ser Phe
385                 390                 395                 400

Ser Gln Asp Gln Val Leu Glu Leu Val Gln Phe Arg Lys Asn Asn Ser
                405                 410                 415

Ser Leu Phe Ser Lys Gly Trp His Asn Phe Ser Leu Lys Leu Met Met
            420                 425                 430

Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr Ile
        435                 440                 445

Leu Thr Arg Leu Gly Lys Gln Lys Ser Lys Glu Thr Ser Lys Arg Thr
    450                 455                 460

Lys Tyr Ile Asp Glu Lys Glu Val Thr Glu Glu Ile Tyr Asn Pro Val
465                 470                 475                 480

Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Ile Asn Glu Ala Thr
                485                 490                 495
```

```
Lys Lys His Gly Ile Phe Asp Asn Ile Val Ile Glu Met Ala Arg Glu
            500                 505                 510

Asn Asn Glu Glu Asp Ala Lys Lys Asp Tyr Ile Lys Arg Gln Lys Ala
        515                 520                 525

Asn Gln Asp Glu Lys Tyr Ala Ala Met Glu Lys Ala Ala Phe Gln Tyr
    530                 535                 540

Asn Gly Lys Lys Glu Leu Pro Asp Asn Ile Phe His Gly His Lys Glu
545                 550                 555                 560

Leu Ala Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Lys Cys Leu
                565                 570                 575

Tyr Thr Gly Lys Ser Ile Pro Ile Ser Asp Leu Ile His Asn Gln Tyr
            580                 585                 590

Lys Tyr Glu Ile Asp His Ile Leu Pro Leu Ser Leu Ser Phe Asp Asp
        595                 600                 605

Ser Leu Ser Asn Lys Val Leu Val Leu Ala Thr Ala Asn Gln Glu Lys
    610                 615                 620

Gly Gln Arg Thr Pro Phe Gln Ala Leu Asp Ser Met Asp Asp Ala Trp
625                 630                 635                 640

Ser Tyr Arg Glu Phe Lys Ser Tyr Val Lys Glu Ser Lys Leu Leu Gly
                645                 650                 655

Asn Lys Lys Lys Glu Tyr Leu Leu Thr Glu Glu Asp Ile Ser Lys Ile
            660                 665                 670

Glu Val Lys Gln Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg Tyr
        675                 680                 685
```

```
Ser Ser Arg Val Val Leu Asn Ala Leu Gln Asp Phe Tyr Lys Asn His
    690                 695                 700

Asn Phe Asp Thr Thr Ile Ser Val Val Arg Gly Gln Phe Thr Ser Gln
705                 710                 715                 720

Leu Arg Arg Lys Trp Gly Leu Glu Lys Ser Arg Glu Thr Tyr His His
                725                 730                 735

His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Arg Leu
            740                 745                 750

Trp Lys Lys Gln Asn Asn Pro Leu Ile Ala Tyr Lys Glu Gly Gln Phe
        755                 760                 765

Val Asp Ser Gln Thr Gly Glu Ile Ile Ser Leu Thr Asp Asp Glu Tyr
    770                 775                 780

Lys Glu Leu Val Phe Lys Ala Pro Tyr Asp His Phe Val Asp Thr Leu
785                 790                 795                 800

Ser Ser Lys Thr Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln Val Asp
                805                 810                 815

Ser Lys Phe Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg
            820                 825                 830

Lys Ala Lys Leu Asp Lys Glu Lys Lys Glu Tyr Thr Tyr Thr Leu Gly
        835                 840                 845

Lys Ile Lys Asp Ile Tyr Ser Leu Gly Thr Lys Thr Pro Ser Lys Thr
    850                 855                 860

Gly Phe Tyr Lys Phe Leu Asp Leu Tyr Asn Lys Asp Lys Ser Gln Phe
865                 870                 875                 880

Leu Met Phe Gln Lys Asp Arg Lys Thr Trp Asp Glu Val Ile Glu Lys
                885                 890                 895
```

```
Ile Met Glu Gln Tyr Arg Pro Phe Lys Glu Tyr Asp Lys Ala Gly Lys
            900                 905                 910

Leu Val Asp Phe Asn Pro Phe Glu Lys Tyr Arg Gln Glu Asn Gly Pro
        915                 920                 925

Ile Arg Lys Tyr Ser Lys Lys Gly Asn Gly Pro Glu Ile Lys Ser Leu
    930                 935                 940

Lys Tyr Tyr Asp Ile Leu Leu Gly Lys His Lys Asn Ile Thr Pro Glu
945                 950                 955                 960

Gly Ser Arg Asn Thr Val Ala Leu Leu Ser Leu Asn Pro Trp Arg Thr
                965                 970                 975

Asp Val Tyr Tyr Asn Met Glu Thr Lys Lys Tyr Glu Phe Leu Gly Leu
            980                 985                 990

Lys Tyr Ala Asp Leu Pro Phe Glu  Glu Gly Gly Ala Tyr  Gly Ile Ser
        995                 1000                1005

Thr Glu  Thr Tyr Asn Glu Leu  Arg Glu Lys Glu Gly  Ile Gly Lys
    1010                1015                1020

Asn Ser  Glu Phe Lys Phe Thr  Leu Tyr Lys Asn Asp  Leu Ile Leu
    1025                1030                1035

Ile Lys  Asp Thr Glu Thr Asn  Cys Gln Gln Phe Phe  Arg Phe Trp
    1040                1045                1050

Ser Arg  Thr Gly Lys Asp Asn  Pro Lys Ser Phe Glu  Lys His Lys
    1055                1060                1065

Ile Glu  Leu Lys Pro Tyr Glu  Lys Ala Lys Phe Glu  Lys Gly Glu
    1070                1075                1080
```

```
Glu Leu  Glu Val Leu Gly Lys  Val Pro Pro Ser Ser  Asn Gln Phe
    1085                1090                1095


Gln Lys  Asn Met Gln Ile Glu  Asn Leu Ser Ile Tyr  Lys Val Lys
    1100                1105                1110


Thr Asp  Val Leu Gly Asn Lys  His Phe Ile Lys Lys  Glu Gly Asp
    1115                1120                1125


Lys Pro  Lys Leu Lys Phe
    1130
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<210> 750
<211> 550
<212> PRT
<213> Streptococcus oralis

<400> 750

```
Met Tyr Ser Leu Asp Lys Asn Gly Ser Pro Thr Pro Leu Tyr Arg Asp
1               5                   10                  15


Gln Leu Asn Gln Tyr Glu Val Asp His Ile Ile Pro Tyr Ser Phe Leu
            20                  25                  30


Pro Ile Asp Ser Ile Asp Asn Lys Val Leu Thr His Arg Glu Asn Asn
        35                  40                  45


Gln Arg Lys Leu Asp Asn Ile Pro Asp Lys Glu Thr Val Ala Asn Met
    50                  55                  60


Lys Pro Phe Trp Glu Lys Leu Tyr Asn Ala Lys Leu Ile Ser Gln Thr
65                  70                  75                  80


Lys Tyr Gln Arg Leu Thr Thr Ser Glu Arg Thr Pro Asp Gly Val Leu
                85                  90                  95


Thr Glu Ser Met Lys Ala Gly Phe Ile Glu Arg Gln Leu Val Glu Thr
            100                 105                 110
```

```
Arg Gln Ile Ile Lys His Val Ala Arg Ile Leu Asp Asn Arg Phe Ser
        115                 120                 125

Asp Thr Lys Ile Ile Thr Leu Lys Ser Gln Leu Val Thr Asn Phe Arg
    130                 135                 140

Asn Thr Phe His Ile Ala Lys Ile Arg Glu Leu Asn Asp Tyr His His
145                 150                 155                 160

Ala His Asp Ala Tyr Leu Ala Val Val Val Gly Gln Thr Leu Leu Lys
                165                 170                 175

Ala Tyr Pro Lys Leu Ala Pro Glu Leu Ile Tyr Gly His His Ala His
            180                 185                 190

Phe Asn Arg His Glu Glu Asn Lys Ala Thr Ile Arg Lys Tyr Leu Tyr
        195                 200                 205

Ser Asn Ile Met Arg Phe Phe Asn Asn Pro Asp Ser Lys Val Ser Lys
    210                 215                 220

Asp Ile Trp Asp Cys Asn Arg Asp Leu Pro Ile Ile Lys Asp Ile Ile
225                 230                 235                 240

Tyr Asn Ser Gln Val Asn Phe Val Lys Arg Thr Met Ile Lys Lys Gly
                245                 250                 255

Ala Phe Tyr Asn Gln Asn Pro Val Gly Lys Phe Asn Lys Gln Ile Ala
            260                 265                 270

Ala Asn Asn Arg Tyr Pro Leu Lys Thr Lys Val Ser Ser Leu Asp Thr
        275                 280                 285

Ser Ile Tyr Gly Gly Tyr Gly Pro Met Asn Ser Ala Leu Ser Ile Ile
    290                 295                 300

Ile Ile Ala Glu Arg Phe Asn Glu Lys Lys Cys Lys Ile Glu Thr Val
```

```
305                 310                 315                 320

Lys Glu Phe His Asp Ile Phe Ile Ile Asp Tyr Lys Lys Phe Asn Asn
                325                 330                 335

Asp Pro Phe Gln Phe Leu Asn Asp Thr Ser Glu Asn Gly Phe Leu Lys
            340                 345                 350

Lys Asn Asn Ile Asn Arg Val Leu Ala Phe Tyr Arg Val Pro Lys Tyr
        355                 360                 365

Ser Leu Met Gln Lys Ile Asp Gly Thr Arg Met Leu Phe Glu Ser Lys
    370                 375                 380

Ser Asn Leu His Lys Ala Thr Gln Phe Lys Leu Thr Lys Thr Gln Asn
385                 390                 395                 400

Glu Leu Phe Phe His Met Arg Arg Leu Leu Thr Lys Ser Asn Leu Met
                405                 410                 415

Asp Leu Lys Ser Glu Ser Ala Ile Lys Glu Ser Gln Asn Phe Ile Leu
            420                 425                 430

Lys His Lys Glu Glu Phe Asp Asn Ile Ser Asn Gln Leu Ser Ala Phe
        435                 440                 445

Ser Gln Lys Met Leu Gly Asp Thr Thr Ser Leu Lys Asn Leu Ile Lys
    450                 455                 460

Gly Tyr Asn Glu Arg Lys Ile Lys Glu Ile Asn Ser Ser Glu Glu Thr
465                 470                 475                 480

Ile Lys Tyr Phe Tyr Asp Asn Phe Ile Lys Met Phe Ser Phe Val Lys
                485                 490                 495

Ser Gly Ala Pro Lys Asp Ile Asn Asp Phe Phe Asn Asn Lys Tyr Thr
            500                 505                 510
```

```
Val Ala Arg Met Arg Pro Lys Pro Asp Lys Lys Leu Leu Asn Ala Thr
        515                 520                 525


Leu Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp Leu
    530                 535                 540


Ser Lys Leu Gly Glu Asp
545                 550


<210>  751
<211>  1140
<212>  PRT
<213>  Streptococcus parasanguinis

<400>  751

Met Asn Gly Leu Val Leu Gly Leu Asp Ile Gly Ile Ala Ser Val Gly
1               5                   10                  15


Val Gly Ile Leu Lys Lys Asp Ile Gly Glu Ile Ile His Thr Asn Ser
            20                  25                  30


Arg Leu Phe Ser Ala Ala Thr Ala Asp Ser Asn Ile Glu Arg Arg Gly
        35                  40                  45


His Arg Gly Gly Lys Arg Leu Thr Arg Arg Lys Lys His Arg Ser Ile
    50                  55                  60


Arg Leu His Asp Leu Phe Glu Asp Phe Gly Leu Leu Thr Asp Phe Ser
65                  70                  75                  80


Lys Val Ser Ile Asn Leu Asn Pro Tyr Gln Leu Arg Val Gln Gly Leu
                85                  90                  95


Asp Asn Gln Leu Thr Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Ile
            100                 105                 110


Val Lys Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Glu Asp Gly
        115                 120                 125
```

```
Gly Thr Val Ser Ser Asp Tyr Gly Lys Ala Val Glu Glu Asn Arg Lys
    130                 135                 140

Leu Leu Ala Glu Gln Thr Pro Gly Gln Ile Gln Leu Asp Arg Phe Glu
145                 150                 155                 160

Lys Tyr Gly Gln Val Arg Gly Asp Phe Asn Val Val Glu Asn Gly Glu
                165                 170                 175

Lys Arg Arg Leu Ile Asn Val Phe Thr Thr Ser Ala Tyr Ser Lys Glu
            180                 185                 190

Ala Glu Arg Ile Leu Arg Lys Gln Gln Glu Phe Asn Lys Lys Ile Thr
        195                 200                 205

Asp Glu Phe Ile Glu Asp Tyr Leu Thr Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240

Tyr Thr Thr Lys Lys Asp Pro Glu Gly Lys Tyr Ile Thr Leu Asp Asn
                245                 250                 255

Ile Phe Gly Ile Leu Ile Gly Lys Cys Thr Phe Tyr Pro Asp Glu Tyr
            260                 265                 270

Arg Ala Ser Lys Ala Ser Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn
        275                 280                 285

Asp Leu Asn Asn Leu Thr Val Pro Thr Glu Thr Lys Lys Leu Ser Glu
    290                 295                 300

Glu Gln Lys Lys Thr Ile Ile Lys Tyr Ala Lys Thr Ala Lys Thr Leu
305                 310                 315                 320
```

```
Gly Ala Ser Thr Leu Leu Lys Tyr Ile Ala Lys Leu Ile Gly Ala Ser
                325                 330                 335

Val Asp Gln Ile His Gly Tyr Arg Ile Asp Pro Asn Lys Lys Pro Glu
            340                 345                 350

Met His Thr Phe Glu Thr Tyr Arg Lys Met Gln Ser Leu Glu Thr Ile
        355                 360                 365

Ser Val Glu Glu Leu Pro Arg Lys Val Leu Asp Glu Leu Ala His Ile
    370                 375                 380

Leu Thr Leu Asn Thr Glu Arg Glu Gly Ile Glu Glu Ala Ile Asn Ala
385                 390                 395                 400

Thr Leu Lys Asp Thr Phe Ser Gln Asp Gln Val Leu Glu Leu Val Gln
                405                 410                 415

Phe Arg Lys Asn Asn Ser Ser Leu Phe Ser Lys Gly Trp His Ser Phe
            420                 425                 430

Ser Leu Lys Leu Met Met Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser
        435                 440                 445

Glu Glu Gln Met Thr Ile Leu Thr Arg Leu Gly Lys Gln Lys Ser Lys
    450                 455                 460

Glu Thr Ser Lys Arg Thr Lys Tyr Ile Asp Glu Lys Glu Leu Thr Glu
465                 470                 475                 480

Glu Ile Tyr Asn Pro Val Val Ala Lys Ser Val Arg Gln Ala Ile Lys
                485                 490                 495

Ile Ile Asn Glu Ala Thr Lys Lys Tyr Gly Ile Phe Asp Asn Ile Val
            500                 505                 510

Ile Glu Met Ala Arg Glu Asn Asn Glu Glu Asp Ala Lys Lys Glu Tyr
        515                 520                 525
```

```
Ile Lys Arg Gln Lys Ala Asn Leu Asp Glu Lys Asn Ala Ala Met Glu
    530                 535                 540

Lys Ala Ala Phe Gln Tyr Asn Gly Lys Lys Glu Leu Pro Asp Asn Val
545                 550                 555                 560

Phe His Gly His Lys Glu Leu Ala Thr Lys Ile Arg Leu Trp His Gln
                565                 570                 575

Gln Gly Glu Lys Cys Leu Tyr Thr Gly Lys Asn Ile Pro Ile Ser Asp
            580                 585                 590

Leu Ile Gln Asn Gln Tyr Lys Tyr Glu Ile Asp His Ile Leu Pro Leu
        595                 600                 605

Ser Leu Ser Phe Asp Asp Ser Leu Ser Asn Lys Val Leu Val Leu Ala
    610                 615                 620

Thr Ala Asn Gln Glu Lys Gly Gln Arg Thr Pro Phe Gln Ala Leu Asp
625                 630                 635                 640

Ser Met Asp Asp Ala Trp Ser Tyr Arg Glu Phe Lys Ser Tyr Val Lys
                645                 650                 655

Asp Ser Lys Leu Leu Gly Asn Lys Lys Lys Glu Tyr Leu Leu Thr Glu
            660                 665                 670

Glu Asp Ile Ser Lys Ile Glu Val Lys Gln Lys Phe Ile Glu Arg Asn
        675                 680                 685

Leu Val Asp Thr Arg Tyr Ser Ser Arg Val Val Leu Asn Ala Leu Gln
    690                 695                 700

Asp Phe Tyr Lys Glu His Gln Phe Asp Thr Thr Ile Ser Val Val Arg
705                 710                 715                 720
```

```
Gly Gln Phe Thr Ser Gln Leu Arg Arg Lys Trp Gly Leu Glu Lys Ser
                725                 730                 735

Arg Glu Thr Tyr His His His Ala Val Asp Ala Leu Ile Ile Ala Ala
            740                 745                 750

Ser Ser Gln Leu Arg Leu Trp Lys Lys Gln Asn Asn Pro Leu Ile Ser
        755                 760                 765

Tyr Thr Glu Gly Gln Phe Val Asp Gln Val Thr Gly Glu Ile Ile Ser
    770                 775                 780

Leu Ser Asp Asp Glu Tyr Lys Glu Leu Val Phe Lys Ala Pro Tyr Asp
785                 790                 795                 800

His Phe Val Asp Thr Leu Lys Ser Lys Lys Phe Glu Asp Ser Ile Leu
                805                 810                 815

Phe Ser Tyr Gln Val Asp Ser Lys Tyr Asn Arg Lys Ile Ser Asp Ala
            820                 825                 830

Thr Ile Tyr Ala Thr Arg Lys Ala Lys Leu Asp Lys Glu Asn Lys Glu
        835                 840                 845

Tyr Thr Tyr Thr Leu Gly Lys Ile Lys Asp Ile Tyr Ala Leu Gly Thr
    850                 855                 860

Lys Ser Pro Ser Lys Thr Gly Phe Tyr Lys Phe Leu Asp Leu Tyr Asn
865                 870                 875                 880

Lys Asp Lys Ser Gln Phe Leu Met Phe Gln Lys Asp Arg Lys Thr Trp
                885                 890                 895

Asp Glu Val Ile Glu Lys Ile Ile Glu Gln Tyr Arg Pro Phe Lys Glu
            900                 905                 910

Tyr Asp Glu Asn Gly Lys Glu Val Asp Phe Asn Pro Phe Glu Lys Tyr
        915                 920                 925
```

```
Arg Ile Glu Asn Gly Pro Ile Arg Lys Tyr Ser Lys Lys Gly Asn Gly
    930                 935                 940

Pro Glu Ile Lys Ser Leu Lys Tyr Tyr Asp Asn Leu Leu Gly Lys Phe
945                 950                 955                 960

Val Asp Ile Thr Pro Ser Glu Ser Lys Asn Pro Val Ala Leu Leu Ser
                965                 970                 975

Leu Asn Pro Trp Arg Thr Asp Val Tyr Tyr Asn Thr Glu Thr Ser Lys
            980                 985                 990

Tyr Glu Phe Leu Gly Leu Lys Tyr  Ala Asp Leu Cys Phe  Glu Lys Gly
        995                 1000                1005

Gly Ala  Tyr Gly Ile Ser Glu  Val Lys Tyr Asn Lys  Ile Arg Glu
    1010                1015                1020

Lys Glu  Gly Ile Gly Lys Glu  Ser Glu Phe Lys Phe  Thr Leu Tyr
    1025                1030                1035

Lys Asn  Asp Leu Ile Leu Ile  Lys Asp Thr Glu Thr  Asn Cys Gln
    1040                1045                1050

Gln Ile  Phe Arg Phe Trp Ser  Arg Thr Gly Lys Asp  Asn Pro Lys
    1055                1060                1065

Ser Phe  Glu Lys His Lys Ile  Glu Leu Lys Pro Tyr  Glu Lys Ala
    1070                1075                1080

Arg Phe  Glu Lys Gly Glu Glu  Leu Glu Val Leu Gly  Lys Val Pro
    1085                1090                1095

Pro Ser  Ser Asn Gln Leu Gln  Lys Asn Met Gln Ile  Glu Asn Leu
    1100                1105                1110
```

```
Ser Ile  Tyr Lys Val Lys Thr  Asp Val Leu Gly Asn  Lys His Phe
    1115                1120                1125


Ile Lys  Lys Glu Gly Glu Glu  Pro Lys Leu Lys Phe
    1130                1135                1140
```

<210> 752
<211> 1374
<212> PRT
<213> Streptococcus pseudoporcinus

<400> 752

```
Met Lys Lys Arg Tyr Ser Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn
1               5                   10                  15


Ser Val Gly Trp Ala Val Ile Asn Glu Asp Tyr Lys Val Pro Ala Lys
            20                  25                  30


Lys Met Thr Val Phe Gly Asn Thr Asp Arg Lys Thr Ile Lys Lys Asn
        35                  40                  45


Leu Leu Gly Thr Val Leu Phe Asp Ser Gly Glu Thr Ala Gln Ala Arg
    50                  55                  60


Arg Leu Lys Arg Thr Asn Arg Arg Arg Tyr Thr Arg Arg Arg Tyr Arg
65                  70                  75                  80


Leu Cys Gln Leu Gln Asn Ile Phe Ala Thr Glu Met Val Lys Val Asp
                85                  90                  95


Asp Thr Phe Phe Gln Arg Leu Ser Glu Ser Phe Phe Tyr Tyr Gln Asp
            100                 105                 110


Lys Ala Phe Asp Lys His Pro Ile Phe Gly Asn Ser Lys Glu Glu Arg
        115                 120                 125


Ala Tyr His Lys Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Asp Leu
    130                 135                 140
```

```
Ala Asp Arg Asp Gln Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu
145                 150                 155                 160

Ser His Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Leu
                165                 170                 175

Asn Ser Glu Asn Thr Asp Val Gln Lys Leu Phe Ile Ala Leu Val Thr
            180                 185                 190

Val Tyr Asn Leu Leu Phe Glu Glu Glu Pro Ile Ala Gly Glu Thr Cys
        195                 200                 205

Asp Ala Lys Ala Leu Leu Thr Ala Lys Thr Ser Lys Ser Lys Arg Leu
    210                 215                 220

Glu Ser Leu Ile Ser Glu Phe Pro Gly Gln Lys Lys Asn Gly Leu Phe
225                 230                 235                 240

Gly Asn Leu Leu Ala Leu Ala Leu Gly Leu Arg Pro Asn Phe Lys Ser
                245                 250                 255

Asn Phe Gly Leu Ser Glu Asp Ala Lys Leu Gln Ile Thr Lys Asp Thr
            260                 265                 270

Tyr Glu Glu Glu Leu Asp Asn Leu Leu Ala Glu Ile Gly Asp His Tyr
        275                 280                 285

Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu
    290                 295                 300

Ser Asp Ile Leu Thr Leu Ser Asp Glu Asn Thr Arg Ala Pro Leu Ser
305                 310                 315                 320

Ala Ser Met Ile Lys Arg Tyr Glu Glu His Gln Glu Asp Leu Ala Leu
                325                 330                 335

Leu Lys Lys Leu Val Lys Glu Gln Met Pro Glu Lys Tyr Trp Glu Ile
```

```
            340                 345                 350

Phe Ser Asn Ala Lys Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Gly Lys
        355                 360                 365

Val Ser Gln Glu Asp Phe Tyr Arg Tyr Ile Lys Pro Ile Leu Ser Arg
    370                 375                 380

Leu Lys Gly Gly Asp Glu Phe Leu Ala Lys Ile Asp Arg Asp Asp Phe
385                 390                 395                 400

Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile
                405                 410                 415

His Leu Lys Glu Leu His Ala Ile Leu Arg Arg Gln Glu Lys Tyr Tyr
            420                 425                 430

Pro Phe Leu Ala Glu Gln Lys Glu Lys Ile Glu Gln Leu Leu Cys Phe
        435                 440                 445

Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Lys Gly Gly Asn Ser Ser
    450                 455                 460

Phe Ala Trp Leu Lys Arg Arg Ser Asp Glu Pro Ile Thr Pro Trp Asn
465                 470                 475                 480

Phe Lys Asp Val Val Asp Glu Glu Ala Ser Ala Gln Ala Phe Ile Glu
                485                 490                 495

Gly Met Thr Asn Tyr Asp Thr Tyr Leu Pro Glu Glu Lys Val Leu Pro
            500                 505                 510

Lys His Ser Pro Leu Tyr Glu Met Phe Thr Val Tyr Asn Glu Leu Thr
        515                 520                 525

Lys Val Lys Tyr Ile Ala Glu Asn Met Thr Lys Pro Leu Tyr Leu Ser
    530                 535                 540
```

```
Ala Glu Gln Lys Glu Ala Ile Ile Asp His Leu Phe Lys Gln Thr Arg
545                 550                 555                 560

Lys Val Thr Val Lys Asp Leu Lys Glu Lys Tyr Phe Ser Gln Ile Glu
                565                 570                 575

Gly Leu Glu Asn Val Asp Val Thr Gly Val Glu Gly Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr Asn Asp Leu Leu Lys Ile Ile Lys Asp Lys Ala
        595                 600                 605

Phe Leu Asp Asp Glu Ala Asn Ala Glu Ile Leu Glu Glu Ile Val Leu
    610                 615                 620

Ile Leu Thr Leu Phe Gln Asp Glu Lys Leu Ile Glu Lys Arg Leu Ala
625                 630                 635                 640

Lys Tyr Ala Asn Leu Phe Glu Lys Ser Val Leu Lys Lys Leu Arg Lys
                645                 650                 655

Arg His Tyr Arg Gly Trp Gly Arg Leu Ser Arg Gln Leu Ile Asp Gly
            660                 665                 670

Met Lys Asp Lys Ala Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ala
        675                 680                 685

Asp Asp Phe Ala Asn Arg Asn Phe Ile Gln Leu Ile Asn Asp Ser Ser
    690                 695                 700

Leu Asp Phe Glu Lys Leu Ile Asp Asp Ala Gln Lys Lys Ala Ile Lys
705                 710                 715                 720

Arg Glu Ser Leu Thr Glu Ala Val Ala Asn Leu Ala Gly Ser Pro Ala
                725                 730                 735

Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys Val Val Asp Glu Ile Val
```

```
            740                 745                 750

Lys Val Met Gly His Asn Pro Asp Asn Ile Val Ile Glu Met Ser Arg
        755                 760                 765

Glu Asn Gln Thr Thr Ala Gln Gly Leu Lys Asn Ala Arg Gln Arg Leu
    770                 775                 780

Lys Lys Ile Lys Glu Val His Lys Lys Thr Gly Ser Arg Ile Leu Glu
785                 790                 795                 800

Asp Asn Ser Glu Arg Ile Thr Asn Leu Thr Leu Gln Asp Asn Arg Leu
                805                 810                 815

Tyr Leu Tyr Leu Leu Gln Asp Gly Lys Asp Met Tyr Thr Gly Gln Asp
            820                 825                 830

Leu Asp Ile Asn Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro
        835                 840                 845

Gln Ser Phe Ile Lys Asp Asn Ser Ile Asp Asn Leu Val Leu Thr Thr
    850                 855                 860

Gln Lys Ala Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Ile Glu Val
865                 870                 875                 880

Val Arg Asp Met Lys Asp Arg Val Trp Arg Arg Gln Leu Ala Asn Gly
                885                 890                 895

Ala Ile Ser Arg Gln Lys Phe Asp His Leu Thr Lys Ala Glu Arg Gly
            900                 905                 910

Gly Leu Ala Asp Ser Asp Lys Ala Arg Phe Leu Arg Arg Gln Leu Val
        915                 920                 925

Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln Leu Leu Asp Ser Arg
    930                 935                 940
```

```
Phe Asn Ser Lys Ser Asn Gln Asn Lys Lys Leu Ala Arg Asn Val Lys
945                 950                 955                 960


Ile Ile Thr Leu Lys Ser Lys Ile Val Ser Asp Phe Arg Lys Asp Phe
                965                 970                 975


Gly Leu Tyr Lys Leu Arg Glu Val Asn Asn Tyr His His Ala His Asp
            980                 985                 990


Ala Tyr Leu Asn Ala Val Val Gly  Thr Ala Leu Leu Lys  Lys Tyr Pro
        995                 1000                1005


Lys Leu  Glu Ala Glu Phe Val  Tyr Gly Asp Tyr Lys  His Phe Asp
    1010                1015                1020


Leu Val  Lys Leu Ile Ser Lys  Ser Asp Pro Ser Leu  Gly Lys Ala
    1025                1030                1035


Thr Ala  Lys Val Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1040                1045                1050


Glu Glu  Leu Ser Leu Ala Asp  Gly Thr Leu Met Lys  Arg Pro Val
    1055                1060                1065


Ile Glu  Thr Asn Thr Glu Thr  Gly Glu Val Val Trp  Asp Lys Val
    1070                1075                1080


Lys Asp  Phe Lys Thr Ile Arg  Lys Val Leu Ser Tyr  Pro Gln Val
    1085                1090                1095


Asn Ile  Val Lys Lys Thr Glu  Ile Gln Ser Gly Ala  Phe Ser Lys
    1100                1105                1110


Glu Ser  Val Leu Ser Lys Gly  Asn Ser Asp Lys Leu  Ile Glu Arg
    1115                1120                1125


Lys Lys  Gly Trp Asp Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro
```

```
    1130                1135                1140

Asn Thr  Ala Tyr Ser Ile Phe  Val Val Ala Lys Val  Ala Lys Arg
    1145                1150                1155

Lys Ala  Gln Lys Leu Lys Thr  Val Lys Glu Ile Val  Gly Ile Thr
    1160                1165                1170

Ile Met  Glu Gln Ala Glu Tyr  Glu Lys Asp Asn Ile  Ala Phe Leu
    1175                1180                1185

Glu Lys  Lys Gly Tyr Gln Asp  Ile Gln Glu Lys Leu  Leu Ile Lys
    1190                1195                1200

Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Arg Arg
    1205                1210                1215

Leu Leu  Ala Ser Ala Asn Glu  Phe Gln Lys Gly Asn  Glu Leu Ala
    1220                1225                1230

Leu Ser  Gly Lys Tyr Met Lys  Phe Leu Tyr Leu Ala  Ser Arg Tyr
    1235                1240                1245

Asp Lys  Leu Ser Ser Lys Ile  Glu Ser Glu Gln Gln  Lys Lys Leu
    1250                1255                1260

Phe Val  Glu Gln His Leu His  Tyr Phe Asp Glu Ile  Leu Asp Ile
    1265                1270                1275

Val Val  Lys His Ala Thr Cys  Tyr Ile Lys Ala Glu  Asn Asn Leu
    1280                1285                1290

Lys Lys  Ile Ile Ser Leu Tyr  Lys Lys Lys Glu Ala  Tyr Ser Ile
    1295                1300                1305

Asn Glu  Gln Ala Leu Asn Met  Leu Asn Leu Phe Ile  Phe Thr Ser
    1310                1315                1320
```

```
Leu Gly  Ala Pro Ser Thr Phe  Val Phe Phe Asp Glu  Thr Ile Asp
    1325                1330                1335


Arg Lys  Arg Tyr Thr Thr Ser  Ser Asp Val Leu Asn  Gly Ile Leu
    1340                1345                1350


Ile Gln  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1355                1360                1365


Ser Arg  Phe Gly Gly Asp
    1370
```

<210> 753
<211> 1052
<212> PRT
<213> Streptococcus pyogenes

<400> 753

```
Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu
1               5                   10                  15


Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys
            20                  25                  30


Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp
        35                  40                  45


Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu
    50                  55                  60


Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu
65                  70                  75                  80


Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His
                85                  90                  95


Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp
            100                 105                 110
```

```
Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu
        115                 120                 125

Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser
    130                 135                 140

Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp
145                 150                 155                 160

Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile
                165                 170                 175

Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu
            180                 185                 190

Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu
        195                 200                 205

Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu
    210                 215                 220

Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn
225                 230                 235                 240

Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile
                245                 250                 255

Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn
            260                 265                 270

Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys
        275                 280                 285

Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val
    290                 295                 300
```

```
Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu
305                 310                 315                 320

Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys
                325                 330                 335

Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn
            340                 345                 350

Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys
        355                 360                 365

Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp
    370                 375                 380

Ser Leu Thr Phe Lys Glu Asp Leu Gln Lys Ala Gln Val Ser Gly Gln
385                 390                 395                 400

Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala
                405                 410                 415

Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val
            420                 425                 430

Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala
        435                 440                 445

Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg
    450                 455                 460

Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Asp Ile Leu
465                 470                 475                 480

Lys Glu Tyr Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr
                485                 490                 495

Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu
            500                 505                 510
```

```
Asp Ile Asn Arg Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln
        515                 520                 525

Ser Phe Leu Lys Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser
    530                 535                 540

Asp Lys Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val
545                 550                 555                 560

Lys Lys Met Lys Asn Tyr Trp Lys Gln Leu Leu Asn Ala Lys Leu Ile
                565                 570                 575

Thr Gln Arg Lys Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu
            580                 585                 590

Ser Glu Leu Asp Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr
        595                 600                 605

Arg Gln Ile Thr Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn
    610                 615                 620

Thr Lys Tyr Asp Glu Asn Asp Lys Leu Ile Arg Glu Val Arg Val Ile
625                 630                 635                 640

Thr Leu Lys Ser Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe
                645                 650                 655

Tyr Lys Val Arg Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr
            660                 665                 670

Leu Asn Ala Val Val Gly Thr Ala Leu Ile Lys Lys Tyr Pro Lys Leu
        675                 680                 685

Glu Ser Glu Phe Val Tyr Gly Asp Tyr Lys Val Tyr Asp Ile Arg Lys
    690                 695                 700
```

```
Met Ile Ala Lys Ser Glu Gln Glu Ile Gly Lys Ala Thr Ala Lys Tyr
705                 710                 715                 720


Phe Phe Tyr Ser Asn Ile Met Asn Phe Phe Lys Thr Glu Ile Thr Leu
                725                 730                 735


Ala Asn Gly Glu Ile Arg Lys Arg Pro Leu Ile Glu Thr Asn Gly Glu
            740                 745                 750


Thr Gly Glu Ile Val Trp Asp Lys Gly Arg Asp Phe Ala Thr Val Arg
        755                 760                 765


Lys Val Leu Ser Met Pro Gln Val Asn Ile Val Lys Lys Thr Glu Val
    770                 775                 780


Gln Thr Gly Gly Phe Ser Lys Glu Ser Ile Leu Pro Lys Arg Asn Ser
785                 790                 795                 800


Asp Lys Leu Ile Ala Arg Lys Lys Asp Trp Asp Pro Lys Lys Tyr Gly
                805                 810                 815


Gly Phe Asp Ser Pro Thr Val Ala Tyr Ser Val Leu Val Val Ala Lys
            820                 825                 830


Val Glu Lys Gly Lys Ser Lys Lys Leu Lys Ser Val Lys Glu Leu Val
        835                 840                 845


Gly Ile Thr Ile Met Glu Arg Ser Ser Phe Glu Lys Asp Pro Val Asp
    850                 855                 860


Phe Leu Glu Ala Lys Gly Tyr Lys Glu Val Arg Lys Asp Leu Ile Ile
865                 870                 875                 880


Lys Leu Pro Lys Tyr Ser Leu Phe Glu Leu Glu Asn Gly Arg Lys Arg
                885                 890                 895


Met Leu Ala Ser Ala Gly Glu Leu Gln Lys Gly Asn Glu Leu Ala Leu
            900                 905                 910
```

```
Pro Ser Lys Tyr Val Asn Phe Leu Tyr Leu Ala Ser His Tyr Glu Lys
        915                 920                 925


Leu Lys Gly Ser Pro Glu Asp Asn Glu Gln Lys Gln Leu Phe Val Glu
    930                 935                 940


Gln His Lys His Tyr Leu Asp Glu Ile Ile Glu Gln Ile Ser Glu Phe
945                 950                 955                 960


Ser Lys Arg Val Ile Leu Ala Asp Ala Asn Leu Asp Lys Val Leu Ser
                965                 970                 975


Ala Tyr Asn Lys His Arg Asp Lys Pro Ile Arg Glu Gln Ala Glu Asn
            980                 985                 990


Ile Ile His Leu Phe Thr Leu Thr  Asn Leu Gly Ala Pro  Ala Ala Phe
        995                 1000                1005


Lys Cys  Phe Asp Thr Thr Ile  Gly Arg Asn Arg Tyr  Lys Ser Ile
    1010                1015                1020


Lys Glu  Val Leu Asp Ala Thr  Leu Ile His Gln Ser  Ile Thr Gly
    1025                1030                1035


Leu Tyr  Glu Thr Arg Ile Asp  Leu Ser Gln Leu Gly  Gly Asp
    1040                1045                1050


<210>  754
<211>  1368
<212>  PRT
<213>  Streptococcus pyogenes

<400>  754

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
```

```
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220
```

```
Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Leu Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
```

```
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620
```

```
Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
```

```
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser
945                 950                 955                 960

Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020
```

```
Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050

Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080

Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155

Ser Val  Lys Glu Leu Leu Gly  Leu Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170

Phe Glu  Lys Asn Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Lys Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
```

```
    1205                1210                1215

Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230

Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245

Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260

His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275

Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290

Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                1300                1305

Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
    1310                1315                1320

Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1325                1330                1335

Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1340                1345                1350

Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                1360                1365


<210>  755
<211>  1367
<212>  PRT
<213>  Streptococcus pyogenes

<400>  755
```

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Gly Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Ile Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Arg Val Asp Ala
        195                 200                 205
```

```
Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Arg Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400
```

```
Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Ala Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605
```

```
Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Gly Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly His Ser Leu
705                 710                 715                 720

His Glu Gln Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Thr Val Lys Ile Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
        755                 760                 765

Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu
    770                 775                 780

Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val
785                 790                 795                 800
```

```
Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln
                805                 810                 815

Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu
            820                 825                 830

Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp
        835                 840                 845

Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly
    850                 855                 860

Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn
865                 870                 875                 880

Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe
                885                 890                 895

Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys
            900                 905                 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925

His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu
    930                 935                 940

Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys
945                 950                 955                 960

Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu
                965                 970                 975

Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val
            980                 985                 990

Gly Thr Ala Leu Ile Lys Lys Tyr  Pro Lys Leu Glu Ser  Glu Phe Val
        995                 1000                1005
```

```
Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg Lys Met  Ile Ala Lys
    1010                1015                1020

Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala Lys Tyr  Phe Phe Tyr
    1025                1030                1035

Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu Ile Thr  Leu Ala Asn
    1040                1045                1050

Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu Thr Asn  Gly Glu Thr
    1055                1060                1065

Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp Phe Ala  Thr Val Arg
    1070                1075                1080

Lys Val  Leu Ser Met Pro Gln  Val Asn Ile Val Lys  Lys Thr Glu
    1085                1090                1095

Val Gln  Thr Gly Gly Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Arg
    1100                1105                1110

Asn Ser  Asp Lys Leu Ile Ala  Arg Lys Lys Asp Trp  Asp Pro Lys
    1115                1120                1125

Lys Tyr  Gly Gly Phe Asp Ser  Pro Thr Val Ala Tyr  Ser Val Leu
    1130                1135                1140

Val Val  Ala Lys Val Glu Lys  Gly Lys Ser Lys Lys  Leu Lys Ser
    1145                1150                1155

Val Lys  Glu Leu Leu Gly Ile  Thr Ile Met Glu Arg  Ser Ser Phe
    1160                1165                1170

Glu Lys  Asn Pro Ile Asp Phe  Leu Glu Ala Lys Gly  Tyr Lys Glu
    1175                1180                1185
```

```
Val Lys  Lys Asp Leu Ile Ile  Lys Leu Pro Lys Tyr  Ser Leu Phe
    1190                 1195                 1200

Glu Leu  Glu Asn Gly Arg Lys  Arg Met Leu Ala Ser  Ala Gly Glu
    1205                 1210                 1215

Leu Gln  Lys Gly Asn Glu Leu  Ala Leu Pro Ser Lys  Tyr Val Asn
    1220                 1225                 1230

Phe Leu  Tyr Leu Ala Ser His  Tyr Glu Lys Leu Lys  Gly Ser Pro
    1235                 1240                 1245

Glu Asp  Asn Glu Gln Lys Gln  Leu Phe Val Glu Gln  His Lys His
    1250                 1255                 1260

Tyr Leu  Asp Glu Ile Ile Glu  Gln Ile Ser Glu Phe  Ser Lys Arg
    1265                 1270                 1275

Val Ile  Leu Ala Asp Ala Asn  Leu Asp Lys Val Leu  Ser Ala Tyr
    1280                 1285                 1290

Asn Lys  His Arg Asp Lys Pro  Ile Arg Glu Gln Ala  Glu Asn Ile
    1295                 1300                 1305

Ile His  Leu Phe Thr Leu Thr  Asn Leu Gly Ala Pro  Ala Ala Phe
    1310                 1315                 1320

Lys Tyr  Phe Asp Thr Thr Ile  Asp Arg Lys Arg Tyr  Thr Ser Thr
    1325                 1330                 1335

Lys Glu  Val Leu Asp Ala Thr  Leu Ile His Gln Ser  Ile Thr Gly
    1340                 1345                 1350

Leu Tyr  Glu Thr Arg Ile Asp  Leu Ser Gln Leu Gly  Gly Asp
    1355                 1360                 1365
```

<210> 756
<211> 1368

<212> PRT
<213> Streptococcus pyogenes

<400> 756

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110


His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125


His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140


Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175


Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
```

```
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380
```

```
Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
```

```
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780
```

```
Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser
945                 950                 955                 960

Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
```

```
           980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020

Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050

Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080

Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155

Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170
```

```
Phe Glu  Lys Asn Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Lys Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215

Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230

Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245

Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260

His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275

Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290

Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                1300                1305

Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
    1310                1315                1320

Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1325                1330                1335

Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1340                1345                1350

Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
```

1355 1360 1365

<210> 757
<211> 1370
<212> PRT
<213> Streptococcus ratti

<400> 757

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

Lys Val Leu Gly Asn Thr Asp Lys Asn Tyr Ile Lys Lys Asn Leu Leu
35 40 45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Leu Leu
65 70 75 80

Tyr Leu Gln Asp Ile Phe Ser Asp Glu Met Asn Lys Val Asp Glu Ser
85 90 95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Ser Glu Asp Lys Arg
100 105 110

Gly Asp His His Pro Ile Phe Gly Asn Val Val Asp Glu Val Lys Tyr
115 120 125

His Glu Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Tyr Leu Ala Asp
130 135 140

Thr Pro Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145 150 155 160

```
Met Ile Lys Phe Arg Gly His Phe Leu Ile Asp Asp Pro Lys Leu Asp
                165                 170                 175

Val Lys Asn Thr Asp Ser Gln Glu Leu Phe Ser Gln Phe Leu Thr Ala
            180                 185                 190

Tyr Asp Val Thr Gln Glu Asp Ser His Leu Ala Asp Val Lys Ile Asn
        195                 200                 205

Ile Ser Asp Ile Ile Thr Glu Lys Met Asn Lys Ser Arg Lys Val Glu
    210                 215                 220

Ala Leu Leu Phe His Phe Pro Ser Gln Lys Lys Asn Ser Phe Phe Gly
225                 230                 235                 240

Asn Leu Val Ser Leu Val Phe Gly Leu Leu Pro Asn Phe Lys Thr Asn
                245                 250                 255

Phe Asn Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Tyr Thr
        275                 280                 285

Asp Val Phe Val Ala Ala Arg Lys Leu Tyr Asp Ser Ile Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Asn Asp Leu Ser Thr Lys Ala Ile Leu Ser Ala
305                 310                 315                 320

Ser Met Val Arg Arg Tyr Glu Glu His Asn Lys Asp Leu Ala Lys Leu
                325                 330                 335

Lys Ala Phe Val Lys Ala Asn Phe Thr His Asp Val Phe Lys Glu Val
            340                 345                 350

Phe Ser Asp Ala Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Gly Lys
        355                 360                 365
```

```
Thr Ser Gln Glu Asp Phe Tyr Lys Tyr Val Lys Asn Leu Ile Gly Lys
    370                 375                 380

Val Asp Gly Ser Ala Asp Phe Ile Glu Lys Ile Asp Arg Glu Asp Phe
385                 390                 395                 400

Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val
                405                 410                 415

His Leu Ala Glu Met Lys Ala Ile Leu Arg Arg Gln Gly Glu Tyr Tyr
            420                 425                 430

Pro Phe Leu Lys Glu His Ala Glu Lys Ile Gln Gln Ile Leu Thr Phe
        435                 440                 445

Arg Ile Pro Tyr Tyr Val Gly Pro Leu Asp Arg His Gly His Ser Asp
    450                 455                 460

Phe Ala Trp Ala Ser Phe Asn Ser Glu Glu Lys Val Thr Pro Trp Asn
465                 470                 475                 480

Phe Glu Glu Ile Ile Asp Lys Asn Lys Ser Ala Gln Ala Phe Ile Glu
                485                 490                 495

Arg Met Thr Asn Gln Asp Leu Tyr Leu Pro Asn Glu Lys Val Leu Pro
            500                 505                 510

Lys His Ser Pro Leu Tyr Glu Lys Tyr Thr Val Tyr Asn Glu Leu Thr
        515                 520                 525

Lys Ile Lys Tyr Val Thr Glu Thr Gly Thr Ala Lys Phe Phe Asp Ala
    530                 535                 540

Asn Leu Lys Gln Glu Ile Phe Asp Gly Leu Phe Lys Lys Glu Arg Lys
545                 550                 555                 560
```

```
Val Thr Lys Arg Lys Leu Leu Thr Phe Leu Glu Lys Asn Phe Asp Glu
                565                 570                 575

Phe Arg Ile Val Asp Ile Gln Gly Leu Asp Lys Glu Thr Glu Thr Phe
            580                 585                 590

Asn Ala Ser Tyr Gly Ile Tyr Gln Asp Leu Leu Lys Ile Ile Lys Asp
        595                 600                 605

Lys Ala Phe Met Asp Asp Ser Glu Asn Ala Asp Ile Leu Glu Asp Ile
    610                 615                 620

Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Gln Arg
625                 630                 635                 640

Leu Ala Lys Tyr Ala Asp Leu Phe Asp Lys Lys Val Ile Asp Asn Leu
                645                 650                 655

Ala Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu
            660                 665                 670

Asn Gly Ile Arg Asp Lys Arg Ser Arg Lys Thr Ile Met Asp Tyr Leu
        675                 680                 685

Val Asp Asp Gly Arg Ser Asn Arg Asn Leu Met Gln Leu Ile Thr Asp
    690                 695                 700

Asp Asn Leu Thr Phe Lys Asp Glu Ile Ala Lys Ala Gln Tyr Ser Asp
705                 710                 715                 720

Asn Ser Asp Asp Leu His Gln Val Val Gln Asp Leu Ala Gly Ser Pro
                725                 730                 735

Ala Ile Lys Lys Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu
            740                 745                 750

Val Lys Val Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala
        755                 760                 765
```

```
Arg Glu Asn Gln Thr Thr Ala Lys Gly Arg Arg Asn Ser Gln Gln Arg
    770                 775                 780

Tyr Lys Arg Leu Glu Glu Ala Ile Lys Asn Leu Asp Arg Asp Leu Asn
785                 790                 795                 800

Tyr Lys Ile Leu Lys Glu His Pro Thr Asp Asn Gln Ala Leu Gln Asn
                805                 810                 815

Asp Arg Leu Phe Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr
            820                 825                 830

Gly Glu Ser Leu Asp Ile Asn Arg Leu Ser Asp Tyr Asp Ile Asp His
        835                 840                 845

Ile Ile Pro Gln Ala Phe Ile Lys Asp Asn Ser Ile Asp Asn Arg Val
    850                 855                 860

Leu Val Ser Ser Ala Lys Asn Arg Gly Lys Ser Asp Asp Val Pro Ser
865                 870                 875                 880

Glu Asp Val Val Asn Arg Met Arg Pro Phe Trp Asn Lys Leu Leu Asn
                885                 890                 895

Cys Gly Leu Ile Ser Gln Arg Lys Tyr Ser Asn Leu Thr Lys Lys Glu
            900                 905                 910

Leu Thr Pro Asn Asp Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu
        915                 920                 925

Thr Arg Gln Ile Thr Lys His Val Ala Arg Ile Leu Asp Glu His Phe
    930                 935                 940

Asn Lys Glu Phe Asp Glu Asp Lys Lys Arg Ile Arg Lys Val Lys Val
945                 950                 955                 960
```

```
Val Thr Leu Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu
               965                 970                 975

Leu Tyr Lys Val Arg Glu Ile Asn Asp Tyr His His Ala His Asp Ala
           980                 985                 990

Tyr Leu Asn Ala Val Val Ala Lys  Ala Leu Leu Met Lys  Tyr Pro Lys
        995                1000                1005

Leu Glu  Pro Glu Phe Val Tyr  Gly Glu Tyr Pro Lys  Tyr Asn Ser
    1010                1015                1020

Tyr Arg  Glu Arg Lys Thr Ala  Thr Gln Arg Met Phe  Phe Tyr Ser
    1025                1030                1035

Asn Ile  Met Asn Met Phe Lys  Ser Lys Val Lys Leu  Ala Asp Glu
    1040                1045                1050

Arg Ile  Ile Glu Arg Pro Met  Ile Glu Val Asn Asp  Glu Thr Gly
    1055                1060                1065

Glu Ile  Ala Trp Asp Lys Thr  Lys His Ile Ala Thr  Val Lys Lys
    1070                1075                1080

Val Leu  Ser Tyr Pro Gln Ile  Asn Ile Val Lys Lys  Val Glu Glu
    1085                1090                1095

Gln Thr  Gly Gly Leu Thr Asn  Glu Thr Ile Tyr Pro  Arg Gly Ser
    1100                1105                1110

Phe Asp  Lys Leu Leu Asn Arg  Lys Asn Thr Leu Glu  Ala Ser Lys
    1115                1120                1125

Tyr Gly  Gly Phe Gly Ser Pro  Thr Val Ala Tyr Cys  Val Leu Val
    1130                1135                1140

Val Ala  Asp Ser Lys Asn Glu  Asn Gly Lys Val Lys  Lys Leu Lys
    1145                1150                1155
```

```
Leu Gly  Ser Glu Leu Leu Gly  Ile Thr Ile Leu Glu  Lys Asn Asp
    1160                1165                1170

Phe Glu  Asn Asn Ser Leu Asp  Phe Leu Ser Arg Lys  Gly Tyr Gln
    1175                1180                1185

Gly Val  Gln Glu Lys Lys Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Phe Gln Asp Gly Ser  Arg Arg Met Leu Ser  Ser Val Met
    1205                1210                1215

Ala Asn  Asp Asn Lys Arg Gly  Asp Leu Gln Lys Ala  Asn Glu Met
    1220                1225                1230

Ile Leu  Pro Ala Tyr Leu Val  Lys Leu Leu Tyr His  Ala Lys His
    1235                1240                1245

Ile Asn  Ser Val Gly Glu Pro  Ala His Lys Asn Tyr  Ile Asn Glu
    1250                1255                1260

His Cys  Ser Glu Phe Gln Asp  Leu Leu Asn Tyr Ile  Arg Gln Phe
    1265                1270                1275

Ala Asp  Lys Phe Val Asp Val  Asp Lys Asn Leu Ser  Lys Ile Arg
    1280                1285                1290

Ser Leu  Ser Lys Ser Met Ala  Glu Tyr Ser Val Ser  Glu Ile Cys
    1295                1300                1305

Ser Ser  Phe Val Asn Leu Leu  Thr Leu Thr Ala Leu  Gly Ala Pro
    1310                1315                1320

Ala Asp  Phe Lys Phe Phe Gly  Thr Thr Ile Pro Arg  Lys Arg Tyr
    1325                1330                1335
```

```
Gly Ser  Pro Gln Ser Ile Leu  Ser Ala Thr Leu Ile  His Gln Ser
    1340                1345                1350


Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Lys Leu Gly
    1355                1360                1365


Glu Asp
    1370
```

<210> 758
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<212> PRT
<213> Streptococcus salivarius

<400> 758

```
Met Ser Asp Leu Val Leu Gly Leu Asp Ile Gly Ile Gly Ser Val Gly
1               5                   10                  15


Val Gly Ile Leu Asn Lys Val Thr Gly Glu Ile Ile His Lys Asn Ser
            20                  25                  30


Arg Ile Phe Pro Ala Ala Gln Ala Glu Asn Asn Leu Glu Arg Arg Thr
        35                  40                  45


Asn Arg Gln Gly Arg Arg Leu Thr Arg Arg Lys Lys His Arg Arg Val
    50                  55                  60


Arg Leu Asn His Leu Phe Glu Glu Ser Gly Leu Ile Thr Asp Phe Thr
65                  70                  75                  80


Lys Val Ser Ile Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly Leu
                85                  90                  95


Thr Ala Glu Leu Ser Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Met
            100                 105                 110


Val Lys His Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Asp Asp Gly
        115                 120                 125
```

```
Asn Ser Ser Val Gly Asp Tyr Ala Gln Ile Val Lys Glu Asn Ser Lys
    130                 135                 140

Gln Leu Glu Thr Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Tyr Gln
145                 150                 155                 160

Lys Tyr Gly Gln Leu Arg Gly Asp Phe Thr Val Glu Glu Asp Gly Arg
                165                 170                 175

Lys His Arg Leu Ile Asn Val Phe Pro Thr Ser Ala Tyr His Ala Glu
            180                 185                 190

Ala Leu Arg Ile Leu Gln Thr Gln Gln Glu Phe Asn Pro Gln Ile Thr
        195                 200                 205

Asp Glu Phe Ile Asn Ser Tyr Leu Glu Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Lys
225                 230                 235                 240

Tyr Thr Thr Lys Lys Asp Ala Gln Gly Gln Tyr Ile Thr Leu Asn Asn
                245                 250                 255

Ile Phe Gly Ile Leu Ile Gly Lys Cys Thr Phe Tyr Pro Glu Glu Tyr
            260                 265                 270

Arg Ala Ala Lys Ala Ser Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn
        275                 280                 285

Asp Leu Asn Asn Leu Thr Val Pro Thr Glu Thr Lys Lys Leu Ser Glu
    290                 295                 300

Glu Gln Lys Tyr Gln Ile Ile Thr Tyr Val Lys Asn Glu Lys Ala Met
305                 310                 315                 320

Gly Pro Ala Lys Leu Phe Lys Tyr Ile Ala Lys Leu Leu Ala Cys Asp
```

```
                325                 330                 335

Ile Ala Asp Ile Lys Gly Tyr Arg Ile Asp Lys Ser Asp Lys Ala Glu
            340                 345                 350

Ile His Thr Phe Glu Ala Tyr Arg Lys Met Lys Thr Leu Glu Thr Ile
        355                 360                 365

Asp Ile Glu Gln Ile Glu Arg Glu Lys Leu Asp Lys Leu Ala Tyr Val
    370                 375                 380

Leu Thr Leu Asn Thr Glu Arg Glu Gly Ile Gln Glu Ala Leu Asp His
385                 390                 395                 400

Glu Phe Ala Asp Gly Thr Phe Ser Gln Glu Gln Val Asp Glu Leu Val
                405                 410                 415

Gln Phe Arg Lys Ala Asn Ser Ser Ile Phe Gly Lys Gly Trp His Ser
            420                 425                 430

Phe Ser Val Lys Leu Met Met Glu Leu Ile Pro Glu Leu Tyr Ala Thr
        435                 440                 445

Ser Glu Glu Gln Met Thr Ile Leu Thr Arg Leu Gly Lys Gln Lys Thr
    450                 455                 460

Thr Ser Ser Ser Asn Lys Thr Lys Tyr Ile Asp Glu Lys Gln Leu Thr
465                 470                 475                 480

Glu Glu Ile Tyr Asn Pro Val Val Ala Lys Ser Val Arg Gln Ala Ile
                485                 490                 495

Lys Ile Val Asn Ala Ala Ile Lys Lys Tyr Gly Asp Phe Asp Asn Ile
            500                 505                 510

Val Ile Glu Met Ala Arg Glu Thr Asn Glu Asp Asp Glu Lys Lys Ala
        515                 520                 525
```

```
Ile Gln Lys Ile Gln Lys Ala Asn Lys Ala Glu Lys Asp Ala Ala Met
    530                 535                 540

Arg Lys Ala Ala Asn Gln Tyr Asn Gly Lys Ala Glu Leu Pro His Ser
545                 550                 555                 560

Val Phe His Gly His Lys Gln Leu Ala Thr Lys Ile Arg Leu Trp His
                565                 570                 575

Gln Gln Gly Glu Arg Cys Leu Tyr Thr Gly Lys Thr Ile Ser Ile His
            580                 585                 590

Asp Leu Ile Asn Asn Pro Asn Gln Phe Glu Ile Asp His Ile Leu Pro
        595                 600                 605

Leu Ser Ile Thr Phe Asp Asp Ser Leu Ala Asn Lys Val Leu Val Tyr
    610                 615                 620

Ala Thr Ala Asn Gln Glu Lys Gly Gln Arg Thr Pro Tyr Gln Ala Leu
625                 630                 635                 640

Asp Ser Met Asp Asp Ala Trp Ser Phe Arg Glu Leu Lys Ala Phe Val
                645                 650                 655

Arg Glu Ser Lys Ala Leu Ser Asn Lys Lys Lys Glu Tyr Leu Leu Thr
            660                 665                 670

Glu Glu Asp Ile Ser Lys Phe Asp Val Arg Lys Lys Phe Ile Glu Arg
        675                 680                 685

Asn Leu Val Asp Thr Arg Tyr Ala Ser Arg Val Val Leu Asn Ala Leu
    690                 695                 700

Gln Glu His Phe Lys Ala His Lys Ile Asp Thr Lys Val Ser Val Val
705                 710                 715                 720

Arg Gly Gln Phe Thr Ser Gln Leu Arg Arg His Trp Gly Ile Asp Lys
```

```
                725                 730                 735

Thr Arg Asp Thr Tyr His His His Ala Val Asp Ala Leu Ile Ile Ala
            740                 745                 750

Ala Ser Ser Gln Leu Asn Leu Trp Lys Lys Gln Lys Asn Thr Leu Val
        755                 760                 765

Ser Tyr Ser Glu Asp Gln Leu Leu Asp Ile Glu Thr Gly Glu Leu Ile
    770                 775                 780

Ser Asp Asp Glu Tyr Lys Glu Ser Val Phe Lys Ala Pro Tyr Gln His
785                 790                 795                 800

Phe Val Asp Thr Leu Lys Ser Lys Glu Phe Glu Asp Ser Ile Leu Phe
                805                 810                 815

Ser Tyr Gln Val Asp Ser Lys Phe Asn Arg Lys Ile Ser Asp Ala Thr
            820                 825                 830

Ile Tyr Ala Thr Arg Gln Ala Lys Val Gly Lys Asp Lys Lys Asp Glu
        835                 840                 845

Thr Tyr Val Leu Gly Lys Ile Lys Asp Ile Tyr Ala Leu Gly Thr Lys
    850                 855                 860

Thr Pro Ser Lys Thr Gly Phe Tyr Lys Phe Leu Asp Leu Tyr Asn Lys
865                 870                 875                 880

Asp Lys Ser Gln Phe Leu Val Tyr Gln Lys Asp Arg Lys Thr Trp Asp
                885                 890                 895

Glu Val Ile Glu Lys Ile Met Glu Gln Tyr Arg Pro Phe Lys Glu Ser
            900                 905                 910

Asp Lys Asn Gly Lys Glu Val Asp Phe Asn Pro Phe Glu Lys Tyr Arg
        915                 920                 925
```

```
Ile Glu Asn Gly Pro Ile Arg Lys Tyr Ser Arg Lys Gly Asn Gly Pro
    930                 935                 940

Glu Ile Lys Ser Leu Lys Tyr Tyr Ala Ser Lys Leu Gly Asn His Ile
945                 950                 955                 960

Asp Ile Thr Pro Lys Asp Ser Asn Asn Lys Val Val Leu Gln Ser Val
                965                 970                 975

Ser Pro Trp Arg Ala Asp Val Tyr Phe Asn Lys Thr Thr Gly Ser Tyr
            980                 985                 990

Glu Ile Leu Gly Leu Lys Tyr Ala  Asp Leu Gln Phe Glu  Lys Gly Thr
        995                 1000                1005

Gly Thr  Tyr Arg Ile Ser Glu  Glu Lys Tyr Asn Asp  Ile Lys Lys
    1010                1015                1020

Lys Glu  Gly Val Asp Ser Asp  Ser Glu Phe Lys Phe  Thr Leu Tyr
    1025                1030                1035

Lys Asn  Asp Leu Leu Leu Ile  Lys Asp Thr Glu Thr  Lys Glu Gln
    1040                1045                1050

Arg Leu  Phe Arg Phe Leu Ser  Arg Ser Met Pro Asn  Lys Lys His
    1055                1060                1065

Tyr Val  Glu Leu Lys Pro Tyr  Ser Lys Asp Lys Phe  Glu Lys Asn
    1070                1075                1080

Glu Ser  Leu Ile Glu Ile Leu  Gly Ser Ala Asp Lys  Ser Gly Arg
    1085                1090                1095

Cys Ile  Lys Gly Leu Ala Lys  Ser Asn Leu Ser Ile  Phe Lys Val
    1100                1105                1110

Arg Thr  Asp Val Leu Gly Asn  Gln His Ile Ile Lys  Asn Glu Gly
```

1115 1120 1125

Asp Lys Pro Lys Leu Asp Phe
1130 1135

<210> 759
<211> 1127
<212> PRT
<213> Streptococcus salivarius

<400> 759

Met Ser Asp Leu Val Leu Gly Leu Asp Ile Gly Ile Gly Ser Val Gly
1 5 10 15

Val Gly Ile Leu Asn Lys Val Thr Gly Glu Ile Ile His Lys Asn Ser
20 25 30

Arg Ile Phe Pro Ala Ala Gln Ala Glu Asn Asn Val Glu Arg Arg Ile
35 40 45

Asn Arg Gln Gly Arg Arg Leu Thr Arg Arg Lys Lys His Arg Arg Val
50 55 60

Arg Leu Asn His Leu Phe Glu Glu Ser Gly Leu Ile Thr Asp Phe Thr
65 70 75 80

Asn Val Ser Ile Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly Leu
85 90 95

Thr Asp Glu Leu Ser Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Met
100 105 110

Val Lys His Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Asp Asp Gly
115 120 125

Asn Ser Ser Val Gly Asp Tyr Ala Gln Ile Val Lys Glu Asn Ser Lys
130 135 140

```
Gln Leu Glu Thr Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Tyr Gln
145                 150                 155                 160

Lys Tyr Gly Gln Leu Arg Gly Asp Phe Thr Val Glu Glu Asp Gly Lys
                165                 170                 175

Lys His Arg Leu Ile Asn Val Phe Pro Thr Ser Ala Tyr Arg Ala Glu
            180                 185                 190

Ala Leu Arg Ile Leu Gln Thr Gln Gln Glu Phe Asn Pro Gln Ile Thr
        195                 200                 205

Asp Glu Phe Ile Asn Ser Tyr Leu Gln Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240

Tyr Thr Thr Lys Lys Asp Ser Glu Asp Glu Tyr Ile Thr Leu Asp Asn
                245                 250                 255

Ile Phe Gly Ile Leu Ile Gly Lys Cys Thr Phe Tyr Pro Glu Glu Tyr
            260                 265                 270

Arg Ala Ala Lys Ala Ser Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn
        275                 280                 285

Asp Leu Asn Asn Leu Thr Val Pro Thr Glu Thr Lys Lys Leu Ser Glu
    290                 295                 300

Glu Gln Lys Asn Gln Ile Ile Thr Asn Val Lys Asn Glu Lys Ala Met
305                 310                 315                 320

Gly Pro Ala Lys Leu Phe Lys Tyr Ile Ala Lys Leu Leu Ser Cys Asp
                325                 330                 335

Val Ala Asp Ile Lys Gly Tyr Arg Ile Asp Lys Ser Asp Lys Ala Glu
            340                 345                 350
```

```
Ile His Thr Phe Glu Ala Tyr Arg Lys Met Lys Thr Leu Ala Thr Ile
        355                 360                 365

Asp Ile Glu Gln Met Glu Arg Glu Asn Leu Asp Lys Leu Ala Tyr Val
    370                 375                 380

Leu Thr Leu Asn Thr Glu Lys Glu Gly Ile Gln Glu Ala Leu Glu His
385                 390                 395                 400

Glu Phe Ala Asp Gly Thr Phe Ser Gln Glu Gln Ile Asp Glu Leu Val
                405                 410                 415

Gln Phe Arg Lys Ala Asn Ser Ser Ile Phe Gly Lys Gly Trp His Ser
            420                 425                 430

Phe Ser Val Lys Leu Met Met Glu Leu Ile Pro Glu Leu Tyr Ala Thr
        435                 440                 445

Ser Glu Glu Gln Met Thr Ile Leu Thr Arg Leu Gly Lys Gln Lys Thr
    450                 455                 460

Thr Ser Ser Ser Asn Lys Thr Lys Tyr Ile Asp Glu Lys Gln Leu Thr
465                 470                 475                 480

Glu Glu Ile Tyr Asn Pro Val Ala Ala Lys Ser Val Arg Gln Ala Ile
                485                 490                 495

Lys Ile Val Asn Ala Ala Ile Lys Glu Tyr Gly Asp Phe Asp Asn Ile
            500                 505                 510

Val Ile Glu Met Ala Arg Glu Thr Asn Glu Asp Asp Glu Lys Lys Ala
        515                 520                 525

Ile Gln Lys Ile Gln Lys Ala Asn Lys Asp Glu Lys Asp Ala Ala Met
    530                 535                 540
```

```
Leu Lys Ala Ala Asn Gln Tyr Asn Gly Lys Ala Glu Leu Pro His Ser
545                 550                 555                 560

Val Phe His Gly His Lys Gln Leu Ala Thr Lys Ile Arg Leu Trp His
                565                 570                 575

Gln Gln Gly Glu Arg Cys Leu Tyr Thr Gly Lys Thr Ile Ser Ile His
            580                 585                 590

Asp Leu Ile Asn Asn Ser Asn Gln Phe Glu Ile Asp His Ile Leu Pro
        595                 600                 605

Leu Ser Ile Thr Phe Asp Asp Ser Leu Ala Asn Lys Val Leu Val Tyr
    610                 615                 620

Ala Thr Ala Asn Gln Glu Lys Gly Gln Arg Thr Pro Tyr Gln Ala Leu
625                 630                 635                 640

Asp Ser Met Asp Asp Ala Trp Ser Phe Arg Glu Leu Lys Ala Phe Val
                645                 650                 655

Arg Asp Ser Lys Ala Leu Ser Asn Lys Lys Lys Glu Tyr Leu Leu Thr
            660                 665                 670

Glu Glu Asp Ile Ser Lys Phe Asp Val Arg Lys Lys Phe Ile Glu Arg
        675                 680                 685

Asn Leu Val Asp Thr Arg Tyr Ala Ser Arg Val Val Leu Asn Ala Leu
    690                 695                 700

Gln Glu His Phe Arg Val His Lys Thr Asp Thr Lys Val Ser Val Val
705                 710                 715                 720

Arg Gly Gln Phe Thr Ser Gln Leu Arg Arg His Trp Gly Ile Glu Lys
                725                 730                 735

Thr Arg Asp Thr Tyr His His His Ala Val Asp Ala Leu Ile Ile Ala
            740                 745                 750
```

```
Ala Ser Ser Gln Leu Asn Leu Trp Lys Lys Gln Lys Asn Thr Leu Val
        755                 760                 765

Ser Tyr Ser Glu Asp Gln Leu Leu Asp Ile Glu Thr Gly Glu Leu Ile
    770                 775                 780

Ser Asp Asp Glu Tyr Lys Glu Ser Val Phe Lys Ala Pro Tyr Gln His
785                 790                 795                 800

Phe Val Asp Thr Leu Lys Ser Lys Glu Phe Glu Asp Ser Ile Leu Phe
                805                 810                 815

Ser Tyr Gln Val Asp Ser Lys Phe Asn Arg Lys Ile Ser Asp Ala Thr
            820                 825                 830

Ile Tyr Ala Thr Arg Gln Ala Lys Val Gly Lys Asp Lys Lys Asp Glu
        835                 840                 845

Thr Tyr Val Leu Gly Lys Ile Lys Asp Ile Tyr Ser Gln Thr Gly Tyr
    850                 855                 860

Asp Ala Phe Ile Lys Ile Tyr Lys Lys Asp Lys Ser Lys Phe Leu Met
865                 870                 875                 880

Tyr Arg His Asp Pro Gln Thr Phe Glu Lys Val Ile Glu Pro Ile Leu
                885                 890                 895

Glu Asn Tyr Pro Asn Lys Glu Leu Asn Glu Lys Gly Lys Glu Val Pro
            900                 905                 910

Cys Asn Pro Phe Leu Lys Tyr Lys Glu Asp His Gly Tyr Ile Arg Lys
        915                 920                 925

Tyr Ser Lys Lys Gly Asn Gly Pro Glu Ile Lys Ser Leu Lys Tyr Tyr
    930                 935                 940
```

```
Asp Ser Lys Leu Gly Asn His Ile Asp Ile Thr Pro Lys Asn Ser Asn
945                 950                 955                 960


Asn Lys Val Val Leu Gln Ser Val Ser Pro Trp Arg Ala Asp Val Tyr
                965                 970                 975


Phe Asn Lys Thr Thr Gly Lys Tyr Glu Ile Leu Gly Leu Lys Tyr Ala
            980                 985                 990


Asp Leu Lys Phe Glu Lys Gly Thr  Gly Thr Tyr Lys Ile  Ser Glu Glu
        995                 1000                1005


Lys Tyr  Asn Asp Ile Lys Ile  Lys Glu Gly Val Asp  Ser Asp Ser
    1010                1015                1020


Glu Phe  Lys Phe Thr Leu Tyr  Lys Asn Asp Leu Leu  Leu Ile Lys
    1025                1030                1035


Asp Thr  Glu Thr Lys Glu Gln  Gln Leu Phe Arg Phe  Leu Ser Arg
    1040                1045                1050


Thr Met  Pro Asn Val Lys His  Tyr Val Glu Leu Lys  Pro Tyr Asp
    1055                1060                1065


Lys Gln  Lys Phe Asp Asp Asn  Glu Glu Leu Ile Lys  Ile Leu Gly
    1070                1075                1080


Ile Val  Ala Lys Gly Gly Gln  Cys Lys Lys Gly Val  Ser Lys Pro
    1085                1090                1095


Asn Ile  Ser Ile Tyr Lys Ile  Arg Thr Asp Val Leu  Gly Asn Gln
    1100                1105                1110


His Ile  Ile Lys Asn Glu Gly  Asp Lys Pro Lys Leu  Asp Phe
    1115                1120                1125


<210>  760
<211>  1385
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<212> PRT
<213> Streptococcus salivarius

<400> 760

Met Thr Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
20 25 30

Lys Val Leu Gly Asn Thr Ser Lys Lys Tyr Ile Lys Lys Asn Leu Leu
35 40 45

Gly Ala Leu Leu Phe Asp Ser Gly Ile Thr Ala Glu Gly Arg Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ser Thr Glu Met Ala Thr Leu Asp Asp Ala
85 90 95

Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Pro Asp Asp Lys Arg
100 105 110

Asp Ser Lys Tyr Pro Ile Phe Gly Asn Leu Val Glu Glu Lys Val Tyr
115 120 125

His Asp Glu Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
130 135 140

Ser Ser Lys Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145 150 155 160

Met Ile Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Asp Phe Asn Ser
165 170 175

Lys Asn Asn Asp Leu Gln Lys Asn Phe Gln Asp Phe Leu Asp Thr Tyr

```
            180                 185                 190

Asn Ala Ile Phe Glu Ser Asp Leu Ser Leu Glu Asn Ser Lys Gln Leu
        195                 200                 205

Glu Glu Ile Val Lys Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Ile Leu Lys Leu Phe Pro Gly Glu Lys Asn Ser Gly Ile Phe Ser Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Arg Lys Tyr Phe
                245                 250                 255

Asn Leu Asp Glu Lys Thr Ser Leu Gln Phe Ser Lys Glu Ser Tyr Asp
            260                 265                 270

Glu Asp Leu Glu Thr Leu Leu Gly His Ile Gly Asp Asp Tyr Ser Asp
        275                 280                 285

Val Phe Leu Lys Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Asn Gly Thr Glu Ala Pro Leu Ser Ser Ala
305                 310                 315                 320

Met Ile Met Arg Tyr Lys Glu His Glu Glu Asp Leu Ala Leu Leu Lys
                325                 330                 335

Ala Tyr Ile Arg Asn Ile Ser Leu Glu Thr Tyr Asn Glu Val Phe Lys
            340                 345                 350

Asp Asn Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Ser
        355                 360                 365

Gln Glu Asp Phe Tyr Val Tyr Leu Lys Arg Leu Leu Ala Gly Leu Glu
    370                 375                 380
```

```
Gly Ala Asp Tyr Phe Leu Glu Lys Ile Asp Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile Tyr Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Leu Asp Lys Gln Ala Lys Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Lys Asn Lys Glu Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Asp Phe Ala Trp
    450                 455                 460

Ser Ile Arg Lys Arg Asn Glu Lys Ile Thr Pro Trp Asn Phe Glu Asp
465                 470                 475                 480

Val Ile Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Ser Phe Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Asn Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Arg
        515                 520                 525

Phe Ile Ala Glu Gly Met Arg Asp Tyr Gln Phe Leu Asp Ser Lys Gln
    530                 535                 540

Lys Lys Asp Ile Val Arg Leu Tyr Phe Lys Gly Lys Arg Lys Val Thr
545                 550                 555                 560

Asp Lys Asp Ile Ile Glu Tyr Leu His Ala Ile Asp Gly Tyr Asp Gly
                565                 570                 575

Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ser Ser Leu Ser Thr
```

```
            580                 585                 590

Tyr His Asp Leu Leu Asn Ile Ile Asn Asp Lys Glu Phe Leu Asp Asp
        595                 600                 605

Ser Ser Asn Glu Thr Ile Ile Glu Glu Ile Ile His Thr Leu Thr Met
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ser Lys Phe Asp Asn
625                 630                 635                 640

Ile Phe Asp Lys Ser Val Leu Lys Lys Leu Ser Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asp Glu
            660                 665                 670

Lys Ser Gly Asn Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Val Ser
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ala Leu Ser Phe Lys
    690                 695                 700

Lys Lys Ile Lys Lys Ala Gln Ile Ile Gly Asp Lys Asp Asn Ile Lys
705                 710                 715                 720

Gln Val Val Lys Ser Leu Pro Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met Gly Arg
            740                 745                 750

Glu Pro Glu Ser Ile Val Val Glu Met Ala Arg Glu Asn Gln Tyr Thr
        755                 760                 765

Asn Gln Gly Lys Ser Asn Ser Gln Gln Arg Leu Lys Arg Leu Glu Glu
    770                 775                 780
```

```
Ser Leu Lys Gly Leu Gly Ser Lys Ile Leu Lys Glu Asn Val Pro Thr
785                 790                 795                 800

Arg Leu Ser Lys Ile Asp Asn Asn Ala Leu Gln Asn Asp Arg Leu Tyr
                805                 810                 815

Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Glu Glu Leu
            820                 825                 830

Asp Ile Asp Arg Leu Ser Asn Tyr Asp Ile Asp His Ile Ile Pro Gln
        835                 840                 845

Ala Phe Leu Lys Asp Asp Ser Ile Asp Asn Lys Val Leu Val Ser Ser
    850                 855                 860

Ala Ser Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Val Val
865                 870                 875                 880

Lys Lys Arg Lys Thr Leu Trp Tyr Gln Leu Leu Lys Ser Lys Leu Ile
                885                 890                 895

Ser Gln Arg Lys Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu
            900                 905                 910

Ser Gln Glu Glu Lys Ala Gly Phe Ile Gln Arg Gln Leu Val Glu Thr
        915                 920                 925

Arg Gln Ile Thr Lys His Val Ala Arg Leu Leu Asp Glu Arg Phe Asn
    930                 935                 940

Asn Lys Lys Asp Glu Asn Asn Arg Thr Leu Arg Thr Val Lys Ile Ile
945                 950                 955                 960

Thr Leu Lys Ser Ser Leu Val Ser Gln Phe Arg Lys Asp Phe Glu Leu
                965                 970                 975

Tyr Lys Val Arg Glu Ile Asn Asp Phe His His Ala His Asp Ala Tyr
```

```
           980                 985                 990

Leu Asn Ala Val Val Ala Ser Ala  Leu Leu Lys Lys Tyr  Pro Lys Leu
        995                 1000                1005

Glu Pro  Glu Phe Val Tyr Gly  Asp Tyr Pro Lys Tyr  Asn Ser Phe
    1010                1015                1020

Arg Glu  Arg Lys Ser Ala Thr  Glu Lys Val Tyr Phe  Tyr Ser Asn
    1025                1030                1035

Ile Met  Asn Ile Phe Lys Lys  Ser Ile Pro Leu Ala  Asp Gly Thr
    1040                1045                1050

Val Ile  Asp Arg Pro Leu Ile  Glu Val Asn Glu Glu  Thr Gly Glu
    1055                1060                1065

Ser Val  Trp Asn Lys Val Ala  Asp Leu Asn Thr Val  Arg Lys Val
    1070                1075                1080

Leu Ser  Tyr Ser Gln Val Asn  Ile Val Lys Lys Val  Glu Glu Gln
    1085                1090                1095

Asn His  Gly Leu Asp Arg Gly  Lys Pro Lys Gly Leu  Phe Asn Ala
    1100                1105                1110

Asn Leu  Ser Ser Lys Pro Lys  Pro Asn Ser Lys Glu  Asn Leu Val
    1115                1120                1125

Gly Ala  Lys Glu Tyr Leu Asp  Pro Lys Lys Tyr Gly  Gly Tyr Ala
    1130                1135                1140

Gly Ile  Ser Asn Ser Phe Ala  Ile Leu Val Lys Gly  Thr Ile Glu
    1145                1150                1155

Lys Gly  Ala Lys Lys Lys Ile  Thr Asn Val Leu Glu  Phe Gln Gly
    1160                1165                1170
```

```
Ile Ser  Ile Leu Asp Arg Ile  Tyr Tyr Arg Lys Asp  Lys Leu Asn
    1175                1180                1185

Phe Leu  Leu Glu Lys Gly Tyr  Lys Asp Ile Glu Leu  Ile Ile Glu
    1190                1195                1200

Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Ser Asp Gly  Ser Arg Arg
    1205                1210                1215

Met Leu  Ala Ser Ile Leu Ser  Thr Asn Asn Lys Arg  Gly Glu Ile
    1220                1225                1230

His Lys  Gly Asn Gln Ile Phe  Ile Ser Gln Lys Phe  Val Lys Leu
    1235                1240                1245

Leu Tyr  His Ala Lys Arg Ile  Ser Ser Thr Phe Asn  Glu Asn His
    1250                1255                1260

Arg Lys  Tyr Val Glu Asn His  Lys Lys Glu Phe Glu  Glu Leu Phe
    1265                1270                1275

Tyr Tyr  Ile Leu Glu Phe Asn  Glu Asn Tyr Val Gly  Ala Lys Lys
    1280                1285                1290

Asn Gly  Glu Leu Leu Lys Ser  Ala Phe Gln Ser Trp  Gln Asn His
    1295                1300                1305

Ser Ile  Asp Glu Leu Cys Ser  Ser Phe Ile Gly Pro  Thr Gly Ser
    1310                1315                1320

Glu Arg  Lys Gly Leu Phe Glu  Leu Thr Ser Arg Gly  Gly Ala Ala
    1325                1330                1335

Asp Phe  Glu Phe Leu Gly Val  Lys Ile Pro Arg Tyr  Arg Asp Tyr
    1340                1345                1350

Thr Pro  Ser Ser Leu Leu Lys  Asp Ala Thr Leu Ile  His Gln Ser
```

```
    1355                1360                1365

Val Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly
    1370                1375                1380

Glu Asp
    1385
```

<210> 761
<211> 1392
<212> PRT
<213> Streptococcus sanguinis

<400> 761

```
Met Glu Asn Lys Asn Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser
1               5                   10                  15

Val Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys
            20                  25                  30

Met Lys Val Phe Gly Asn Thr Asp Lys His Phe Ile Lys Lys Asn Leu
        35                  40                  45

Ile Gly Ala Leu Leu Phe Asp Glu Gly Ala Thr Ala Glu Asp Arg Arg
    50                  55                  60

Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu
65                  70                  75                  80

Arg Tyr Leu Gln Glu Ile Phe Ser Glu Glu Ile Ser Lys Leu Asp Ser
                85                  90                  95

Ser Phe Phe His Arg Leu Asp Asp Ser Phe Leu Val Pro Lys Asp Lys
            100                 105                 110

Arg Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Glu Glu Glu Lys Glu
        115                 120                 125
```

```
Tyr His Lys Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala
    130                 135                 140

Asp Ser Lys Glu Lys Thr Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala
145                 150                 155                 160

His Met Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Glu Ser Phe Asp
                165                 170                 175

Ile Lys Asn Asn Asp Ile Gln Lys Ile Phe Asn Glu Phe Ile Ser Ile
            180                 185                 190

Tyr Asp Asn Thr Phe Glu Gly Ser Ser Leu Ser Gly Gln Asn Ala Gln
        195                 200                 205

Val Glu Ala Ile Phe Thr Asp Lys Ile Ser Lys Ser Ala Lys Arg Glu
    210                 215                 220

Arg Val Leu Lys Leu Phe Ser Asp Glu Lys Ser Thr Ser Leu Phe Ser
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asp Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Gly Phe Thr
        275                 280                 285

Asp Leu Phe Leu Val Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Pro Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Glu Arg Tyr Glu Ser His Gln Lys Asp Leu Ala Ala Leu
                325                 330                 335
```

```
Lys Gln Phe Ile Lys Asn Asn Leu Pro Lys Arg Tyr Asn Glu Val Phe
            340                 345                 350

Ser Asp Gln Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr
        355                 360                 365

Thr Gln Glu Ala Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Phe
    370                 375                 380

Glu Gly Ala Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His
                405                 410                 415

Leu Gln Glu Met Asn Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Arg Asp Phe Ala
    450                 455                 460

Trp Leu Thr Arg Asn Ser Asp Gln Ala Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Glu Ile Val Asp Lys Ala Ser Ser Ala Glu Glu Phe Ile Asn Lys Met
                485                 490                 495

Thr Asn Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525
```

```
Lys Phe Ile Ala Glu Gly Leu Arg Asp Tyr Gln Phe Leu Asp Ser Gly
    530                 535                 540

Gln Lys Lys Gln Ile Val Asn Gln Leu Phe Lys Glu Lys Arg Lys Val
545                 550                 555                 560

Thr Glu Lys Asp Ile Ile His Tyr Leu His Asn Val Asp Gly Tyr Asp
                565                 570                 575

Gly Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Glu Phe Met Asp
        595                 600                 605

Asp Pro Lys Asn Glu Glu Ile Leu Glu Asn Ile Val His Thr Leu Thr
    610                 615                 620

Ile Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln Tyr Asp
625                 630                 635                 640

Ser Ile Phe Asp Glu Lys Val Ile Lys Ala Leu Thr Arg Arg His Tyr
                645                 650                 655

Thr Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Cys Asp
            660                 665                 670

Lys Gln Thr Gly Asp Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Lys
        675                 680                 685

Ile Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu Ser Phe
    690                 695                 700

Lys Glu Ile Ile Gln Lys Ala Gln Val Val Gly Lys Thr Asp Asp Val
705                 710                 715                 720

Lys Gln Val Val Gln Glu Leu Pro Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735
```

```
Ile Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

Tyr Ala Pro Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
        755                 760                 765

Thr Ala Arg Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile Glu
    770                 775                 780

Asp Ser Leu Lys Asn Leu Ala Pro Gly Leu Asp Ser Asn Ile Leu Lys
785                 790                 795                 800

Glu Asn Pro Thr Asp Asn Ile Gln Leu Gln Asn Asp Arg Leu Phe Leu
                805                 810                 815

Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Lys Pro Leu Asp
            820                 825                 830

Ile Asp Gln Leu Ser Ser Tyr Asp Ile Asp His Ile Ile Pro Gln Ala
        835                 840                 845

Phe Ile Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys
    850                 855                 860

Asp Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Leu Glu Val Val Gln
865                 870                 875                 880

Lys Arg Lys Ala Phe Trp Gln Gln Leu Leu Asp Ser Lys Leu Ile Ser
                885                 890                 895

Glu Arg Lys Phe Asn Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Asp
            900                 905                 910

Glu Arg Asp Lys Val Gly Phe Ile Arg Arg Gln Leu Val Glu Thr Arg
        915                 920                 925
```

```
Gln Ile Thr Lys His Val Ala Gln Ile Leu Asp Ala Ser Phe Asn Thr
    930                 935                 940

Glu Val Asn Glu Lys Asn Gln Lys Ile Arg Thr Val Lys Ile Ile Thr
945                 950                 955                 960

Leu Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr
                965                 970                 975

Lys Val Arg Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu
            980                 985                 990

Asn Ala Val Val Ala Lys Ala Ile  Leu Lys Lys Tyr Pro  Lys Leu Glu
        995                 1000                1005

Pro Glu  Phe Val Tyr Gly Asp  Tyr Gln Lys Tyr Asp  Leu Lys Arg
    1010                1015                1020

Tyr Ile  Ser Arg Phe Lys Pro  Ser Lys Glu Ile Glu  Lys Ala Thr
    1025                1030                1035

Glu Lys  Tyr Phe Phe Tyr Ser  Asn Leu Leu Asn Phe  Phe Lys Glu
    1040                1045                1050

Glu Val  His Tyr Ala Asp Gly  Ile Ile Val Lys Arg  Glu Asn Ile
    1055                1060                1065

Glu Tyr  Ser Lys Asp Thr Gly  Glu Ile Ala Trp Asn  Lys Glu Lys
    1070                1075                1080

Asp Phe  Ala Thr Ile Lys Lys  Val Leu Ser Tyr Pro  Gln Val Asn
    1085                1090                1095

Ile Val  Lys Lys Thr Glu Ile  Gln Thr His Gly Leu  Asp Arg Gly
    1100                1105                1110

Lys Pro  Lys Gly Leu Phe Asn  Ser Asn Pro Ser Pro  Lys Pro Ser
    1115                1120                1125
```

```
Glu Asp  Ser Lys Glu Asn Leu  Val Pro Ile Lys Gln  Gly Leu Asp
    1130                1135                1140

Pro Arg  Lys Tyr Gly Gly Tyr  Ala Gly Ile Ser Asn  Ser Tyr Ala
    1145                1150                1155

Val Leu  Val Lys Ala Ile Val  Glu Lys Gly Ala Lys  Lys Gln Gln
    1160                1165                1170

Lys Thr  Ile Leu Glu Phe Gln  Gly Ile Ser Ile Leu  Asp Lys Ile
    1175                1180                1185

Asn Phe  Glu Asn Asn Lys Glu  Asn Tyr Leu Leu Lys  Lys Arg Tyr
    1190                1195                1200

Ile Glu  Ile Leu Ser Thr Ile  Thr Leu Pro Lys Tyr  Ser Leu Phe
    1205                1210                1215

Glu Phe  Pro Asp Gly Thr Arg  Arg Arg Leu Ala Ser  Ile Leu Ser
    1220                1225                1230

Thr Asn  Asn Lys Arg Gly Glu  Ile His Lys Gly Asn  Glu Leu Val
    1235                1240                1245

Leu Pro  Gly Lys Tyr Thr Thr  Leu Leu Tyr His Ala  Lys Asn Ile
    1250                1255                1260

Asn Lys  Lys Leu Glu Pro Glu  His Leu Glu Tyr Val  Glu Lys His
    1265                1270                1275

Arg Asn  Asp Phe Ala Lys Leu  Leu Glu Cys Val Leu  Asn Phe Asn
    1280                1285                1290

Asp Lys  Tyr Val Gly Ala Leu  Lys Asn Gly Glu Arg  Ile Arg Gln
    1295                1300                1305
```

```
Ala Phe  Thr Asp Trp Glu Thr  Val Asp Ile Glu Lys  Leu Cys Phe
    1310                1315                1320


Ser Phe  Ile Gly Pro Glu Asn  Ser Lys Asn Ala Gly  Leu Phe Glu
    1325                1330                1335


Leu Thr  Ser Gln Gly Ser Ala  Ser Asp Phe Glu Phe  Leu Gly Val
    1340                1345                1350


Lys Ile  Pro Arg Tyr Arg Asp  Tyr Ala Pro Ser Ser  Leu Leu Lys
    1355                1360                1365


Ala Thr  Leu Ile His Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg
    1370                1375                1380


Ile Asp  Leu Ser Lys Leu Gly  Glu Asp
    1385                1390


<210>  762
<211>  1377
<212>  PRT
<213>  Streptococcus sanguinis

<400>  762

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys His Phe Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Glu Gly Thr Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ser Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65                  70                  75                  80
```

```
Tyr Leu Gln Glu Ile Phe Ser Glu Glu Ile Ser Lys Leu Asp Ser Ser
                85                  90                  95

Phe Phe His Arg Leu Asp Asp Ser Phe Leu Val Pro Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Glu Glu Glu Lys Glu Tyr
        115                 120                 125

His Lys Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140

Ser Lys Glu Lys Thr Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Glu Ser Phe Asp Ile
                165                 170                 175

Lys Asn Asn Asp Ile Gln Lys Ile Phe Asn Glu Phe Ile Ser Ile Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Gly Ser Ser Leu Ser Gly Gln Asn Ala Gln Val
        195                 200                 205

Glu Ala Ile Phe Thr Asp Lys Ile Ser Lys Ser Thr Lys Arg Glu Arg
    210                 215                 220

Val Leu Lys Leu Phe Ser Asp Glu Lys Ser Thr Gly Leu Phe Ser Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Asp Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Gly Phe Ala Asp
```

```
        275                 280                 285

Leu Phe Leu Val Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Pro Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Glu Arg Tyr Glu Asn His Gln Glu Asp Leu Ala Ala Leu Lys
                325                 330                 335

Gln Phe Ile Lys Asn Asn Leu Ser Glu Lys Tyr Ala Glu Val Phe Ser
            340                 345                 350

Asp Gln Ser Lys Asp Gly Tyr Ala Gly Phe Ile Asp Gly Lys Thr Thr
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Leu Glu
    370                 375                 380

Gly Ala Asp Tyr Phe Leu Asn Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Asn Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Leu Phe
            420                 425                 430

Leu Lys Glu Asn Arg Glu Lys Ile Glu Lys Ile Leu Ala Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Arg Asp Phe Ala Trp
    450                 455                 460

Leu Thr Arg Asn Ser Asp Gln Ala Ile Arg Pro Trp Asn Phe Glu Glu
465                 470                 475                 480
```

```
Val Val Asp Lys Ala Ser Ser Ala Glu Asp Phe Ile Asn Lys Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Phe Ile Ala Glu Gly Leu Arg Asp Tyr Gln Phe Leu Asp Ser Gly Gln
    530                 535                 540

Lys Lys Gln Ile Val Asn Gln Leu Phe Lys Asp Lys Arg Lys Val Thr
545                 550                 555                 560

Glu Lys Asp Ile Ile His Tyr Leu His Asn Val Asp Gly Tyr Asp Gly
                565                 570                 575

Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Glu Phe Met Asp Asn
        595                 600                 605

Pro Lys Asn Gly Glu Ile Leu Glu Asn Ile Ile His Thr Leu Thr Ile
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln Tyr Asp Thr
625                 630                 635                 640

Leu Phe Asp Glu Lys Val Ile Lys Ala Leu Thr Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Thr Gly Lys Thr Ile Leu Glu Tyr Leu Ile Asp Asp Gly Asp Cys
```

```
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu Ser Phe Lys
    690                 695                 700

Glu Ile Ile Gln Lys Ala Gln Val Val Gly Lys Thr Asp Asp Val Lys
705                 710                 715                 720

Gln Val Val Gln Glu Ile Pro Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met Gly His
            740                 745                 750

Asn Pro Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Ala Lys Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile Glu Asp
    770                 775                 780

Ala Leu Lys Asn Leu Ala Pro Gly Leu Asp Ser Asn Ile Leu Lys Glu
785                 790                 795                 800

Asn Pro Thr Asp Asn Ile Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr
                805                 810                 815

Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Lys Ala Ile Asp Ile
            820                 825                 830

Asn Gln Leu Ser Asn Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe
        835                 840                 845

Ile Lys Asp Asp Ser Leu Asp Asn Arg Val Leu Thr Ser Ser Lys Asp
    850                 855                 860

Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Ile Glu Val Val Gln Lys
865                 870                 875                 880
```

```
Arg Lys Ala Phe Trp Gln Gln Leu Leu Asp Ser Lys Leu Ile Ser Glu
               885                 890                 895


Arg Lys Phe Asn Asn Leu Thr Lys Ala Lys Arg Gly Gly Leu Asp Glu
            900                 905                 910


Arg Asp Lys Val Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln
        915                 920                 925


Ile Thr Lys His Val Ala Gln Leu Leu Asp Thr Arg Phe Asn Thr Glu
    930                 935                 940


Val Asn Glu Glu Asn Gln Lys Ile Arg Thr Val Lys Ile Ile Thr Leu
945                 950                 955                 960


Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Leu Tyr Lys
               965                 970                 975


Val Arg Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn
            980                 985                 990


Ala Val Val Ala Lys Ala Ile Leu  Lys Lys Tyr Pro Lys  Leu Glu Pro
        995                 1000                1005


Glu Phe  Val Tyr Gly Asp Tyr  Gln Lys Tyr Asp Leu  Lys Arg Tyr
    1010                1015                1020


Ile Leu  Lys Ser Lys Ala Ser  Asn Thr Ile Asp Lys  Ala Thr Glu
    1025                1030                1035


Lys Tyr  Phe Phe Tyr Ser Asn  Leu Leu Asn Phe Phe  Lys Glu Lys
    1040                1045                1050


Val Arg  Tyr Ala Asp Gly Thr  Ile Lys Lys Arg Glu  Asn Ile Glu
    1055                1060                1065


Tyr Ser  Asn Asp Thr Gly Glu  Ile Ala Trp Asn Lys  Glu Lys Asp
```

```
    1070                1075                1080

Phe Ala  Thr Ile Lys Lys Val  Leu Ser Leu Pro Gln  Val Asn Ile
    1085                1090                1095

Val Lys  Lys Thr Glu Glu Gln  Thr Val Gly Gln Asn  Gly Gly Leu
    1100                1105                1110

Phe Asp  Asn Asn Ile Val Ser  Lys Lys Lys Val Val  Asp Ala Ser
    1115                1120                1125

Lys Leu  Ile Pro Ile Lys Ser  Ser Leu Ser Pro Glu  Lys Tyr Gly
    1130                1135                1140

Gly Tyr  Ala Arg Pro Thr Ile  Ala Tyr Ser Val Leu  Val Ile Ala
    1145                1150                1155

Asp Ile  Glu Lys Gly Lys Gly  Lys Ala Lys Lys Leu  Lys Arg Ile
    1160                1165                1170

Lys Glu  Ile Val Gly Ile Thr  Ile Gln Asp Lys Lys  Lys Phe Glu
    1175                1180                1185

Ser Asn  Pro Val Thr Tyr Leu  Glu Glu Cys Gly Tyr  Lys Asn Ile
    1190                1195                1200

Asn Ser  Asn Leu Ile Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu
    1205                1210                1215

Phe Asn  Asp Gly Gln Arg Arg  Leu Leu Ala Ser Ser  Ile Glu Leu
    1220                1225                1230

Gln Lys  Gly Asn Glu Leu Ile  Leu Pro Tyr His Leu  Thr Ala Leu
    1235                1240                1245

Leu Tyr  His Ala Gln Arg Ile  Asn Lys Ile Ser Glu  Pro Ile His
    1250                1255                1260
```

```
Lys Gln  Tyr Val Glu Ala His  Gln Asn Glu Phe Lys  Glu Leu Leu
    1265                 1270                 1275


Thr Thr  Ile Ile Ser Leu Ser  Lys Lys Tyr Ile Gln  Lys Pro Asn
    1280                 1285                 1290


Val Glu  Leu Leu Leu Gln Gln  Ala Phe Asp Gln Ala  Asp Lys Asp
    1295                 1300                 1305


Ile Tyr  Gln Leu Ser Glu Ser  Phe Ile Ser Leu Leu  Lys Leu Thr
    1310                 1315                 1320


Ser Phe  Gly Ala Pro Gly Ala  Phe Lys Phe Leu Gly  Val Glu Ile
    1325                 1330                 1335


Ser Gln  Ser Ser Val Arg Tyr  Lys Pro Asn Ser Gln  Phe Leu Asp
    1340                 1345                 1350


Thr Thr  Leu Ile His Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg
    1355                 1360                 1365


Ile Asp  Leu Ser Lys Leu Gly  Glu Asp
    1370                 1375


<210>  763
<211>  1370
<212>  PRT
<213>  Streptococcus sanguinis

<400>  763

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Phe Gly Asp Thr Asp Arg Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45
```

```
Gly Thr Leu Leu Phe Asp Asp Gly Asn Thr Ala Glu Ser Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Thr Glu Ser Met Asn Glu Ile Asp Glu Ser
                85                  90                  95

Phe Phe His Arg Leu Asp Asp Ser Phe Leu Val Pro Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Glu Tyr
        115                 120                 125

His Lys Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Gln Leu Ala Asp
    130                 135                 140

Ser Lys Glu Lys Ser Asp Val Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Glu Thr Phe Asp Ile
                165                 170                 175

Lys Asn Asn Asp Ile Gln Lys Ile Phe Asn Glu Phe Ile Asn Ile Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Gly Ser Ser Leu Ser Gly Gln Asn Ala Gln Val
        195                 200                 205

Glu Ala Ile Phe Thr Asp Lys Ile Ser Lys Ser Ala Lys Arg Glu Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asp Glu Lys Ser Thr Gly Leu Phe Ser Glu
225                 230                 235                 240
```

```
Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Asp Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Glu Glu Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Asp Phe Ala Asp
        275                 280                 285

Leu Phe Leu Ile Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Pro Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Glu Arg Tyr Glu Asn His Gln Lys Asp Leu Ala Ala Leu Lys
                325                 330                 335

Gln Phe Ile Lys Asn Asn Leu Pro Glu Lys Tyr Val Glu Val Phe Ser
            340                 345                 350

Asp Gln Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Thr
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Phe Glu
    370                 375                 380

Gly Ala Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Asn Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445
```

```
Pro Tyr Tyr Val Gly Pro Leu Ala Arg Asp Asn Arg Asp Phe Ser Trp
    450                 455                 460

Leu Thr Arg Asn Ser Asp Glu Pro Ile Arg Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Ala Arg Ser Ala Glu Asp Phe Ile His Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Phe Ile Ala Glu Gly Leu Arg Asp Tyr Gln Phe Leu Asp Ser Gly Gln
    530                 535                 540

Lys Lys Gln Ile Val Asn Gln Leu Phe Lys Glu Lys Arg Lys Val Thr
545                 550                 555                 560

Glu Lys Asp Ile Ile His Tyr Leu His Asn Val Asp Gly Tyr Asp Gly
                565                 570                 575

Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Asn Leu Ser Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Thr Lys Asp Lys Glu Phe Met Asp Asp
        595                 600                 605

Pro Lys Asn Glu Glu Ile Leu Glu Asn Ile Val His Thr Leu Thr Ile
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln Tyr Asp Thr
625                 630                 635                 640
```

```
Leu Phe Asp Glu Lys Val Ile Lys Ala Leu Thr Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Asp Lys Ile
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu Ser Phe Lys
    690                 695                 700

Glu Ile Ile Gln Lys Ala Gln Val Val Gly Lys Thr Asp Asp Val Lys
705                 710                 715                 720

Gln Val Val Gln Glu Leu Pro Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met Gly Tyr
            740                 745                 750

Ala Leu Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Ala Arg Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile Glu Asp
    770                 775                 780

Ala Leu Lys Asn Leu Ala Pro Gly Leu Asp Ser Asn Ile Leu Lys Glu
785                 790                 795                 800

Asn Pro Thr Asp Asn Ile Gln Leu Lys Asn Asp Arg Leu Phe Leu Tyr
                805                 810                 815

Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Lys Pro Leu Asp Ile
            820                 825                 830

Asn Gln Leu Ser Ser Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe
        835                 840                 845
```

```
Ile Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Asp
    850                 855                 860

Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Leu Glu Val Val Gln Lys
865                 870                 875                 880

Arg Lys Ala Phe Trp Gln Gln Leu Leu Asp Ser Lys Leu Ile Ser Glu
                885                 890                 895

Arg Lys Phe Asn Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Asp Glu
            900                 905                 910

Arg Asp Lys Val Gly Phe Ile Arg Arg Gln Leu Val Glu Thr Gln Gln
        915                 920                 925

Ile Thr Lys Asn Val Ala Gln Ile Leu Asp Ala Arg Phe Asn Thr Glu
    930                 935                 940

Val Lys Glu Lys Asn Gln Lys Ile Arg Thr Val Lys Ile Ile Thr Leu
945                 950                 955                 960

Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Leu Tyr Lys
                965                 970                 975

Val Arg Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn
            980                 985                 990

Ala Val Val Ala Lys Ala Ile Leu  Lys Lys Tyr Pro Lys  Leu Glu Pro
        995                 1000                1005

Glu Phe  Val Tyr Gly Asp Tyr  Gln Lys Tyr Asp Leu  Lys Lys Tyr
    1010                1015                1020

Ile Ser  Arg Phe Lys Pro Ser  Lys Glu Ile Glu Lys  Ala Thr Glu
    1025                1030                1035
```

```
Lys Tyr  Phe Phe Tyr Ser Asn  Leu Leu Asn Phe Phe  Lys Glu Glu
    1040                1045                1050

Val Leu  Tyr Ala Asp Gly Thr  Ile Arg Lys Arg Glu  Asn Ile Glu
    1055                1060                1065

Tyr Ser  Lys Asp Thr Gly Glu  Ile Ala Trp Asp Lys  Glu Lys Asp
    1070                1075                1080

Phe Ala  Thr Ile Lys Lys Val  Leu Ser Tyr Pro Gln  Val Asn Ile
    1085                1090                1095

Val Lys  Lys Arg Glu Val Gln  Thr Gly Gly Phe Ser  Lys Glu Ser
    1100                1105                1110

Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu Ile Pro  Arg Lys Thr
    1115                1120                1125

Lys Asp  Ile Leu Trp Asp Thr  Thr Lys Tyr Gly Gly  Phe Asp Ser
    1130                1135                1140

Pro Val  Ile Ala Tyr Ser Ile  Leu Leu Ile Ala Asp  Ile Glu Lys
    1145                1150                1155

Gly Lys  Ala Lys Lys Leu Lys  Thr Val Lys Thr Leu  Val Gly Ile
    1160                1165                1170

Thr Ile  Met Glu Lys Ala Ala  Phe Glu Glu Asn Pro  Ile Thr Phe
    1175                1180                1185

Leu Glu  Asn Lys Gly Tyr His  Asn Val Arg Lys Glu  Asn Ile Leu
    1190                1195                1200

Cys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Arg
    1205                1210                1215

Arg Leu  Leu Ala Ser Ala Lys  Glu Leu Gln Lys Gly  Asn Glu Ile
    1220                1225                1230
```

```
Val Leu  Pro Val Cys Leu Thr  Thr Leu Leu Tyr His  Ser Lys Asn
    1235                1240                1245


Leu His  Lys Leu Asp Glu Pro  Glu His Leu Glu Tyr  Ile Gln Lys
    1250                1255                1260


His Arg  Asn Glu Phe Lys Asp  Leu Leu Asn Leu Val  Ser Glu Phe
    1265                1270                1275


Ser Gln  Lys Tyr Ile Leu Ala  Glu Ala Asn Leu Glu  Lys Ile Lys
    1280                1285                1290


Asp Leu  Tyr Ala Asp Asn Glu  Gln Ala Asp Ile Glu  Ile Leu Ala
    1295                1300                1305


Asn Ser  Phe Ile Asn Leu Leu  Thr Phe Thr Ala Leu  Gly Ala Pro
    1310                1315                1320


Ala Ala  Phe Lys Phe Phe Gly  Lys Asp Val Asp Arg  Lys Arg Tyr
    1325                1330                1335


Thr Thr  Val Ser Glu Ile Leu  Asn Ala Thr Leu Ile  His Gln Ser
    1340                1345                1350


Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Lys Leu Gly
    1355                1360                1365


Glu Glu
    1370
```

<210> 764
<211> 1421
<212> PRT
<213> Streptococcus sanguinis

<400> 764

```
Met Thr Lys Phe Asn Lys Asn Tyr Ser Ile Gly Leu Asp Ile Gly Val
```

```
1               5                   10                  15

Ser Ser Val Gly Tyr Ala Val Val Thr Glu Asp Tyr Arg Val Pro Ala
            20                  25                  30

Phe Lys Phe Lys Val Leu Gly Asn Thr Glu Lys Glu Lys Ile Lys Lys
        35                  40                  45

Asn Leu Ile Gly Ser Thr Thr Phe Val Ser Ala Gln Pro Ala Lys Gly
    50                  55                  60

Thr Arg Val Phe Arg Val Asn Arg Arg Arg Ile Asp Arg Arg Asn His
65                  70                  75                  80

Arg Ile Thr Tyr Leu Arg Asp Ile Phe Gln Lys Glu Ile Glu Lys Val
                85                  90                  95

Asp Lys Asn Phe Tyr Arg Arg Leu Asp Glu Ser Phe Arg Val Leu Gly
            100                 105                 110

Asp Lys Ser Glu Asp Leu Gln Ile Lys Gln Pro Phe Phe Gly Asp Lys
        115                 120                 125

Glu Leu Glu Thr Ala Tyr His Lys Lys Tyr Pro Thr Ile Tyr His Leu
    130                 135                 140

Arg Lys His Leu Ala Asp Ala Asp Lys Asn Ser Pro Val Ala Asp Ile
145                 150                 155                 160

Arg Glu Val Tyr Met Ala Ile Ser His Ile Leu Lys Tyr Arg Gly His
                165                 170                 175

Phe Leu Thr Leu Asp Lys Ile Asn Pro Asn Asn Ile Asn Met Gln Asn
            180                 185                 190

Ser Trp Ile Asp Phe Ile Glu Ser Cys Gln Glu Val Phe Asp Leu Glu
        195                 200                 205
```

```
Ile Ser Asp Glu Ser Lys Asn Ile Ala Asp Ile Phe Lys Ser Ser Glu
    210                 215                 220

Asn Arg Gln Glu Lys Val Lys Lys Ile Leu Pro Tyr Phe Gln Gln Glu
225                 230                 235                 240

Leu Leu Lys Lys Asp Lys Ser Ile Phe Lys Gln Leu Leu Gln Leu Leu
                245                 250                 255

Phe Gly Leu Lys Thr Lys Phe Lys Asp Cys Phe Glu Leu Glu Glu Glu
            260                 265                 270

Pro Asp Leu Asn Phe Ser Lys Glu Asn Tyr Asp Glu Asn Leu Glu Asn
        275                 280                 285

Phe Leu Gly Ser Leu Glu Glu Asp Phe Ser Asp Val Phe Ala Lys Leu
    290                 295                 300

Lys Val Leu Arg Asp Thr Ile Leu Leu Ser Gly Met Leu Thr Tyr Thr
305                 310                 315                 320

Gly Ala Thr His Ala Arg Phe Ser Ala Thr Met Val Glu Arg Tyr Glu
                325                 330                 335

Glu His Arg Lys Asp Leu Gln Arg Phe Lys Phe Phe Ile Lys Gln Asn
            340                 345                 350

Leu Ser Glu Gln Asp Tyr Leu Asp Ile Phe Gly Arg Lys Thr Gln Asn
        355                 360                 365

Gly Phe Asp Val Asp Lys Glu Thr Lys Gly Tyr Val Gly Tyr Ile Thr
    370                 375                 380

Asn Lys Met Val Leu Thr Asn Pro Gln Lys Gln Lys Thr Ile Gln Gln
385                 390                 395                 400

Asn Phe Tyr Asp Tyr Ile Ser Gly Lys Ile Thr Gly Ile Glu Gly Ala
```

```
                405                 410                 415

Glu Tyr Phe Leu Asn Lys Ile Ser Asp Gly Thr Phe Leu Arg Lys Leu
            420                 425                 430

Arg Thr Ser Asp Asn Gly Ala Ile Pro Asn Gln Ile His Ala Tyr Glu
        435                 440                 445

Leu Glu Lys Ile Ile Glu Arg Gln Gly Lys Asp Tyr Pro Phe Leu Leu
    450                 455                 460

Glu Asn Lys Asp Lys Leu Leu Ser Ile Leu Thr Phe Lys Ile Pro Tyr
465                 470                 475                 480

Tyr Val Gly Pro Leu Ala Lys Gly Ser Asn Ser Arg Phe Ala Trp Ile
                485                 490                 495

Lys Arg Ala Thr Ser Ser Asp Ile Leu Asp Asp Asn Asp Glu Asp Thr
            500                 505                 510

Arg Asn Gly Lys Ile Arg Pro Trp Asn Tyr Gln Lys Leu Ile Asn Met
        515                 520                 525

Asp Glu Thr Arg Asp Ala Phe Ile Thr Asn Leu Ile Gly Asn Asp Ile
    530                 535                 540

Ile Leu Leu Asn Glu Lys Val Leu Pro Lys Arg Ser Leu Ile Tyr Glu
545                 550                 555                 560

Glu Val Met Leu Gln Asn Glu Leu Thr Arg Val Lys Tyr Lys Asp Lys
                565                 570                 575

Tyr Gly Lys Ala His Phe Phe Asp Ser Glu Leu Arg Gln Asn Ile Ile
            580                 585                 590

Asn Gly Leu Phe Lys Asn Asn Ser Lys Arg Val Asn Ala Lys Ser Leu
        595                 600                 605
```

```
Ile Lys Tyr Leu Ser Asp Asn His Lys Asp Leu Asn Ala Ile Glu Ile
    610                 615                 620

Val Ser Gly Val Glu Lys Gly Lys Ser Phe Asn Ser Thr Leu Lys Thr
625                 630                 635                 640

Tyr Asn Asp Leu Lys Thr Ile Phe Ser Glu Glu Leu Leu Asp Ser Glu
                645                 650                 655

Ile Tyr Gln Lys Glu Leu Glu Glu Ile Ile Lys Val Ile Thr Val Phe
            660                 665                 670

Asp Asp Lys Lys Ser Ile Lys Asn Tyr Leu Thr Lys Phe Phe Gly His
        675                 680                 685

Leu Glu Ile Leu Asp Glu Glu Lys Ile Asn Gln Leu Ser Lys Leu Arg
    690                 695                 700

Tyr Ser Gly Trp Gly Arg Tyr Ser Ala Lys Leu Leu Leu Asp Ile Arg
705                 710                 715                 720

Asp Glu Asp Thr Gly Phe Asn Leu Leu Gln Phe Leu Arg Asn Asp Glu
                725                 730                 735

Glu Asn Arg Asn Leu Thr Lys Leu Ile Ser Asp Asn Thr Leu Ser Phe
            740                 745                 750

Glu Pro Lys Ile Lys Asp Ile Gln Ser Lys Ser Thr Ile Glu Asp Asp
        755                 760                 765

Ile Phe Asp Glu Ile Lys Lys Leu Ala Gly Ser Pro Ala Ile Lys Arg
    770                 775                 780

Gly Ile Leu Asn Ser Ile Lys Ile Val Asp Glu Leu Val Gln Ile Ile
785                 790                 795                 800

Gly Tyr Pro Pro His Asn Ile Val Ile Glu Met Ala Arg Glu Asn Met
```

```
                805                 810                 815

Thr Thr Glu Glu Gly Gln Lys Lys Ala Lys Thr Arg Lys Thr Lys Leu
            820                 825                 830

Glu Ser Ala Leu Lys Asn Ile Glu Asn Ser Leu Leu Glu Asn Gly Lys
        835                 840                 845

Val Pro His Ser Asp Glu Gln Leu Gln Ser Glu Lys Leu Tyr Leu Tyr
    850                 855                 860

Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Leu Asp Lys Thr Gly Ser
865                 870                 875                 880

Pro Ala Pro Leu Tyr Leu Asp Gln Leu Asp Gln Tyr Glu Val Asp His
                885                 890                 895

Ile Ile Pro Tyr Ser Phe Leu Pro Ile Asp Ser Ile Asp Asn Lys Val
            900                 905                 910

Leu Thr His Arg Glu Asn Asn Gln Gln Lys Leu Asn Asn Ile Pro Asp
        915                 920                 925

Lys Glu Thr Val Ala Asn Met Lys Pro Phe Trp Glu Lys Leu Tyr Asn
    930                 935                 940

Ala Lys Leu Ile Ser Gln Thr Lys Tyr Gln Arg Leu Thr Thr Ser Glu
945                 950                 955                 960

Arg Thr Pro Asp Gly Val Leu Thr Glu Ser Met Lys Ala Gly Phe Ile
                965                 970                 975

Glu Arg Gln Leu Val Glu Thr Arg Gln Ile Ile Lys His Val Ala Arg
            980                 985                 990

Ile Leu Asp Asn Arg Phe Ser Asp  Thr Lys Ile Ile Thr  Leu Lys Ser
        995                 1000                1005
```

```
Gln Leu  Ile Thr Asn Phe Arg  Asn Thr Phe His Ile  Ala Lys Ile
    1010                1015                1020

Arg Glu  Leu Asn Asp Tyr His  His Ala His Asp Ala  Tyr Leu Ala
    1025                1030                1035

Val Val  Val Gly Gln Thr Leu  Leu Lys Val Tyr Pro  Lys Leu Ala
    1040                1045                1050

Pro Glu  Leu Ile Tyr Gly His  His Ala His Phe Asn  Arg His Glu
    1055                1060                1065

Glu Asn  Lys Ala Thr Leu Arg  Lys His Leu Tyr Ser  Asn Ile Met
    1070                1075                1080

Arg Phe  Phe Asn Asn Pro Asp  Ser Lys Val Ser Lys  Asp Ile Trp
    1085                1090                1095

Asp Cys  Asn Arg Asp Leu Pro  Ile Ile Lys Asp Val  Ile Tyr Asn
    1100                1105                1110

Ser Gln  Ile Asn Phe Val Lys  Arg Thr Met Ile Lys  Lys Gly Ala
    1115                1120                1125

Phe Tyr  Asn Gln Asn Pro Val  Gly Lys Phe Asn Lys  Gln Leu Ala
    1130                1135                1140

Ala Asn  Asn Arg Tyr Pro Leu  Lys Thr Lys Ala Leu  Cys Leu Asp
    1145                1150                1155

Thr Ser  Ile Tyr Gly Gly Tyr  Gly Pro Met Asn Ser  Ala Leu Ser
    1160                1165                1170

Ile Ile  Ile Ile Ala Glu Arg  Phe Asn Glu Lys Lys  Gly Lys Ile
    1175                1180                1185

Glu Thr  Val Lys Glu Phe His  Asp Ile Phe Ile Ile  Asp Tyr Glu
```

```
    1190                1195                1200

Lys Phe  Asn Asn Asn Pro Phe  Gln Phe Leu Asn Asp  Thr Ser Glu
    1205                1210                1215

Asn Gly  Phe Leu Lys Lys Asn  Asn Ile Asn Arg Val  Leu Gly Phe
    1220                1225                1230

Tyr Arg  Ile Pro Lys Tyr Ser  Leu Met Gln Lys Ile  Asp Gly Thr
    1235                1240                1245

Arg Met  Leu Phe Glu Ser Lys  Ser Asn Leu His Lys  Ala Thr Gln
    1250                1255                1260

Phe Lys  Leu Thr Lys Thr Gln  Asn Glu Leu Phe Phe  His Met Lys
    1265                1270                1275

Arg Leu  Leu Thr Lys Ser Asn  Leu Met Asp Leu Lys  Ser Lys Ser
    1280                1285                1290

Ala Ile  Lys Glu Ser Gln Asn  Phe Ile Leu Lys His  Lys Glu Glu
    1295                1300                1305

Phe Asp  Asn Ile Ser Asn Gln  Leu Ser Ala Phe Ser  Gln Lys Met
    1310                1315                1320

Leu Gly  Asn Thr Thr Ser Leu  Lys Asn Leu Ile Lys  Gly Tyr Asn
    1325                1330                1335

Glu Arg  Lys Ile Lys Glu Ile  Asp Ile Arg Asp Glu  Thr Ile Lys
    1340                1345                1350

Tyr Phe  Tyr Asp Asn Phe Ile  Lys Met Phe Ser Phe  Val Lys Ser
    1355                1360                1365

Gly Ala  Pro Lys Asp Ile Asn  Asp Phe Phe Asp Asn  Lys Cys Thr
    1370                1375                1380
```

```
Val Ala  Arg Met Arg Pro Lys  Pro Asp Lys Lys Leu  Leu Asn Ala
    1385                1390                1395


Thr Leu  Ile His Gln Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile
    1400                1405                1410


Asp Leu  Ser Lys Leu Gly Glu  Asp
    1415                1420
```

<210> 765
<211> 317
<212> PRT
<213> Streptococcus sp.

<400> 765

```
Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln Val Asp Ser Lys Phe Asn
1               5                   10                  15


Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg Lys Ala Lys Leu
            20                  25                  30


Asp Lys Glu Lys Ser Glu Glu Thr Tyr Val Leu Gly Lys Ile Lys Asp
        35                  40                  45


Ile Tyr Ser Gln Ala Gly Tyr Asp Ala Phe Ile Lys Ile Tyr Asn Lys
    50                  55                  60


Asp Lys Ser Lys Phe Leu Met Tyr His Lys Asp Pro Gln Thr Phe Glu
65                  70                  75                  80


Lys Val Ile Glu Glu Ile Leu Arg Thr Tyr Pro Ser Lys Glu Leu Asn
                85                  90                  95


Asp Lys Asn Lys Glu Ile Pro Cys Asn Pro Phe Glu Lys Tyr Arg Gln
            100                 105                 110


Glu Asn Gly Pro Ile Arg Lys Tyr Ser Lys Lys Ser Asn Gly Pro Glu
        115                 120                 125
```

```
Ile Lys Ser Leu Lys Tyr Tyr Asp Asn Lys Leu Gly Asn His Ile Asp
    130                 135                 140

Ile Thr Pro Glu Ser Ser Asp Asn Gln Val Val Leu Gln Ser Leu Lys
145                 150                 155                 160

Pro Trp Arg Thr Asp Val Tyr Phe Asn His Gln Thr Lys Lys Tyr Glu
                165                 170                 175

Leu Met Gly Leu Lys Tyr Ser Asp Leu Ser Phe Glu Lys Gly Ser Gly
            180                 185                 190

Lys Tyr Ser Ile Ser Asn Gln Lys Tyr Asn Ser Ile Lys Arg Ile Glu
        195                 200                 205

Gly Ile Asp Glu Gln Ser Glu Phe Lys Phe Thr Leu Tyr Lys Asn Asp
    210                 215                 220

Leu Ile Leu Ile Lys Asp Ser Glu Asn Asn Glu Gln Lys Leu Phe Arg
225                 230                 235                 240

Phe Asn Ser Arg Asn Asp Thr Ala Lys His Tyr Ile Glu Leu Lys Pro
                245                 250                 255

Tyr Asp Lys Ala Lys Phe Asp Gly Glu Gln Glu Leu Ile Thr Ile Leu
            260                 265                 270

Gly Asn Val Ala Lys Gly Gly Arg Cys Leu Lys Gly Leu Asn Lys Ser
        275                 280                 285

Asn Ile Ser Ile Phe Lys Val Lys Thr Asp Val Leu Gly Lys Lys His
    290                 295                 300

Ile Ile Lys Lys Glu Gly Asp Glu Pro Lys Leu Lys Phe
305                 310                 315
```

<210> 766
<211> 1420
<212> PRT
<213> Streptococcus sp.

<400> 766

```
Met Ala Lys Phe Asn Lys Asn Tyr Ser Ile Gly Leu Asp Ile Gly Val
1               5                  10                  15


Ser Ser Val Gly Tyr Ala Val Val Thr Glu Asp Tyr Arg Val Pro Ala
            20                  25                  30


Phe Lys Phe Lys Val Leu Gly Asn Thr Glu Lys Glu Lys Ile Lys Lys
        35                  40                  45


Asn Leu Ile Gly Ser Thr Thr Phe Val Pro Ala Gln Ser Ala Gln Gly
    50                  55                  60


Thr Arg Val Phe Arg Val Asn Arg Arg Arg Ile Asp Arg Arg Asn His
65                  70                  75                  80


Arg Ile Ala Tyr Leu Arg Asp Ile Phe Gln Lys Glu Ile Glu Lys Ile
                85                  90                  95


Asp Lys Asn Phe Tyr Arg Arg Leu Asp Glu Ser Phe Arg Val Leu Gly
            100                 105                 110


Asp Lys Ser Glu Asp Ile Gln Ile Lys Gln Pro Phe Phe Gly Asn Lys
        115                 120                 125


Glu Leu Glu Thr Ala Tyr His Lys Lys Tyr Pro Thr Ile Tyr His Leu
    130                 135                 140


Arg Lys His Leu Ala Asp Ala Asp Lys Asn Ser Pro Val Ala Asp Ile
145                 150                 155                 160


Arg Glu Val Tyr Met Val Leu Ser His Ile Leu Lys Tyr Arg Gly His
                165                 170                 175
```

```
Phe Leu Thr Leu Gly Lys Ile Asp Pro Asn Asn Ile Asn Met Gln Asn
            180                 185                 190

Ser Trp Ile Asp Phe Ile Glu Ser Cys Gln Asp Ala Phe Asp Leu Glu
        195                 200                 205

Ile Ser Asp Glu Ser Lys Thr Ile Ala Ala Ile Phe Lys Ser Ser Glu
    210                 215                 220

Asn Arg Gln Glu Lys Val Lys Gln Ile Leu Ser Tyr Phe Gln Gln Glu
225                 230                 235                 240

Leu Leu Lys Lys Asp Lys Ser Ile Phe Lys Gln Leu Leu Gln Leu Leu
                245                 250                 255

Phe Gly Leu Lys Thr Lys Phe Lys Asp Cys Phe Glu Leu Glu Glu Glu
            260                 265                 270

Pro Asp Leu Asn Phe Ser Lys Glu Asn Tyr Asp Glu Asn Leu Glu Asn
        275                 280                 285

Leu Leu Gly Ala Leu Glu Glu Asp Phe Ser Asp Val Phe Ala Lys Leu
    290                 295                 300

Lys Ile Leu Arg Asp Thr Ile Leu Leu Ser Ser Met Leu Thr Tyr Thr
305                 310                 315                 320

Gly Ala Thr His Ala Arg Phe Ser Ala Thr Met Val Glu Arg Tyr Glu
                325                 330                 335

Glu His Arg Lys Asp Leu Gln Arg Phe Lys Ser Phe Val Lys Gln Asn
            340                 345                 350

Leu Ser Glu Gln Asp Tyr Leu Asp Ile Phe Gly Arg Lys Thr Pro Thr
        355                 360                 365

Gly Phe Asp Val Asp Lys Glu Thr Lys Gly Tyr Val Gly Tyr Ile Ser
```

```
    370                 375                 380

Asn Lys Met Val Leu Thr Asn Pro Gln Lys Gln Lys Thr Ile Gln Gln
385                 390                 395                 400

Asn Phe Tyr Asp Tyr Ile Ser Gly Lys Ile Thr Gly Ile Glu Gly Ala
                405                 410                 415

Glu Cys Phe Leu Asn Lys Ile Ser Asp Gly Thr Phe Leu Arg Lys Leu
            420                 425                 430

Arg Thr Thr Asp Asn Gly Ala Ile Pro Asn Gln Ile His Ala Tyr Glu
        435                 440                 445

Leu Glu Lys Ile Ile Glu Arg Gln Gly Arg Asp Tyr Pro Phe Leu Leu
    450                 455                 460

Glu Asn Lys Asp Lys Leu Leu Ser Ile Leu Thr Phe Lys Ile Pro Tyr
465                 470                 475                 480

Tyr Val Gly Pro Leu Ala Lys Gly Asn Asn Ser Arg Phe Ala Trp Ile
                485                 490                 495

Lys Arg Thr Thr Ser Gln Asp Val Leu Asp Asp Asn Asp Glu Asp Thr
            500                 505                 510

Arg Asn Gly Lys Ile Arg Pro Trp Asn Tyr His Lys Leu Ile Asn Met
        515                 520                 525

Asp Glu Thr Arg Asp Ala Phe Ile Ile Asn Leu Ile Gly Asn Asp Ile
    530                 535                 540

Ile Leu Leu Asn Glu Lys Val Leu Pro Lys Arg Ser Leu Ile Tyr Glu
545                 550                 555                 560

Glu Val Met Leu Gln Asn Glu Leu Thr Arg Val Lys Tyr Lys Asp Lys
                565                 570                 575
```

```
Tyr Gly Lys Ile His Phe Phe Asn Ser Glu Leu Arg Gln Glu Ile Ile
            580                 585                 590

Asn Asn Leu Phe Lys Thr Asn Ser Lys Arg Val Ser Ser Ala Met Leu
        595                 600                 605

Leu Ser Tyr Leu Glu Asn Phe Thr Asn Leu Gln Ala Val Glu Ile Val
    610                 615                 620

Ser Gly Ile Glu Lys Gly Lys Ser Leu Asn Ser Thr Leu Lys Thr Tyr
625                 630                 635                 640

Asn Asp Leu Lys Thr Ile Phe Ser Glu Glu Leu Leu Asp Ser Glu Ile
                645                 650                 655

Tyr Gln Lys Glu Leu Glu Glu Ile Ile Lys Val Ile Thr Val Phe Asp
            660                 665                 670

Asp Lys Lys Ser Ile Lys Asn Tyr Leu Thr Lys Tyr Phe Gly His Leu
        675                 680                 685

Glu Phe Leu Asn Glu Glu Lys Ile Asn Gln Leu Ser Lys Leu Arg Tyr
    690                 695                 700

Thr Gly Trp Gly Arg Tyr Ser Gly Lys Leu Leu Leu Gly Ile Arg Asp
705                 710                 715                 720

Glu Asp Thr Gly Phe Asn Leu Met Gln Phe Leu Arg Asn Asp Asp Glu
                725                 730                 735

Asn Arg Asn Leu Thr Gln Leu Ile Ser Asp Thr Thr Leu Ser Phe Asp
            740                 745                 750

Ser Ala Ile Lys Ala Ile Gln Ser Lys Ser Thr Val Glu Asp Asp Val
        755                 760                 765

Phe Glu Glu Ile Lys Asn Leu Ala Gly Ser Pro Ala Ile Lys Arg Gly
```

```
    770                 775                 780

Ile Leu Asn Ser Ile Lys Ile Val Asp Glu Leu Val Gln Ile Ile Gly
785                 790                 795                 800

Tyr Pro Pro Gln Asn Ile Ile Ile Glu Met Ala Arg Glu Asn Met Thr
                805                 810                 815

Thr Glu Glu Gly Gln Lys Lys Ala Lys Thr Arg Lys Ser Lys Leu Glu
            820                 825                 830

Ser Ala Leu Lys Asn Ile Glu Asp Ser Val Leu Glu Ser Gly Lys Val
        835                 840                 845

Pro His Ser Asp Glu Gln Leu Gln Ser Glu Lys Leu Tyr Leu Tyr Tyr
    850                 855                 860

Leu Gln Asn Gly Lys Asp Met Tyr Ser Leu Asp Lys Thr Gly Ser Pro
865                 870                 875                 880

Thr Pro Leu Tyr Arg Asp Gln Leu Asp Gln Tyr Glu Val Asp His Ile
                885                 890                 895

Ile Pro Tyr Ser Phe Leu Pro Ile Asp Ser Ile Asp Asn Lys Val Leu
            900                 905                 910

Thr His Arg Glu Asn Asn Gln Arg Lys Leu Asn Asn Ile Pro Asp Lys
        915                 920                 925

Glu Thr Val Ala Asn Met Lys Pro Phe Trp Glu Lys Leu Tyr Asn Ala
    930                 935                 940

Lys Leu Ile Ser Gln Thr Lys Tyr Gln Arg Leu Thr Thr Ser Glu Arg
945                 950                 955                 960

Thr Pro Asp Gly Val Leu Thr Glu Ser Met Lys Ala Gly Phe Ile Glu
                965                 970                 975
```

```
Arg Gln Leu Val Glu Thr Arg Gln Ile Ile Lys His Val Ala Arg Ile
            980                 985                 990

Leu Asp Asn Arg Phe Ser Asp Thr  Lys Ile Ile Thr Leu  Lys Ser Gln
        995                 1000                1005

Leu Val  Thr Asn Phe Arg Asn  Thr Phe His Ile Ala  Lys Ile Arg
    1010                1015                1020

Glu Leu  Asn Asp Tyr His His  Ala His Asp Ala Tyr  Leu Ala Val
    1025                1030                1035

Val Val  Gly Gln Thr Leu Leu  Lys Ala Tyr Pro Lys  Leu Ala Pro
    1040                1045                1050

Glu Leu  Ile Tyr Gly His His  Ala His Phe Asn Arg  His Glu Glu
    1055                1060                1065

Asn Lys  Ala Thr Leu Arg Lys  His Leu Tyr Ser Asn  Ile Met Arg
    1070                1075                1080

Phe Phe  Asn Asn Pro Asp Ser  Lys Val Ser Lys Asp  Ile Trp Asp
    1085                1090                1095

Cys Asn  Arg Asp Leu Pro Ile  Val Lys Asp Val Ile  Tyr Asn Ser
    1100                1105                1110

Gln Ile  Asn Phe Val Lys Arg  Thr Met Ile Lys Lys  Gly Ala Phe
    1115                1120                1125

Tyr Asn  Gln Asn Pro Val Gly  Lys Leu Asn Lys Gln  Ile Ala Ala
    1130                1135                1140

Asn Asn  Arg Tyr Pro Leu Lys  Thr Lys Val Ser Ser  Leu Asp Thr
    1145                1150                1155

Ser Ile  Tyr Gly Gly Tyr Gly  Pro Met Asn Ser Ala  Leu Ser Ile
```

```
    1160                1165                1170

Ile Ile  Ile Ala Glu Arg Phe  Asn Glu Lys Lys Gly  Lys Ile Glu
    1175                1180                1185

Thr Val  Lys Glu Phe His Asp  Ile Phe Ile Ile Asp  Tyr Glu Lys
    1190                1195                1200

Phe Asn  Asn Asn Pro Phe Gln  Phe Leu Asn Asn Val  Ser Glu Glu
    1205                1210                1215

Gly Phe  Leu Lys Lys Asn Asp  Leu Asn Arg Val Leu  Ala Phe Tyr
    1220                1225                1230

Arg Ile  Ser Lys Tyr Ser Leu  Met Gln Lys Ile Asp  Gly Thr Arg
    1235                1240                1245

Met Leu  Phe Glu Ser Lys Ser  Asn Leu His Lys Val  Thr Gln Phe
    1250                1255                1260

Lys Leu  Thr Lys Thr Gln Asn  Glu Leu Phe Phe His  Met Lys Arg
    1265                1270                1275

Leu Leu  Thr Lys Ser Asn Leu  Met Asp Leu Lys Ser  Glu Ser Ala
    1280                1285                1290

Ile Lys  Glu Ser Gln Asn Phe  Ile Gln Thr His Gln  Asn Glu Phe
    1295                1300                1305

Asp Asn  Ile Ala Asp Arg Leu  Ser Asn Tyr Ser Gln  Lys Met Leu
    1310                1315                1320

Gly Glu  Thr Lys Ser Leu Gln  Thr Leu Ile Asn Gly  Tyr Asn Glu
    1325                1330                1335

Arg Pro  Ile Lys Gln Ile Asp  Asn Asn Glu Glu Thr  Ile Arg Tyr
    1340                1345                1350
```

```
Tyr Tyr  Asp Asn Phe Ile Lys  Met Phe Ser Phe Val  Lys Ser Gly
    1355                1360                1365


Ala Pro  Lys Asp Ile Ile Asn  Phe Phe Asn Asp Lys  Tyr Thr Val
    1370                1375                1380


Pro Arg  Met Arg Pro Lys Pro  Asp Arg Lys Met Leu  Asp Ala Thr
    1385                1390                1395


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1400                1405                1410


Leu Ser  Lys Leu Gly Glu Asp
    1415                1420
```

<210> 767
<211> 1371
<212> PRT
<213> Streptococcus sp.

<400> 767

```
Met Glu Asn Lys Asn Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser
1               5                   10                  15


Val Gly Trp Ser Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys
            20                  25                  30


Met Lys Val Leu Gly Asn Thr Asp Lys His Phe Ile Lys Lys Asn Leu
        35                  40                  45


Ile Gly Ala Leu Leu Phe Asp Glu Gly Thr Thr Ala Glu Ala Arg Arg
    50                  55                  60


Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu
65                  70                  75                  80


Arg Tyr Leu Gln Glu Ile Phe Ser Glu Glu Ile Gly Lys Val Asp Ser
                85                  90                  95
```

```
Ser Phe Phe His Arg Leu Asp Asp Ser Phe Leu Ile Pro Glu Asp Lys
            100                 105                 110

Arg Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Ala Glu Glu Lys Lys
        115                 120                 125

Tyr His Lys Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Gln Leu Ala
    130                 135                 140

Asp Ser Lys Glu Lys Thr Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala
145                 150                 155                 160

His Met Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Glu Ala Phe Asp
                165                 170                 175

Ile Lys Asn Asn Asp Ile Gln Lys Ile Phe Asn Glu Phe Ile Ser Ile
            180                 185                 190

Tyr Asn Asn Thr Phe Glu Gly Asn Ser Leu Ser Gly Gln Asn Val Gln
        195                 200                 205

Val Glu Ala Ile Phe Thr Asp Lys Ile Ser Lys Ser Ala Lys Arg Glu
    210                 215                 220

Arg Val Leu Lys Leu Phe Pro Asp Glu Lys Ser Thr Gly Leu Phe Ser
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asp Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Arg Asp Thr Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Asp Phe Ala
        275                 280                 285
```

```
Asp Leu Phe Leu Val Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asn Pro Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Glu Arg Tyr Glu Asn His Gln Lys Asp Leu Ala Ser Leu
                325                 330                 335

Lys Gln Phe Ile Lys Asn Asn Leu Pro Glu Lys Tyr Asp Glu Val Phe
            340                 345                 350

Ser Asp Gln Ser Glu Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr
        355                 360                 365

Thr Gln Glu Thr Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Phe
    370                 375                 380

Glu Gly Ala Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His
                405                 410                 415

Leu Gln Glu Met Asn Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Lys Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Arg Asp Phe Ala
    450                 455                 460

Trp Leu Thr Arg Asn Ser Asp Gln Ala Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Glu Ile Val Asp Lys Ala Ser Ser Ala Glu Asp Phe Ile Asn Lys Met
                485                 490                 495
```

```
Thr Asn Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Lys Phe Ile Ala Glu Gly Leu Arg Asp Tyr Gln Phe Leu Asp Ser Gly
    530                 535                 540

Gln Lys Lys Gln Ile Val Thr Gln Leu Phe Lys Glu Lys Arg Lys Val
545                 550                 555                 560

Thr Glu Lys Asp Ile Ile Gln Phe Leu His Asn Val Asp Gly Tyr Asp
                565                 570                 575

Gly Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Ala Phe Met Asp
        595                 600                 605

Asp Ala Lys Asn Glu Ala Ile Leu Glu Asn Ile Val His Thr Leu Thr
    610                 615                 620

Ile Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln Tyr Asp
625                 630                 635                 640

Ser Leu Phe Asp Glu Lys Val Ile Lys Ala Leu Thr Arg Arg His Tyr
                645                 650                 655

Thr Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Ser Asp
            660                 665                 670

Lys Gln Thr Gly Asn Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Glu
        675                 680                 685
```

```
Ile Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu Ser Phe
    690                 695                 700

Lys Glu Ile Ile Gln Lys Ala Gln Val Val Gly Lys Thr Asn Asp Val
705                 710                 715                 720

Lys Gln Val Val Gln Glu Leu Pro Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

His Ala Pro Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
        755                 760                 765

Thr Ala Arg Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile Glu
    770                 775                 780

Asp Ser Leu Lys Ile Leu Ala Ser Gly Leu Asn Ser Lys Ile Leu Lys
785                 790                 795                 800

Glu His Pro Thr Asp Asn Ile Gln Leu Gln Asn Asp Arg Leu Phe Leu
                805                 810                 815

Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Glu Ala Leu Asp
            820                 825                 830

Ile Asn Gln Leu Ser Ser Cys Asp Ile Asp His Ile Ile Pro Gln Ala
        835                 840                 845

Phe Ile Lys Asp Asp Ser Leu Asp Asn Arg Val Leu Thr Ser Ser Lys
    850                 855                 860

Asp Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Leu Glu Val Val Asp
865                 870                 875                 880

Lys Met Lys Val Phe Trp Gln Gln Leu Leu Asp Ser Lys Leu Ile Ser
                885                 890                 895
```

```
Tyr Arg Lys Phe Asn Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Asn
            900                 905                 910

Glu Leu Asp Lys Val Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg
        915                 920                 925

Gln Ile Thr Lys His Val Ala Gln Ile Leu Asp Ala Arg Phe Asn Lys
    930                 935                 940

Glu Val Thr Glu Lys Asp Lys Lys Asn Arg Thr Val Lys Ile Ile Thr
945                 950                 955                 960

Leu Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr
                965                 970                 975

Lys Val Arg Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu
            980                 985                 990

Asn Ala Val Val Ala Lys Ala Ile  Leu Lys Lys Tyr Pro  Lys Leu Glu
        995                 1000                1005

Pro Glu  Phe Val Tyr Gly Asp  Tyr Gln Lys Tyr Asp  Leu Lys Arg
    1010                1015                1020

Tyr Ile  Ser Arg Ser Lys Asp  Pro Lys Glu Ile Glu  Lys Ala Thr
    1025                1030                1035

Glu Lys  Tyr Phe Phe Tyr Ser  Asn Leu Leu Asn Phe  Phe Lys Glu
    1040                1045                1050

Glu Val  His Tyr Ala Asp Gly  Thr Ile Val Lys Arg  Glu Asn Ile
    1055                1060                1065

Glu Tyr  Ser Lys Asp Thr Gly  Glu Ile Ala Trp Asn  Lys Glu Lys
    1070                1075                1080
```

```
Asp Phe  Ala Thr Ile Lys Lys  Val Leu Ser Leu Pro  Gln Val Asn
    1085                1090                1095

Ile Val  Lys Lys Arg Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu
    1100                1105                1110

Ser Ile  Leu Pro Lys Gly Asn  Ser Asp Lys Leu Ile  Pro Arg Lys
    1115                1120                1125

Thr Lys  Asp Ile Leu Trp Asp  Thr Thr Lys Tyr Gly  Gly Phe Asp
    1130                1135                1140

Ser Pro  Val Ile Ala Tyr Ser  Ile Leu Leu Ile Ala  Asp Ile Glu
    1145                1150                1155

Lys Gly  Lys Ala Lys Lys Leu  Lys Thr Val Lys Thr  Leu Val Gly
    1160                1165                1170

Ile Thr  Ile Met Glu Lys Asp  Ala Phe Glu Lys Asn  Pro Ile Ala
    1175                1180                1185

Phe Leu  Glu Asn Lys Gly Tyr  His Asn Val Cys Lys  Glu Asn Ile
    1190                1195                1200

Leu Cys  Leu Pro Lys Tyr Ser  Leu Phe Glu Leu Glu  Asn Gly Arg
    1205                1210                1215

Arg Arg  Leu Leu Ala Ser Ala  Lys Glu Leu Gln Lys  Cys Asn Glu
    1220                1225                1230

Ile Val  Leu Pro Val Tyr Leu  Thr Thr Leu Leu Tyr  His Ser Lys
    1235                1240                1245

Asn Val  His Lys Leu Asp Glu  Pro Gly His Leu Glu  Tyr Ile Gln
    1250                1255                1260

Lys His  Arg Asn Glu Phe Lys  Asp Leu Leu Asn Leu  Val Ser Glu
    1265                1270                1275
```

```
Phe Ser  Gln Lys Tyr Val Leu  Ala Asp Ala Asn Leu  Glu Lys Ile
    1280                1285                1290


Lys Asn  Leu Tyr Ala Asp Asn  Glu Gln Ala Asp Ile  Glu Ile Leu
    1295                1300                1305


Ala Asn  Ser Phe Ile Asn Leu  Leu Thr Phe Thr Ala  Leu Gly Ala
    1310                1315                1320


Pro Ala  Ala Phe Lys Phe Phe  Gly Lys Asp Val Asp  Arg Lys Arg
    1325                1330                1335


Tyr Thr  Thr Val Ser Glu Ile  Leu Asn Ala Thr Leu  Ile His Gln
    1340                1345                1350


Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile Asp Leu  Ser Lys Leu
    1355                1360                1365


Gly Glu  Asp
    1370
```

<210> 768
<211> 93
<212> PRT
<213> Streptococcus sp.

<400> 768

```
Met Ile Leu Ile Lys Asp Ser Glu Asn Asn Glu Gln Lys Leu Phe Arg
1               5                   10                  15


Phe Asn Ser Arg Asn Asp Thr Ala Lys His Tyr Val Glu Leu Lys Pro
            20                  25                  30


Tyr Asp Lys Ala Arg Phe Asp Gly Gln Gln Glu Leu Ile Thr Ile Leu
        35                  40                  45


Gly Asn Val Ala Lys Gly Gly Gln Cys Leu Lys Gly Leu Asn Lys Ser
```

```
    50                  55                  60

Asn Ile Ser Ile Phe Lys Val Lys Thr Asp Val Leu Gly Lys Lys His
65                  70                  75                  80

Ile Ile Lys Lys Glu Gly Asp Glu Pro Lys Leu Lys Phe
                85                  90
```

<210> 769
<211> 1121
<212> PRT
<213> Streptococcus sp.

<400> 769

```
Met Asn Gly Leu Val Leu Gly Leu Asp Ile Gly Ile Ala Ser Val Gly
1               5                   10                  15

Val Gly Ile Leu Glu Lys Asn Ser Gly Lys Ile Ile His Ala Asn Ser
            20                  25                  30

Arg Leu Phe Pro Ala Ala Thr Ala Asp Asn Asn Val Glu Arg Arg Lys
        35                  40                  45

Asn Arg Gln Ala Arg Arg Leu His Arg Arg Lys Lys His Arg Gly Val
    50                  55                  60

Arg Phe Gln Asp Leu Phe Glu Asp Tyr Gly Leu Leu Thr Asp Phe Ser
65                  70                  75                  80

Lys Val Ser Ile Asn Leu Asn Pro Tyr Arg Leu Arg Val Asp Gly Leu
                85                  90                  95

Asn Gln Gln Leu Thr Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Ile
            100                 105                 110

Val Lys Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Glu Asp Gly
        115                 120                 125
```

```
Gly Thr Val Ser Ser Asp Tyr Gly Lys Ala Val Glu Glu Asn Arg Lys
    130                 135                 140

Leu Leu Ala Glu Gln Thr Pro Gly Gln Ile Gln Leu Glu Arg Phe Glu
145                 150                 155                 160

Lys Tyr Gly Gln Val Arg Gly Asp Phe Thr Val Val Glu Asn Gly Glu
                165                 170                 175

Lys Arg Arg Leu Ile Asn Val Phe Ser Thr Ser Ala Tyr Arg Lys Glu
            180                 185                 190

Ala Glu Arg Ile Leu Arg Lys Gln Gln Glu Phe Asn Ser Lys Ile Thr
        195                 200                 205

Asp Glu Phe Ile Glu Asp Cys Leu Lys Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240

Phe Arg Thr Asp Gly Thr Thr Leu Asp Asn Ile Phe Gly Ile Leu Ile
                245                 250                 255

Gly Lys Cys Thr Phe Tyr Pro Asp Glu Tyr Arg Ala Ser Lys Ala Ser
            260                 265                 270

Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285

Val Pro Thr Glu Thr Lys Lys Leu Ser Glu Glu Gln Lys Lys Val Ile
    290                 295                 300

Val Glu Tyr Ala Lys Glu Ala Lys Thr Leu Gly Ala Ser Thr Leu Leu
305                 310                 315                 320

Lys Tyr Ile Ala Lys Met Ile Asp Ala Ser Val Asp Gln Ile Arg Gly
                325                 330                 335
```

```
Tyr Arg Val Asp Val Asn Asn Lys Pro Glu Ile His Thr Phe Glu Ala
            340                 345                 350

Tyr Arg Lys Met Gln Ser Leu Glu Thr Ile Ser Val Gly Glu Leu Ser
        355                 360                 365

Arg Asn Val Leu Asp Glu Leu Ala His Ile Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Glu Glu Ala Ile Asn Thr Lys Leu Lys Asp Ser Phe
385                 390                 395                 400

Ser Gln Asp Gln Val Leu Glu Leu Val Gln Phe Arg Lys Asn Asn Ser
                405                 410                 415

Ser Leu Phe Ser Lys Gly Trp His Asn Phe Ser Leu Lys Leu Met Met
            420                 425                 430

Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr Ile
        435                 440                 445

Leu Thr Arg Leu Gly Lys Gln Lys Ser Lys Glu Ile Ser Lys Arg Thr
    450                 455                 460

Lys Tyr Ile Asp Glu Lys Glu Leu Thr Glu Glu Ile Tyr Asn Pro Val
465                 470                 475                 480

Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Ile Asn Glu Ala Thr
                485                 490                 495

Lys Lys His Gly Ile Phe Asp Asn Ile Val Ile Glu Met Ala Arg Glu
            500                 505                 510

Asn Asn Glu Glu Asp Ala Lys Lys Asp Tyr Ile Lys Arg Gln Lys Ala
        515                 520                 525
```

```
Asn Gln Asp Glu Lys Asn Ala Ala Met Glu Lys Ala Ala Phe Gln Tyr
    530                 535                 540

Asn Gly Lys Lys Glu Leu Pro Asp Ser Ile Phe His Gly Gln Lys Glu
545                 550                 555                 560

Leu Ala Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Lys Cys Leu
                565                 570                 575

Tyr Thr Gly Lys Asn Ile Pro Ile Ser Asp Leu Ile His Asn Gln Tyr
            580                 585                 590

Lys Tyr Glu Ile Asp His Ile Leu Pro Leu Ser Leu Ser Phe Asp Asp
        595                 600                 605

Ser Leu Ser Asn Lys Val Leu Val Leu Ala Thr Ala Asn Gln Glu Lys
    610                 615                 620

Gly Gln Arg Thr Pro Phe Gln Ala Leu Asp Ser Met Asp Asp Ala Trp
625                 630                 635                 640

Ser Tyr Arg Glu Phe Lys Ser Tyr Val Lys Glu Ser Lys Leu Leu Gly
                645                 650                 655

Asn Lys Lys Lys Glu Tyr Leu Leu Thr Glu Glu Asp Ile Ser Lys Ile
            660                 665                 670

Glu Val Lys Gln Lys Phe Ile Glu Arg Asn Leu Ile Asp Thr Arg Tyr
        675                 680                 685

Ser Ser Arg Val Val Leu Asn Ala Leu Gln Asp Phe Tyr Lys Ala His
    690                 695                 700

Lys Phe Asp Thr Thr Ile Ser Val Val Arg Gly Gln Phe Thr Ser Gln
705                 710                 715                 720

Leu Arg Arg Lys Trp Gly Leu Glu Lys Ser Arg Glu Thr Tyr His His
                725                 730                 735
```

```
His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Arg Leu
            740                 745                 750

Trp Lys Lys Gln Asn Asn Pro Leu Ile Ala Tyr Lys Glu Gly Gln Phe
        755                 760                 765

Val Asp Ser Glu Thr Gly Glu Ile Ile Ser Leu Ser Asp Asp Glu Tyr
    770                 775                 780

Lys Glu Leu Val Phe Lys Ala Pro Tyr Asp His Phe Val Asp Thr Leu
785                 790                 795                 800

Ser Ser Lys Thr Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln Val Asp
                805                 810                 815

Ser Lys Phe Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg
            820                 825                 830

Lys Ala Lys Leu Asp Lys Glu Lys Ser Glu Glu Thr Tyr Val Leu Gly
        835                 840                 845

Lys Ile Lys Asp Ile Tyr Ser Gln Ala Gly Tyr Asp Ala Phe Ile Lys
    850                 855                 860

Ile Tyr Asn Lys Asp Lys Ser Lys Phe Leu Met Tyr His Lys Asp Pro
865                 870                 875                 880

Gln Thr Phe Glu Lys Val Ile Glu Glu Ile Leu Arg Thr Tyr Pro Ser
                885                 890                 895

Lys Glu Leu Asn Asp Lys Asn Lys Glu Ile Pro Cys Asn Pro Phe Glu
            900                 905                 910

Lys Tyr Arg Gln Glu Asn Gly Pro Ile Arg Lys Tyr Ser Lys Lys Ser
        915                 920                 925
```

```
Asn Gly Pro Glu Ile Lys Ser Leu Lys Tyr Tyr Asp Asn Lys Leu Gly
    930                 935                 940

Asn His Ile Asp Ile Thr Pro Glu Ser Ser Asp Asn Gln Val Val Leu
945                 950                 955                 960

Gln Ser Leu Lys Pro Trp Arg Thr Asp Val Tyr Phe Asn His Gln Thr
                965                 970                 975

Lys Lys Tyr Glu Leu Met Gly Leu Lys Tyr Ser Asp Leu Ser Phe Glu
            980                 985                 990

Lys Gly Ser Gly Lys Tyr Ser Ile  Ser Asn Gln Lys Tyr  Asn Ser Ile
        995                 1000                1005

Lys Arg  Ile Glu Gly Ile Asp  Glu Gln Ser Glu Phe  Lys Phe Thr
    1010                1015                1020

Leu Tyr  Lys Asn Asp Leu Ile  Leu Ile Lys Asp Ser  Glu Asn Asn
    1025                1030                1035

Glu Gln  Lys Leu Phe Arg Phe  Asn Ser Arg Asn Asp  Thr Ala Lys
    1040                1045                1050

His Tyr  Ile Glu Leu Lys Pro  Tyr Asp Lys Ala Lys  Phe Asp Gly
    1055                1060                1065

Glu Gln  Glu Leu Ile Thr Ile  Leu Gly Asn Val Ala  Lys Gly Gly
    1070                1075                1080

Arg Cys  Leu Lys Gly Leu Asn  Lys Ser Asn Ile Ser  Ile Phe Lys
    1085                1090                1095

Val Lys  Thr Asp Val Leu Gly  Lys Lys His Ile Ile  Lys Lys Glu
    1100                1105                1110

Gly Asp  Glu Pro Lys Leu Lys  Phe
    1115                1120
```

<210> 770
<211> 1026
<212> PRT
<213> Streptococcus sp.

<400> 770

Met Asn Gly Leu Val Leu Gly Leu Asp Ile Gly Ile Ala Ser Val Gly
1 5 10 15

Val Gly Ile Leu Glu Lys Asn Ser Gly Lys Ile Ile His Ala Asn Ser
20 25 30

Arg Leu Phe Pro Ala Ala Thr Ala Asp Asn Asn Val Glu Arg Arg Lys
35 40 45

Asn Arg Gln Ala Arg Arg Leu Asn Arg Arg Lys Lys His Arg Gly Val
50 55 60

Arg Phe Gln Asp Leu Phe Glu Asp Tyr Gly Leu Leu Thr Asp Phe Ser
65 70 75 80

Lys Val Ser Ile Asn Leu Asn Pro Tyr Arg Leu Arg Val Asp Gly Leu
85 90 95

Asn Gln Gln Leu Thr Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Ile
100 105 110

Val Lys Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Glu Asp Gly
115 120 125

Gly Ala Val Ser Ser Asp Tyr Gly Lys Ala Val Glu Glu Asn Arg Lys
130 135 140

Leu Leu Ala Glu Gln Thr Pro Gly Gln Ile Gln Leu Glu Arg Phe Glu
145 150 155 160

Lys Tyr Gly Gln Val Arg Gly Asp Phe Thr Val Val Glu Asn Gly Glu

```
                165                 170                 175

Lys Arg Arg Leu Ile Asn Val Phe Ser Thr Ser Ala Tyr Arg Lys Glu
            180                 185                 190

Ala Glu Lys Ile Leu Arg Lys Gln Gln Glu Phe Asn Asn Gln Ile Thr
        195                 200                 205

Asp Glu Phe Ile Glu Asp Tyr Leu Lys Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240

Phe Arg Thr Asp Gly Thr Thr Leu Asp Asn Ile Phe Gly Val Leu Ile
                245                 250                 255

Gly Lys Cys Thr Phe Tyr Pro Asn Glu Tyr Arg Ala Ser Lys Ser Ser
            260                 265                 270

Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285

Val Pro Thr Glu Thr Lys Lys Leu Ser Glu Glu Gln Lys Lys Val Ile
    290                 295                 300

Val Glu Tyr Ala Lys Glu Ala Lys Thr Leu Gly Ala Ser Thr Leu Leu
305                 310                 315                 320

Lys Tyr Ile Val Lys Met Ile Asp Ala Ser Val Asp Gln Ile Ser Gly
                325                 330                 335

Tyr Arg Val Asp Val Asn Asn Lys Pro Glu Met His Thr Phe Glu Val
            340                 345                 350

Tyr Arg Lys Met Gln Ser Leu Glu Thr Ile Ser Val Gly Glu Leu Ser
        355                 360                 365
```

```
Arg Asn Val Leu Asp Glu Leu Ala His Ile Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Glu Glu Ala Ile Asn Ser Lys Leu Met Gly Val Phe
385                 390                 395                 400

Ser Gln Asp Gln Val Leu Glu Leu Val Gln Phe Arg Lys Asn Asn Ser
                405                 410                 415

Ser Leu Phe Ser Lys Gly Trp His Asn Phe Ser Leu Lys Leu Met Met
            420                 425                 430

Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr Ile
        435                 440                 445

Leu Thr Arg Leu Gly Lys Gln Lys Ser Lys Glu Thr Ser Lys Arg Thr
    450                 455                 460

Lys Tyr Ile Asp Glu Lys Glu Leu Thr Glu Glu Ile Tyr Asn Pro Val
465                 470                 475                 480

Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Ile Asn Glu Ala Thr
                485                 490                 495

Lys Lys His Gly Ile Phe Asp Asn Ile Val Ile Glu Met Ala Arg Glu
            500                 505                 510

Asn Asn Glu Glu Asp Ala Lys Lys Asp Tyr Ile Lys Arg Gln Lys Ala
        515                 520                 525

Asn Gln Asp Glu Lys Asn Ala Ala Met Glu Lys Ala Ala Phe Gln Tyr
    530                 535                 540

Asn Gly Lys Lys Glu Leu Pro Gly Asn Ile Phe Asn Gly His Lys Glu
545                 550                 555                 560

Leu Ala Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Lys Cys Leu
```

```
                565                 570                 575

Tyr Thr Gly Lys Thr Ile Pro Ile Ser Asp Leu Ile His Asn Gln Tyr
            580                 585                 590

Lys Tyr Glu Ile Asp His Ile Leu Pro Leu Ser Leu Ser Phe Asp Asp
        595                 600                 605

Ser Leu Ser Asn Lys Val Leu Val His Ala Thr Ala Asn Gln Glu Lys
    610                 615                 620

Gly Gln Arg Thr Pro Phe Gln Ala Leu Asp Ser Met Asp Asp Ala Trp
625                 630                 635                 640

Ser Tyr Arg Glu Phe Lys Ser Tyr Val Lys Asp Leu Lys Ser Leu Ser
                645                 650                 655

Asn Lys Lys Lys Asp Tyr Leu Leu Thr Glu Glu Asp Ile Ser Lys Ile
            660                 665                 670

Glu Val Lys Gln Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg Tyr
        675                 680                 685

Ser Ser Arg Val Val Leu Asn Ala Leu Gln Asp Phe Tyr Lys Ser His
    690                 695                 700

Gln Phe Asp Thr Thr Ile Ser Val Val Arg Gly Gln Phe Thr Ser Gln
705                 710                 715                 720

Leu Arg Arg Lys Trp Gly Leu Glu Lys Ser Arg Glu Thr Tyr His His
                725                 730                 735

His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Arg Leu
            740                 745                 750

Trp Lys Lys Gln Asn Asn Pro Leu Ile Thr Tyr Lys Glu Gly Gln Phe
        755                 760                 765
```

```
Ile Asp Ser Gln Thr Gly Glu Ile Ile Ser Leu Thr Asp Asp Glu Tyr
    770                 775                 780

Lys Glu Leu Val Phe Lys Ala Pro Tyr Asp His Phe Val Asp Thr Leu
785                 790                 795                 800

His Ser Lys Thr Phe Glu Asp Gly Ile Leu Phe Ser Tyr Gln Val Asp
                805                 810                 815

Ser Lys Tyr Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg
            820                 825                 830

Lys Ala Lys Leu Asp Lys Asp Lys Ser Glu Glu Thr Tyr Val Leu Gly
        835                 840                 845

Lys Ile Lys Asp Ile Tyr Ser Gln Ala Gly Tyr Asp Ala Phe Ile Lys
    850                 855                 860

Ile Tyr Asn Lys Asp Lys Arg Lys Phe Leu Met Tyr His Lys Asp Pro
865                 870                 875                 880

Gln Thr Phe Glu Lys Val Ile Glu Glu Ile Leu Arg Thr Tyr Pro Ser
                885                 890                 895

Lys Glu Arg Asn Asp Lys Asn Lys Glu Val Pro Cys Asn Pro Phe Glu
            900                 905                 910

Lys Tyr Arg Gln Glu Asn Gly Pro Ile Arg Lys Tyr Ser Lys Lys Gly
        915                 920                 925

Asn Gly Pro Glu Ile Lys Cys Leu Lys Tyr Tyr Asp Asn Lys Leu Gly
    930                 935                 940

Asn Tyr Ile Asp Ile Ser Pro Asp Gly Ser Asp Asn Gln Val Val Leu
945                 950                 955                 960

Gln Ser Leu Lys Pro Trp Arg Thr Asp Val Tyr Phe Asn His Gln Thr
```

965 970 975

Lys Lys Tyr Glu Leu Met Gly Leu Lys Tyr Ser Asp Leu Ser Phe Glu
980 985 990

Lys Gly Ser Gly Lys Tyr Ser Ile Ser Asn Glu Lys Tyr Asn Ser Ile
995 1000 1005

Lys Arg Ile Glu Gly Val Asn Glu Gln Ser Glu Phe Lys Phe Thr
1010 1015 1020

Leu Tyr Lys
1025

<210> 771
<211> 1377
<212> PRT
<213> Streptococcus sp.

<400> 771

Met Asn Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser
1 5 10 15

Val Gly Trp Ser Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys
20 25 30

Met Lys Val Leu Gly Asn Thr Asp Lys Arg Phe Ile Lys Lys Asn Leu
35 40 45

Ile Gly Ala Leu Leu Phe Asp Glu Gly Thr Thr Ala Glu Ala Arg Arg
50 55 60

Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu
65 70 75 80

Arg Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Ser
85 90 95

```
Ser Phe Phe His Arg Leu Asp Asp Ser Phe Leu Ile Pro Glu Asp Lys
            100                 105                 110

Arg Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Val Glu Glu Lys Glu
        115                 120                 125

Tyr His Lys Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Gln Leu Ala
    130                 135                 140

Asp Ser Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Val Leu Ala
145                 150                 155                 160

His Met Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Glu Ala Phe Asp
                165                 170                 175

Ile Lys Asn Asn Asp Ile Gln Lys Ile Phe Asn Glu Phe Ile Ser Ile
            180                 185                 190

Tyr Asp Asn Thr Phe Glu Gly Ser Ser Leu Ser Gly Gln Asn Ala Gln
        195                 200                 205

Val Glu Thr Ile Phe Thr Asp Lys Ile Ser Lys Ser Ala Lys Arg Glu
    210                 215                 220

Arg Val Leu Lys Leu Phe Pro Asp Glu Lys Ser Thr Gly Leu Phe Ser
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asp Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Glu Gln Ile Gly Asp Asp Phe Ala
        275                 280                 285

Asp Leu Phe Val Ala Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser
    290                 295                 300
```

```
Gly Ile Leu Thr Val Thr Asp Pro Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Glu Arg Tyr Glu Asn His Gln Lys Asp Leu Ala Val Leu
                325                 330                 335

Lys Gln Phe Ile Lys Thr Asn Leu Pro Glu Lys Tyr Val Glu Val Phe
            340                 345                 350

Ser Asp Gln Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr
        355                 360                 365

Thr Gln Glu Ala Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Phe
    370                 375                 380

Asp Gly Ala Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Val Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His
                405                 410                 415

Leu Gln Glu Met Asn Thr Ile Leu Arg Arg Gln Gly Glu His Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Lys Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr His Val Gly Pro Leu Ala Arg Gly Asn Arg Asp Phe Ala
    450                 455                 460

Trp Leu Thr Arg Asn Ser Asp Gln Ala Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Glu Ile Val Asp Lys Ala Ser Ser Ala Glu Asp Phe Ile Asn Lys Met
                485                 490                 495
```

```
Thr Asn Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Lys Phe Ile Ala Glu Gly Met Arg Asp Tyr Gln Phe Leu Asp Ser Gly
    530                 535                 540

Gln Lys Lys Lys Ile Ile Asn Gln Leu Phe Lys Lys Lys Arg Lys Val
545                 550                 555                 560

Thr Glu Asp Asp Ile Ile Asp Cys Leu Gln Lys Ile Asp Asn Tyr Asp
                565                 570                 575

Gly Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser
            580                 585                 590

Thr Tyr His Asp Ile Leu Lys Ile Ile Arg Asp Lys Glu Phe Met Asp
        595                 600                 605

Asp Pro Lys Asn Gly Asp Ile Leu Glu Asn Val Ile His Thr Leu Thr
    610                 615                 620

Ile Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln Tyr Asn
625                 630                 635                 640

Ser Ile Phe Asp Glu Lys Val Ile Lys Ala Leu Ser Arg Lys His Tyr
                645                 650                 655

Thr Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asp Gly Ile Arg Asp
            660                 665                 670

Lys Gln Thr Gly Lys Thr Ile Leu Asp Tyr Leu Met Asp Asp Gly Lys
        675                 680                 685

Ser Asn Arg Asn Phe Met Gln Leu Ile Lys Asp Asp Glu Leu Ser Phe
    690                 695                 700
```

```
Thr Glu Ile Ile Gln Lys Ala Gln Val Val Gly Asp Thr Asp Asn Leu
705                 710                 715                 720


Arg Gln Val Val Gln Asn Leu Pro Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735


Ile Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750


His Ala Pro Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
        755                 760                 765


Thr Ala Arg Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile Glu
    770                 775                 780


Asp Ser Leu Lys Asn Leu Ala Ser Gly Leu Asp Ser Asn Ile Leu Lys
785                 790                 795                 800


Glu Asn Pro Thr Asp Asn Ile Gln Leu Gln Asn Asp Arg Leu Phe Leu
                805                 810                 815


Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Glu Ala Leu Asn
            820                 825                 830


Ile Asn Gln Leu Ser Ser Tyr Asp Ile Asp His Ile Ile Pro Gln Ala
        835                 840                 845


Phe Ile Lys Asp Asp Ser Leu Asp Asn Arg Val Leu Thr Ser Ser Lys
    850                 855                 860


Asp Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Leu Glu Val Val Glu
865                 870                 875                 880


Lys Met Lys Ala Phe Trp Gln Gln Leu Leu Asp Ser Lys Leu Ile Ser
                885                 890                 895
```

```
Glu Arg Lys Tyr Asn Asn Leu Thr Lys Ala Glu Arg Glu Arg Gly Gly
            900                 905                 910

Leu Asn Glu Leu Asp Lys Val Gly Phe Ile Lys Arg Gln Leu Val Glu
        915                 920                 925

Thr Arg Gln Ile Thr Lys His Val Ala Gln Ile Leu Asp Ala Arg Phe
    930                 935                 940

Asn Lys Glu Val Thr Glu Lys Asn Lys Lys Asn Arg Asn Val Lys Ile
945                 950                 955                 960

Ile Thr Leu Lys Ser Asn Met Val Ser Asn Phe Arg Lys Glu Phe Gly
                965                 970                 975

Leu Tyr Lys Val Arg Glu Ile Asn Asp Tyr His His Ala His Asp Ala
            980                 985                 990

Tyr Leu Asn Ala Val Val Ala Lys  Ala Ile Leu Lys Lys  Tyr Pro Lys
        995                 1000                1005

Leu Glu  Pro Glu Phe Val Tyr  Gly Asp Tyr Gln Lys  Tyr Asp Leu
    1010                1015                1020

Lys Arg  Tyr Ile Ser Arg Ser  Lys Asp Pro Lys Glu  Val Glu Lys
    1025                1030                1035

Ala Thr  Glu Lys Tyr Phe Phe  Tyr Ser Asn Leu Leu  Asn Phe Phe
    1040                1045                1050

Lys Glu  Glu Val His Tyr Ala  Asp Gly Thr Ile Val  Lys Arg Glu
    1055                1060                1065

Asn Ile  Glu Tyr Ser Lys Asp  Thr Gly Glu Ile Ala  Trp Asn Lys
    1070                1075                1080

Glu Lys  Asp Phe Ala Thr Ile  Lys Lys Val Leu Ser  Leu Pro Gln
    1085                1090                1095
```

```
Val Asn  Ile Val Lys Lys Thr  Glu Glu Gln Thr Val  Gly Gln Asn
    1100                1105                1110

Gly Gly  Leu Phe Asp Asn Asn  Ile Val Ser Lys Lys  Lys Val Val
    1115                1120                1125

Asp Ala  Ser Lys Leu Ile Pro  Ile Lys Ser Gly Leu  Ser Pro Glu
    1130                1135                1140

Lys Tyr  Gly Gly Tyr Ala Arg  Pro Thr Ile Ala Tyr  Ser Val Leu
    1145                1150                1155

Val Thr  Tyr Lys Gln Asn Asn  Lys Ile Lys Asn Thr  Met Val Gly
    1160                1165                1170

Ile Pro  Val Leu Thr Lys Leu  Glu Phe Glu Arg Asp  Pro Asn Leu
    1175                1180                1185

Tyr Leu  Arg Asn Leu Gly Ile  Asn Asn Val Ser His  Val Ile Lys
    1190                1195                1200

Leu Val  Lys Tyr Thr Val Leu  Glu Phe Lys His Lys  Tyr Gly Thr
    1205                1210                1215

Tyr Arg  Arg Phe Ile Val Ser  Asn Gln Glu Leu Lys  Arg Ala Asn
    1220                1225                1230

Gln Ile  Phe Val Thr Thr Lys  Gln Met Lys Leu Ile  Ser Gln Tyr
    1235                1240                1245

Thr Thr  Leu Asp Lys Asn Glu  His Asp Ser Leu Leu  Lys Asn Asn
    1250                1255                1260

Gln Gln  Leu Ile Gln Ser Ile  Trp Asn Gln Phe Leu  Glu Phe Met
    1265                1270                1275
```

```
Leu Ala  Thr Asp Leu Val Asn  Lys Lys Gln Tyr Asp  Glu Leu Ile
    1280                1285                1290


Leu Thr  Asn Asn Gln Thr Ile  Glu Glu Cys Arg Asn  Ile Met Asn
    1295                1300                1305


Arg Val  Ile Thr Thr Leu Ser  Phe Thr Asn Ile Asn  Ala Gly Gln
    1310                1315                1320


Lys Lys  Ile Ile Phe Asp Asp  Thr Leu Ser Leu Pro  Ile Lys Arg
    1325                1330                1335


Trp Gln  Phe Thr Asp Ser Asp  Lys Met Val Lys Lys  Ile Ile Glu
    1340                1345                1350


Ser Thr  Leu Ile His Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg
    1355                1360                1365


Ile Asp  Leu Ser Lys Leu Gly  Glu Asp
    1370                1375
```

<210> 772
<211> 1371
<212> PRT
<213> Streptococcus sp.

<400> 772

```
Met Asn Asn Asn Asn Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser
1               5                   10                  15


Val Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys
            20                  25                  30


Met Arg Val Leu Gly Asn Thr Asp Lys Arg Phe Ile Lys Lys Asn Leu
        35                  40                  45


Ile Gly Ala Leu Leu Phe Asp Glu Gly Thr Thr Ala Glu Asp Arg Arg
    50                  55                  60
```

```
Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu
65                  70                  75                  80

Arg Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Ser
                85                  90                  95

Ser Phe Phe His Arg Leu Asp Asp Ser Phe Leu Val Pro Glu Asp Lys
            100                 105                 110

Ser Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Ala Glu Glu Lys Glu
        115                 120                 125

Tyr His Lys Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala
    130                 135                 140

Asp Ser Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala
145                 150                 155                 160

His Ile Thr Lys Tyr Arg Gly His Phe Leu Tyr Glu Glu Ala Phe Asp
                165                 170                 175

Ile Lys Asn Asn Asp Ile Gln Lys Ile Phe Asn Glu Phe Ile Asn Ile
            180                 185                 190

Tyr Asp Asn Thr Phe Glu Gly Ser Ser Leu Ser Gly Gln Asn Ala Gln
        195                 200                 205

Val Glu Ala Ile Phe Thr Gly Lys Ile Ser Lys Ser Val Lys Arg Glu
    210                 215                 220

His Val Leu Lys Leu Phe Pro Asp Glu Lys Ser Thr Gly Leu Phe Ser
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asp Leu Glu Glu Lys Ala Ser Leu Gln Phe Ser Lys Asp Thr Tyr
```

```
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Asp Phe Ala
        275                 280                 285

Asp Leu Phe Leu Val Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Pro Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Glu Arg Tyr Glu Asn His Gln Glu Asp Leu Ala Ala Leu
                325                 330                 335

Lys Gln Phe Ile Lys Asn Asn Leu Pro Glu Lys Tyr Ala Glu Val Phe
            340                 345                 350

Ser Asp Gln Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr
        355                 360                 365

Thr Gln Glu Ala Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Phe
    370                 375                 380

Glu Gly Ala Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His
                405                 410                 415

Leu Gln Glu Met Asn Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro
            420                 425                 430

Leu Leu Lys Glu Asn Lys Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Arg Asp Phe Ala
    450                 455                 460
```

```
Trp Leu Thr Arg Asn Ser Asp Gln Ala Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Glu Ile Val Asp Lys Ala Ser Ser Ala Glu Ser Phe Ile Asn Lys Met
                485                 490                 495

Thr Asn Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Lys Phe Ile Ala Glu Gly Leu Arg Asp Tyr Gln Phe Phe Asp Ser Gly
    530                 535                 540

Gln Lys Lys Gln Ile Val Asn Gln Leu Phe Lys Glu Lys Arg Lys Val
545                 550                 555                 560

Thr Glu Lys Asp Ile Ile His Tyr Leu His Asn Val Asp Gly Tyr Asp
                565                 570                 575

Gly Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Glu Phe Met Asp
        595                 600                 605

Asn His Lys Asn Gln Glu Ile Leu Glu Asn Ile Val His Thr Leu Thr
    610                 615                 620

Ile Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln Tyr Asp
625                 630                 635                 640

Ser Ile Phe Asp Glu Lys Val Ile Lys Ala Leu Thr Arg Arg His Tyr
                645                 650                 655

Thr Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Cys Asp
```

```
            660                 665                 670

Lys Lys Thr Gly Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Tyr
        675                 680                 685

Asn Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu Ser Phe
    690                 695                 700

Lys Glu Ile Ile Gln Lys Ala Gln Val Val Gly Lys Thr Asp Asp Leu
705                 710                 715                 720

Thr Gln Val Val Arg Glu Leu Ser Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Ile Met Gly
            740                 745                 750

Tyr Ala Pro Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
        755                 760                 765

Thr Ala Lys Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile Glu
    770                 775                 780

Asp Ala Leu Lys Asn Leu Ala Pro Gly Leu Asp Ser Thr Ile Ser Lys
785                 790                 795                 800

Glu Asn Pro Thr Asp Asn Ile Gln Leu Gln Asn Asp Arg Leu Phe Leu
                805                 810                 815

Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Glu Ala Leu Asp
            820                 825                 830

Ile Asn Gln Leu Ser Ser Tyr Asp Ile Asp His Ile Ile Pro Gln Ala
        835                 840                 845

Phe Ile Lys Asp Asp Ser Leu Asp Asn Arg Val Leu Thr Ser Ser Lys
    850                 855                 860
```

```
Asp Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Leu Glu Val Val Lys
865                 870                 875                 880


Lys Arg Lys Ala Phe Trp Gln Gln Leu Leu Asp Ser Lys Leu Ile Ser
                885                 890                 895


Glu Arg Lys Phe Asn Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Asp
            900                 905                 910


Glu Arg Asp Lys Val Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg
        915                 920                 925


Gln Ile Thr Lys His Val Ala Arg Ile Leu Asp Ala Arg Phe Asn Thr
    930                 935                 940


Glu Val Ser Glu Lys Asn Gln Lys Ile Arg Ser Val Lys Ile Ile Thr
945                 950                 955                 960


Leu Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Lys Leu Tyr
                965                 970                 975


Lys Val Arg Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu
            980                 985                 990


Asn Ala Val Val Ala Lys Ala Ile  Leu Lys Lys Tyr Pro  Lys Leu Glu
        995                 1000                1005


Pro Glu  Phe Val Tyr Gly Asp  Tyr Gln Lys Tyr Asp  Leu Lys Arg
    1010                1015                1020


Tyr Ile  Ser Lys Ser Lys Asp  Pro Lys Glu Val Glu  Lys Ala Thr
    1025                1030                1035


Glu Lys  Tyr Phe Phe Tyr Ser  Asn Leu Leu Asn Phe  Phe Lys Glu
    1040                1045                1050


Glu Val  His Tyr Ala Asp Gly  Thr Ile Val Lys Arg  Glu Asn Ile
```

```
    1055                1060                1065

Glu Tyr  Ser Lys Asp Thr Gly  Glu Ile Ala Trp Asn  Lys Glu Lys
    1070                1075                1080

Asp Phe  Val Thr Ile Lys Lys  Val Leu Ser Tyr Pro  Gln Val Asn
    1085                1090                1095

Ile Val  Lys Lys Arg Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu
    1100                1105                1110

Ser Ile  Leu Pro Lys Gly Asn  Ser Asp Lys Leu Ile  Pro Arg Lys
    1115                1120                1125

Thr Lys  Asp Ile Leu Trp Asp  Thr Thr Lys Tyr Gly  Gly Phe Asp
    1130                1135                1140

Ser Pro  Val Ile Ala Tyr Ser  Ile Leu Leu Ile Ala  Asp Ile Glu
    1145                1150                1155

Lys Gly  Lys Ala Lys Lys Leu  Lys Thr Val Lys Thr  Leu Val Gly
    1160                1165                1170

Ile Thr  Ile Met Glu Lys Ala  Ala Phe Glu Lys Asn  Pro Ile Thr
    1175                1180                1185

Phe Leu  Glu Asn Lys Gly Tyr  His Asn Val Arg Lys  Glu Asn Ile
    1190                1195                1200

Leu Cys  Leu Pro Lys Tyr Ser  Leu Phe Glu Leu Glu  Asn Gly Arg
    1205                1210                1215

Arg Arg  Leu Leu Ala Ser Ala  Lys Glu Leu Gln Lys  Gly Asn Glu
    1220                1225                1230

Ile Val  Leu Pro Val Tyr Leu  Thr Thr Leu Leu Tyr  His Ser Lys
    1235                1240                1245
```

```
Asn Val  His Lys Leu Asp Glu  Pro Glu His Leu Glu  Tyr Ile Gln
    1250                1255                1260


Lys His  Arg Tyr Glu Phe Lys  Asp Leu Leu Asn Leu  Val Ser Glu
    1265                1270                1275


Phe Ser  Gln Lys Tyr Val Leu  Ala Glu Ala Asn Leu  Glu Lys Ile
    1280                1285                1290


Lys Ser  Leu Tyr Val Asp Asn  Glu Gln Ala Asp Ile  Glu Ile Leu
    1295                1300                1305


Ala Asn  Ser Phe Ile Asn Leu  Leu Thr Phe Thr Ala  Leu Gly Ala
    1310                1315                1320


Pro Ala  Ala Phe Lys Phe Phe  Gly Lys Asp Val Asp  Arg Lys Arg
    1325                1330                1335


Tyr Thr  Thr Val Ser Glu Ile  Leu Asn Ala Thr Leu  Ile His Gln
    1340                1345                1350


Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile Asp Leu  Ser Lys Leu
    1355                1360                1365


Gly Glu  Asp
    1370
```

<210> 773
<211> 1139
<212> PRT
<213> Streptococcus sp.

<400> 773

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Met Ser Asp Leu Val Leu Gly Leu Asp Ile Gly Ile Gly Ser Val Gly
1               5                  10                  15


Val Gly Ile Leu Asn Lys Val Thr Gly Glu Ile Ile His Lys Asn Ser
            20                  25                  30
```

```
Arg Ile Phe Pro Ala Ala Gln Ala Glu Asn Asn Leu Glu Arg Arg Thr
        35                  40                  45

Asn Arg Gln Gly Arg Arg Leu Thr Arg Arg Lys Lys His Arg Arg Val
    50                  55                  60

Arg Leu Asn His Leu Phe Glu Glu Ser Gly Leu Ile Thr Asp Phe Thr
65                  70                  75                  80

Lys Val Ser Ile Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly Leu
                85                  90                  95

Thr Ala Glu Leu Ser Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Met
            100                 105                 110

Val Lys His Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Asp Asp Gly
        115                 120                 125

Asn Ser Ser Val Gly Asp Tyr Ala Gln Ile Val Lys Glu Asn Ser Lys
    130                 135                 140

Gln Leu Glu Thr Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Tyr Gln
145                 150                 155                 160

Lys Tyr Gly Gln Leu Arg Gly Asp Phe Thr Val Glu Glu Asp Gly Arg
                165                 170                 175

Lys His Arg Leu Ile Asn Val Phe Pro Thr Ser Ala Tyr His Ala Glu
            180                 185                 190

Ala Leu Arg Ile Leu Gln Thr Gln Gln Glu Phe Asn Pro Gln Ile Thr
        195                 200                 205

Asp Glu Phe Ile Asn Ser Tyr Leu Glu Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220
```

```
Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Lys
225                 230                 235                 240

Tyr Thr Thr Lys Lys Asp Ala Gln Gly Gln Tyr Ile Thr Leu Asn Asn
                245                 250                 255

Ile Phe Gly Ile Leu Ile Gly Lys Cys Thr Phe Tyr Pro Glu Glu Tyr
            260                 265                 270

Arg Ala Ala Lys Ala Ser Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn
        275                 280                 285

Asp Leu Asn Asn Leu Thr Val Pro Thr Glu Thr Lys Lys Leu Ser Glu
    290                 295                 300

Glu Gln Lys Tyr Gln Ile Ile Thr Tyr Val Lys Asn Glu Lys Ala Met
305                 310                 315                 320

Gly Pro Ala Lys Leu Phe Lys Tyr Ile Ala Lys Leu Leu Ser Cys Asp
                325                 330                 335

Val Ala Asp Ile Lys Gly Tyr Arg Ile Asp Lys Ser Asp Lys Ala Glu
            340                 345                 350

Ile His Thr Phe Glu Ala Tyr Arg Lys Met Lys Thr Leu Glu Thr Leu
        355                 360                 365

Asp Val Lys Lys Met Ala Arg Glu Glu Leu Asp Lys Leu Ala Tyr Val
    370                 375                 380

Leu Thr Leu Asn Thr Glu Arg Glu Gly Ile Gln Glu Ala Leu Asp His
385                 390                 395                 400

Glu Phe Ala Asp Gly Thr Phe Ser Gln Glu Gln Val Asp Glu Leu Val
                405                 410                 415

Gln Phe Arg Lys Ala Asn Ser Ser Ile Phe Gly Lys Gly Trp His Ser
            420                 425                 430
```

```
Phe Ser Val Lys Leu Met Met Glu Leu Ile Pro Glu Leu Tyr Ala Thr
        435                 440                 445

Ser Glu Glu Gln Met Thr Ile Leu Thr Arg Leu Gly Lys Gln Lys Thr
    450                 455                 460

Thr Ser Ser Ser Asn Lys Thr Lys Tyr Ile Asp Glu Lys Gln Leu Thr
465                 470                 475                 480

Glu Glu Ile Tyr Asn Pro Val Val Ala Lys Ser Val Arg Gln Ala Ile
                485                 490                 495

Lys Ile Val Asn Ala Ala Ile Lys Lys Tyr Gly Asp Phe Asp Asn Ile
            500                 505                 510

Val Ile Glu Met Ala Arg Glu Thr Asn Glu Asp Asp Glu Lys Lys Ala
        515                 520                 525

Ile Gln Lys Ile Gln Lys Ala Asn Lys Ala Glu Lys Asp Ala Ala Met
    530                 535                 540

Arg Lys Ala Ala Asn Gln Tyr Asn Gly Lys Ala Glu Leu Pro His Ser
545                 550                 555                 560

Val Phe His Gly His Lys Gln Leu Ala Thr Lys Ile Arg Leu Trp His
                565                 570                 575

Gln Gln Gly Glu Arg Cys Leu Tyr Thr Gly Lys Thr Ile Ser Ile His
            580                 585                 590

Asp Leu Ile Asn Asn Pro Asn Gln Phe Glu Ile Asp His Ile Leu Pro
        595                 600                 605

Leu Ser Ile Thr Phe Asp Asp Ser Leu Ala Asn Lys Val Leu Val Tyr
    610                 615                 620
```

```
Ala Thr Ala Asn Gln Glu Lys Gly Gln Arg Thr Pro Tyr Gln Ala Leu
625                 630                 635                 640

Asp Ser Met Asp Asp Ala Trp Ser Phe Arg Glu Leu Lys Ala Phe Val
                645                 650                 655

Arg Glu Ser Lys Ala Leu Ser Asn Lys Lys Lys Glu Tyr Leu Leu Thr
            660                 665                 670

Glu Glu Asp Ile Ser Lys Phe Asp Val Arg Lys Lys Phe Ile Glu Arg
        675                 680                 685

Asn Leu Val Asp Thr Arg Tyr Ala Ser Arg Val Val Leu Asn Ala Leu
    690                 695                 700

Gln Glu His Phe Arg Thr His Lys Ile Asp Thr Lys Val Ser Val Val
705                 710                 715                 720

Arg Gly Gln Phe Thr Ser Gln Leu Arg Arg His Trp Gly Ile Glu Lys
                725                 730                 735

Thr Arg Asp Thr Tyr His His His Ala Val Asp Ala Leu Ile Ile Ala
            740                 745                 750

Ala Ser Ser Gln Leu Asn Leu Trp Lys Lys Gln Lys Asn Thr Leu Val
        755                 760                 765

Ser Tyr Ser Glu Asp Gln Leu Leu Asp Ile Glu Thr Gly Glu Leu Ile
    770                 775                 780

Ser Asp Asp Glu Tyr Lys Glu Ser Val Phe Lys Ala Pro Tyr Gln His
785                 790                 795                 800

Phe Val Asp Thr Leu Lys Ser Lys Glu Phe Glu Asp Ser Ile Leu Phe
                805                 810                 815

Ser Tyr Gln Val Asp Ser Lys Phe Asn Arg Lys Ile Ser Asp Ala Thr
            820                 825                 830
```

```
Ile Tyr Ala Thr Arg Lys Ala Lys Leu Asp Lys Glu Lys Lys Glu Tyr
        835                 840                 845

Thr Tyr Thr Leu Gly Lys Ile Lys Asp Ile Tyr Ala Leu Gly Thr Lys
    850                 855                 860

Thr Pro Ser Lys Thr Gly Phe Tyr Lys Phe Leu Asp Leu Tyr Lys Lys
865                 870                 875                 880

Asp Lys Ser Gln Phe Leu Met Tyr Gln Lys Asp Arg Arg Thr Trp Asp
                885                 890                 895

Glu Val Ile Glu Lys Ile Leu Glu Gln Tyr Arg Pro Phe Lys Glu Lys
            900                 905                 910

Asp Lys Asn Gly Lys Glu Val Asp Phe Asn Pro Phe Glu Lys Tyr Arg
        915                 920                 925

Ile Glu Asn Gly Pro Ile Arg Lys Tyr Ser Arg Lys Gly Asn Gly Pro
    930                 935                 940

Glu Ile Lys Ser Leu Lys Tyr Tyr Asp Asn Leu Leu Gly Arg Phe Val
945                 950                 955                 960

Asp Ile Thr Pro Ser Glu Ser Lys Asn Pro Val Ala Leu Leu Ser Leu
                965                 970                 975

Asn Pro Trp Arg Thr Asp Val Tyr Tyr Asn Thr Glu Thr Arg Lys Tyr
            980                 985                 990

Glu Phe Leu Gly Leu Lys Tyr Ala  Asp Leu Cys Phe Glu  Lys Gly Gly
        995                 1000                1005

Ser Tyr  Gly Ile Ser Lys Val  Lys Tyr Asn Lys Ile  Arg Glu Lys
    1010                1015                1020
```

```
Glu Gly  Ile Gly Lys Asn Ser  Glu Phe Lys Phe Thr  Leu Tyr Lys
    1025                1030                1035


Asn Asp  Leu Ile Leu Ile Lys  Asp Thr Glu Thr Asn  Arg Gln Gln
    1040                1045                1050


Ile Phe  Arg Phe Trp Ser Arg  Thr Gly Lys Asp Asn  Pro Lys Ser
    1055                1060                1065


Phe Glu  Lys His Lys Leu Glu  Leu Lys Pro Tyr Glu  Lys Thr Arg
    1070                1075                1080


Phe Glu  Lys Gly Glu Glu Leu  Lys Val Leu Gly Lys  Val Pro Pro
    1085                1090                1095


Ser Ser  Asn Arg Leu Gln Lys  Asn Met Gln Ile Glu  Asn Leu Ser
    1100                1105                1110


Ile Tyr  Lys Val Arg Thr Asp  Val Leu Gly Asn Gln  His Ile Ile
    1115                1120                1125


Lys Asn  Glu Gly Asp Lys Pro  Lys Leu Asp Phe
    1130                1135


<210>  774
<211>  1375
<212>  PRT
<213>  Streptococcus sp.

<400>  774

Met Ser Asn Lys Ser Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser
1               5                   10                  15


Val Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys
            20                  25                  30


Met Lys Val Leu Gly Asn Thr Asp Lys His Phe Ile Lys Lys Asn Leu
        35                  40                  45
```

```
Ile Gly Ala Leu Leu Phe Asp Glu Gly Thr Thr Ala Glu Asp Arg Arg
    50                  55                  60

Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu
65                  70                  75                  80

Arg Tyr Leu Gln Glu Ile Phe Ser Gln Glu Ile Ser Lys Val Asp Ser
                85                  90                  95

Ser Phe Phe His Arg Leu Asp Asp Phe Phe Leu Val Pro Glu Asp Lys
            100                 105                 110

Arg Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Val Glu Glu Lys Glu
        115                 120                 125

Tyr His Lys Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala
    130                 135                 140

Asp Ser Lys Glu Lys Thr Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala
145                 150                 155                 160

His Met Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Glu Ser Phe Asp
                165                 170                 175

Ile Lys Asn Asn Asp Ile Gln Lys Ile Phe Ser Glu Phe Ile Ser Ile
            180                 185                 190

Tyr Asp Asn Thr Phe Glu Gly Lys Ser Leu Ser Gly Gln Asn Ala Gln
        195                 200                 205

Val Glu Ala Ile Phe Thr Asp Lys Ile Ser Lys Ser Thr Lys Arg Glu
    210                 215                 220

Arg Val Leu Lys Leu Phe Pro Asp Glu Lys Ser Thr Gly Leu Phe Ser
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
```

```
                245                 250                 255

Phe Asp Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Asp Phe Ala
        275                 280                 285

Asp Leu Phe Leu Val Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Lys Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Glu Arg Tyr Glu Asn His Gln Lys Asp Leu Ala Ala Leu
                325                 330                 335

Lys Gln Phe Ile Gln Asn Asn Leu Gln Glu Lys Tyr Asp Glu Val Phe
            340                 345                 350

Ser Asp Gln Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr
        355                 360                 365

Thr Gln Glu Ala Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Phe
    370                 375                 380

Glu Gly Ala Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu
385                 390                 395                 400

Lys Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His
                405                 410                 415

Leu Gln Glu Met Asn Ala Ile Ile Arg Arg Gln Gly Glu His Tyr Pro
            420                 425                 430

Phe Leu Gln Glu Asn Lys Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445
```

```
Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Gly Asp Phe Ala
    450                 455                 460

Trp Leu Thr Arg Asn Ser Asp Gln Ala Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Glu Ile Val Asp Gln Ala Ser Ser Ala Glu Asp Phe Ile Asn Lys Met
                485                 490                 495

Thr Asn Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Lys Phe Ile Ala Glu Gly Leu Thr Arg Tyr Gln Phe Leu Asp Lys Lys
    530                 535                 540

Gln Lys Lys Asp Ile Phe Asp Thr Phe Phe Lys Ala Glu Asn Lys Arg
545                 550                 555                 560

Lys Val Thr Glu Lys Asp Ile Ile His Tyr Leu His Asn Val Asp Gly
                565                 570                 575

Tyr Asp Gly Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser
            580                 585                 590

Leu Ser Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Ala Phe
        595                 600                 605

Met Asp Asp Ser Lys Asn Glu Glu Ile Leu Glu Asn Ile Ile His Thr
    610                 615                 620

Leu Thr Ile Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln
625                 630                 635                 640

Tyr Asp Ser Leu Phe Asp Glu Lys Val Ile Lys Ala Leu Thr Arg Arg
```

```
                645                 650                 655

His Tyr Thr Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Lys Ser Gly Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Glu Ile Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Glu Ile Ile Gln Lys Ala Gln Val Phe Gly Lys Thr Asn
705                 710                 715                 720

Asp Val Lys Gln Val Val Gln Glu Leu Pro Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly His Ala Pro Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Ala Arg Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg
    770                 775                 780

Ile Glu Asp Ser Leu Lys Asn Leu Ala Ser Gly Leu Asp Ser Asn Ile
785                 790                 795                 800

Leu Lys Glu Asn Pro Thr Asp Asn Ile Gln Leu Gln Asn Asp Arg Leu
                805                 810                 815

Phe Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Lys Pro
            820                 825                 830

Leu Glu Ile Asn Gln Leu Ser Asn Tyr Asp Ile Asp His Ile Ile Pro
        835                 840                 845
```

```
Gln Ala Phe Ile Lys Asp Asp Ser Leu Asp Asn Arg Val Leu Thr Ser
    850                 855                 860

Ser Lys Asp Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Leu Glu Val
865                 870                 875                 880

Val Glu Lys Met Lys Ala Phe Trp Gln Gln Leu Leu Asp Ser Lys Leu
                885                 890                 895

Ile Ser Glu Arg Lys Phe Asn Asn Leu Thr Lys Ala Glu Arg Glu Arg
            900                 905                 910

Gly Gly Leu Asn Glu Leu Asp Lys Val Gly Phe Ile Lys Arg Gln Leu
        915                 920                 925

Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln Phe Leu Asp Ala
    930                 935                 940

Arg Phe Asn Lys Glu Val Thr Glu Lys Asp Lys Lys Asn Arg Asn Val
945                 950                 955                 960

Lys Ile Ile Thr Leu Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu
                965                 970                 975

Phe Gly Leu Tyr Lys Val Arg Glu Ile Asn Asp Tyr His His Ala His
            980                 985                 990

Asp Ala Tyr Leu Asn Ala Val Leu  Ala Lys Ala Ile Leu  Lys Lys Tyr
        995                 1000                1005

Pro Lys  Leu Glu Pro Glu Phe  Val Tyr Gly Asp Tyr  Gln Lys Tyr
    1010                1015                1020

Asp Leu  Gln Arg Tyr Ile Ser  Lys Ser Arg Glu Pro  Lys Glu Val
    1025                1030                1035

Glu Lys  Ala Thr Gln Lys Tyr  Phe Phe Tyr Ser Asn  Leu Leu Asn
```

```
    1040                1045                1050

Phe Phe  Lys Glu Glu Val His  Tyr Ala Asp Gly Thr  Ile Val Lys
    1055                1060                1065

Arg Glu  Asn Ile Glu Tyr Ser  Lys Asp Thr Gly Glu  Ile Ala Trp
    1070                1075                1080

Asn Lys  Glu Lys Asp Phe Ala  Thr Val Lys Lys Val  Leu Ser Leu
    1085                1090                1095

Pro Gln  Val Asn Ile Val Lys  Lys Thr Glu Val Gln  Thr Gly Gly
    1100                1105                1110

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1115                1120                1125

Ile Pro  Arg Lys Thr Lys Glu  Ile Leu Trp Asp Thr  Thr Lys Tyr
    1130                1135                1140

Gly Gly  Phe Asp Ser Pro Val  Ile Ala Tyr Ser Ile  Leu Leu Ile
    1145                1150                1155

Ala Asp  Ile Glu Lys Gly Lys  Ala Lys Lys Leu Lys  Thr Val Lys
    1160                1165                1170

Thr Leu  Val Gly Ile Thr Ile  Met Glu Lys Ala Thr  Phe Glu Lys
    1175                1180                1185

Asn Pro  Ile Thr Phe Leu Glu  Asn Lys Gly Tyr His  Asn Val Arg
    1190                1195                1200

Lys Glu  Asn Ile Leu Cys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu
    1205                1210                1215

Glu Ser  Gly Arg Arg Arg Met  Leu Ala Ser Ala Lys  Glu Leu Gln
    1220                1225                1230
```

```
Lys Gly  Asn Glu Ile Val Leu  Pro Val Tyr Leu Thr  Thr Leu Leu
    1235                1240                1245


Tyr His  Ser Lys Asn Val His  Lys Leu Asp Glu Pro  Glu His Leu
    1250                1255                1260


Glu Tyr  Ile Gln Lys His Arg  Tyr Glu Phe Lys Asp  Leu Leu Asn
    1265                1270                1275


Leu Val  Ser Glu Phe Ser Gln  Lys Tyr Val Leu Ala  Asp Ala Asn
    1280                1285                1290


Leu Glu  Lys Ile Lys Asn Leu  Tyr Ala Asp Asn Glu  Gln Ala Asp
    1295                1300                1305


Ile Glu  Ile Leu Ala Asn Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1310                1315                1320


Ala Leu  Gly Ala Pro Ala Ala  Phe Lys Phe Leu Gly  Lys Asp Val
    1325                1330                1335


Asp Arg  Lys Arg Tyr Thr Thr  Val Ser Glu Ile Leu  Asn Ala Thr
    1340                1345                1350


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1355                1360                1365


Leu Ser  Lys Leu Gly Glu Asp
    1370                1375


<210>  775
<211>  206
<212>  PRT
<213>  Streptococcus sp.

<400>  775

Arg Thr Pro Phe Gln Ala Leu Asp Ser Met Asp Asp Ala Trp Ser Tyr
1               5                   10                  15
```

```
Arg Glu Phe Lys Ser Tyr Val Lys Glu Ser Lys Leu Leu Gly Asn Lys
            20                  25                  30

Lys Lys Glu Tyr Leu Leu Thr Glu Glu Asp Ile Ser Lys Ile Glu Val
        35                  40                  45

Lys Gln Lys Phe Ile Glu Arg Asn Leu Ile Asp Thr Arg Tyr Ser Ser
    50                  55                  60

Arg Val Val Leu Asn Ala Leu Gln Asp Phe Tyr Lys Ala His Lys Phe
65                  70                  75                  80

Asp Thr Thr Ile Ser Val Val Arg Gly Gln Phe Thr Ser Gln Leu Arg
                85                  90                  95

Arg Lys Trp Gly Leu Glu Lys Ser Arg Glu Thr Tyr His His His Ala
            100                 105                 110

Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Arg Leu Trp Lys
        115                 120                 125

Lys Gln Asn Asn Pro Leu Ile Ala Tyr Lys Glu Gly Gln Phe Val Asp
    130                 135                 140

Ser Glu Thr Gly Glu Ile Ile Ser Leu Ser Asp Asp Glu Tyr Lys Glu
145                 150                 155                 160

Leu Val Phe Lys Ala Pro Tyr Asp His Phe Val Asp Thr Leu Ser Ser
                165                 170                 175

Lys Thr Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln Val Asp Ser Lys
            180                 185                 190

Phe Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg
        195                 200                 205
```

<210> 776
<211> 1122
<212> PRT
<213> Streptococcus suis

<400> 776

```
Met Ser Asn Gly Lys Ile Leu Gly Leu Asp Ile Gly Ile Ala Ser Val
1               5                   10                  15


Gly Val Gly Val Ile Asp Ala Gln Thr Gly Glu Ile Ile His Ala Ser
            20                  25                  30


Ser Arg Ile Phe Pro Ser Ala Asn Ala Ala Asn Asn Ala Glu Arg Arg
        35                  40                  45


Thr Phe Arg Gly Ser Arg Arg Leu Ile Arg Arg Lys Lys His Arg Ile
    50                  55                  60


Lys Arg Leu Asp Asp Leu Phe Asn Asp Phe His Ile Asn Leu Asp Gly
65                  70                  75                  80


Glu Met Ser Thr Asp Asn Pro Tyr Val Leu Arg Val Lys Gly Leu Ser
                85                  90                  95


Gln Lys Leu Thr Val Glu Glu Leu Tyr Ile Ser Ile Lys Asn Ile Met
            100                 105                 110


Lys Arg Arg Gly Ile Ser Tyr Leu Asp Asp Ala Glu Ser Asp Asn Glu
        115                 120                 125


Ala Gly Arg Ser Asp Tyr Ala Lys Ala Ile Glu Arg Asn Arg Gln Leu
    130                 135                 140


Leu Thr Ser Lys Thr Pro Gly Glu Ile Gln Leu Glu Arg Leu Glu Lys
145                 150                 155                 160


Tyr Gly Gln Leu Arg Gly Asn Phe Thr Ile Ile Asp Glu Glu Gly Gln
                165                 170                 175
```

```
Ser Gln Gln Ile Ile Asn Val Phe Ser Thr Ser Asp Tyr Val Lys Glu
            180                 185                 190

Val Glu Lys Ile Leu Asp Cys Gln Lys Met Tyr His Lys Phe Ile Ser
        195                 200                 205

Asp Glu Phe Cys Asp Lys Leu Ile Glu Leu Leu Arg Glu Lys Arg Lys
    210                 215                 220

Tyr Tyr Val Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Ile
225                 230                 235                 240

Tyr Arg Thr Asp Gly Thr Thr Leu Glu Asn Leu Phe Gly Ile Leu Ile
                245                 250                 255

Gly Lys Cys Thr Phe Tyr Pro Asp Gln Tyr Arg Ser Ser Arg Ala Ser
            260                 265                 270

Tyr Thr Ala Gln Glu Phe Asn Phe Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285

Val Pro Thr Glu Thr Lys Lys Leu Ser Gln Glu Gln Lys Glu Phe Leu
    290                 295                 300

Val Asn Tyr Ala Lys Glu Thr Ser Val Leu Gly Ala Gly Lys Ile Leu
305                 310                 315                 320

Gln Gln Ile Ala Lys Leu Ala Asp Cys Lys Val Glu Asp Ile Arg Gly
                325                 330                 335

Tyr Arg Leu Asp Asn Lys Asp Lys Pro Glu Leu His Thr Phe Glu Thr
            340                 345                 350

Tyr Arg Ala Met Lys Gly Leu Val Pro Leu Val Asp Ile Gly Val Leu
        355                 360                 365

Ser Arg Glu Gln Leu Asp Ile Leu Ala Asp Ile Leu Thr Leu Asn Thr
```

```
    370                 375                 380

Asp Phe Glu Gly Ile Arg Glu Ala Leu Lys Lys Gln Leu Pro Asn Val
385                 390                 395                 400

Phe Asp Glu Lys Gln Val Lys Gly Leu Ala Ser Phe Arg Lys Ser Lys
                405                 410                 415

Ser Gln Leu Phe Ala Lys Gly Trp His Asn Leu Ser Gln Lys Ile Met
            420                 425                 430

Leu Glu Val Ile Pro Glu Leu Tyr Ala Thr Ser Asp Glu Gln Met Thr
        435                 440                 445

Ile Leu Thr Arg Leu Gly Lys Phe Glu Lys Ser Ser Val Ala Glu Tyr
    450                 455                 460

Pro Ser Ser Ile Asn Val Asp Glu Ile Thr Asp Glu Ile Tyr Asn Pro
465                 470                 475                 480

Val Val Ala Lys Ser Ile Arg Gln Thr Ile Lys Ile Ile Asn Ala Ser
                485                 490                 495

Ile Lys Lys Trp Asp Glu Phe Asp Gln Ile Val Ile Glu Met Pro Arg
            500                 505                 510

Asp Arg Asn Glu Asp Glu Glu Lys Lys Arg Ile Ala Asp Gly Gln Lys
        515                 520                 525

Ala Asn Ala Lys Glu Lys Ala Asp Ser Ile Leu Arg Ala Ala Glu Leu
    530                 535                 540

Tyr Cys Ala Gly Lys Val Leu Pro Asp Tyr Val Tyr Asn Gly His Asn
545                 550                 555                 560

Gln Leu Ala Thr Lys Ile Arg Leu Trp Tyr Gln Gln Gly Glu Arg Cys
                565                 570                 575
```

```
Ile Tyr Thr Gly Gln Pro Ile Ser Ile His Asp Leu Ile His Asn Gln
            580                 585                 590

Asn Gln Tyr Glu Ile Asp His Ile Leu Pro Leu Ser Leu Thr Phe Asp
        595                 600                 605

Asp Ser Leu Ser Asn Lys Val Leu Val Leu Ala Thr Ala Asn Gln Glu
    610                 615                 620

Lys Ala Gln Arg Thr Pro Tyr Asn Tyr Leu Lys Ser Ala Thr Ser Ala
625                 630                 635                 640

Trp Ser Tyr Arg Glu Phe Lys Asp Tyr Val Thr Lys Arg Lys Gly Ile
                645                 650                 655

Gly Lys Lys Lys Cys Glu Tyr Leu Thr Phe Glu Glu Asp Ile Asn Gly
            660                 665                 670

Phe Glu Val Arg Ser Lys Phe Ile Gln Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Ala Ser Lys Val Ile Leu Asn Ala Leu Gln Asp Tyr Phe Lys Ile
    690                 695                 700

Ser Gly Ile Gln Thr Lys Val Ser Val Val Arg Gly Gln Phe Thr Ser
705                 710                 715                 720

Gln Leu Arg His Lys Trp Gly Ile Glu Lys Thr Arg Glu Thr Tyr His
                725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Arg
            740                 745                 750

Leu Trp Lys Lys Gln Glu Ser Pro Leu Val Val Asp Tyr Gln Glu Gly
        755                 760                 765

Arg Gln Val Asp Leu Glu Thr Gly Glu Ile Leu Glu Leu Thr Asp Glu
```

```
    770                 775                 780

Gln Tyr Lys Glu Leu Val Tyr Gln Pro Pro Tyr Gln Gly Phe Val Asn
785                 790                 795                 800

Thr Ile Ser Ser Ser Ala Phe Asp Asn Glu Ile Leu Phe Ser Tyr Gln
                805                 810                 815

Val Asp Ser Lys Val Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala
            820                 825                 830

Thr Arg Asn Ala Gln Leu Gly Lys Asp Lys Thr Glu Gly Ile Tyr Val
        835                 840                 845

Leu Gly Lys Ile Lys Asp Ile Tyr Thr Gln Ala Gly Tyr Glu Ala Phe
    850                 855                 860

Leu Lys Arg Tyr Thr Lys Asp Lys Thr Ser Phe Leu Met Tyr His Lys
865                 870                 875                 880

Asp Leu Asp Thr Trp Glu Lys Val Ile Glu Ile Ile Leu Arg Asp Tyr
                885                 890                 895

Arg Glu Tyr Asp Glu Lys Gly Lys Glu Ile Gly Asn Pro Phe Glu Arg
            900                 905                 910

Tyr Arg Arg Glu Asn Gly Tyr Val Lys Lys Tyr Ser Arg Lys Gly Asn
        915                 920                 925

Gly Thr Ala Ile Lys Ser Leu Lys Tyr Tyr Asp Asn Lys Leu Gly Asn
    930                 935                 940

His Ile Asp Ile Thr Pro Glu Asn Ser Arg Asn Ala Val Val Leu Gln
945                 950                 955                 960

Ser Leu Lys Pro Trp Arg Thr Asp Val Tyr Phe Asn Lys Glu Thr Gly
                965                 970                 975
```

Lys Tyr Glu Phe Leu Gly Ile Lys Tyr Ser Asp Leu Ser Phe Glu Lys
980 985 990

Gly Thr Gly Glu Tyr Gly Ile Ser Gln Glu Lys Tyr Asp Ser Ile Lys
995 1000 1005

Ile Ala Glu Gly Val Ala Lys Lys Ser Ile Phe Lys Phe Thr Leu
1010 1015 1020

Tyr Lys Gln Asp Leu Leu Phe Ile Lys Asp Ile Glu Asn Asn Phe
1025 1030 1035

Gly Lys Leu Leu Arg Phe Thr Ser Lys Asn Asp Thr Ser Lys His
1040 1045 1050

Tyr Val Glu Leu Lys Pro Tyr Asp Lys Asn Lys Phe Gly Thr Glu
1055 1060 1065

Glu Pro Leu Leu Pro Val Leu Gly Asn Val Ala Lys Ser Gly Gln
1070 1075 1080

Cys Ile Lys Gly Leu Asn Lys Ser Asn Ile Ser Ile Tyr Lys Val
1085 1090 1095

Arg Thr Asp Ile Leu Gly Tyr Arg His Phe Ile Lys Gln Glu Gly
1100 1105 1110

Glu His Pro Gln Leu Lys Phe Lys Lys
1115 1120

<210> 777
<211> 1381
<212> PRT
<213> Streptococcus suis

<400> 777

Met Val Lys Lys Lys Tyr Ala Ile Gly Ile Asp Ile Gly Thr Asn Ser
1 5 10 15

```
Val Gly Trp Ser Ile Val Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys
            20                  25                  30

Met Lys Val Phe Gly Asn Thr Glu Lys Arg Tyr Ile Lys Lys Asn Leu
        35                  40                  45

Leu Gly Thr Leu Leu Phe Asp Glu Gly Asn Thr Ala Glu Asn Arg Arg
    50                  55                  60

Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile
65                  70                  75                  80

Leu Tyr Leu Gln Glu Ile Phe Ala Glu Glu Ile Asn Lys Ile Asp Asp
                85                  90                  95

Ser Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Ile Val Glu Asp Lys
            100                 105                 110

Gln Gly Ser Lys His Pro Ile Phe Gly Thr Leu Gln Glu Glu Lys Glu
        115                 120                 125

Tyr His Lys Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Gln Leu Ala
    130                 135                 140

Asp Ser Ser Gln Lys Ala Asp Ile Arg Leu Ile Tyr Leu Ala Leu Ala
145                 150                 155                 160

His Ile Ile Lys Tyr Arg Gly His Phe Leu Phe Glu Gly Asp Leu Lys
                165                 170                 175

Ser Glu Asn Lys Asp Val Gln His Leu Phe Asn Asp Phe Val Glu Met
            180                 185                 190

Phe Asp Lys Thr Val Glu Gly Ser Tyr Leu Ser Glu Asn Leu Pro Asn
        195                 200                 205
```

```
Val Ala Asp Val Leu Val Glu Lys Val Ser Lys Ser Arg Arg Leu Glu
    210                 215                 220

Asn Ile Leu His Tyr Phe Pro Asn Glu Lys Lys Asn Gly Leu Phe Gly
225                 230                 235                 240

Asn Phe Leu Ala Leu Ala Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn
                245                 250                 255

Phe Glu Leu Ala Glu Asp Ala Lys Ile Gln Phe Ser Lys Glu Thr Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala
        275                 280                 285

Asp Leu Phe Ile Ala Thr Lys Ser Leu Tyr Asp Gly Ile Leu Leu Ala
    290                 295                 300

Gly Ile Leu Ser Thr Thr Asp Ser Thr Thr Lys Ala Pro Leu Ser Ser
305                 310                 315                 320

Ser Met Val Asn Arg Tyr Glu Glu His Gln Lys Asp Leu Ala Leu Leu
                325                 330                 335

Lys Asn Phe Ile His Gln Asn Leu Ser Asp Ser Tyr Lys Glu Val Phe
            340                 345                 350

Asn Asp Lys Leu Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Thr Gln Glu Asn Phe Tyr Arg Phe Ile Lys Lys Ala Ile Glu Lys Ile
    370                 375                 380

Glu Gly Ser Asn Tyr Phe Ile Asp Lys Ile Asp Arg Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His
                405                 410                 415
```

```
Leu Gln Glu Met His Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro
            420                 425                 430

Phe Leu Val Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Glu Phe Ala
    450                 455                 460

Trp Leu Asn Arg Lys Ser Asp Glu Lys Ile Arg Pro Trp Asn Phe Asp
465                 470                 475                 480

Glu Met Val Asp Lys Glu Thr Ser Ala Glu Asn Phe Ile Thr Arg Met
                485                 490                 495

Thr Asn Tyr Asp Arg Tyr Leu Pro Asp Gln Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Leu Tyr Glu Lys Phe Ala Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Lys Phe Ile Ala Glu Gly Met Arg Asp Tyr Gln Phe Leu Asp Ser Gly
    530                 535                 540

Gln Lys Lys Asp Ile Val Lys Thr Leu Phe Lys Thr Lys Arg Lys Val
545                 550                 555                 560

Thr Ala Lys Asp Ile Lys Ala Tyr Leu Glu Asn Ser Asn Gly Tyr Ala
                565                 570                 575

Gly Val Glu Leu Lys Gly Leu Glu Glu Gln Phe Asn Ala Ser Leu Pro
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Leu Arg Asp Lys Ala Phe Ile Asp
        595                 600                 605
```

```
Ala Glu Glu Asn Gln Glu Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Lys Tyr Lys
625                 630                 635                 640

Asp Ile Leu Thr Glu Glu Gln Arg Lys Lys Leu Glu Arg Arg His Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile Leu Asp
            660                 665                 670

Lys Val Thr Arg Lys Thr Ile Leu Gly Tyr Leu Ile Asp Asp Gly Thr
        675                 680                 685

Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Thr Leu Ser Phe
    690                 695                 700

Val Asp Glu Ile Arg Leu Ala Gln Gly Ser Gly Glu Ala Glu Asp Tyr
705                 710                 715                 720

Arg Ala Glu Val Gln Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Ile Glu Val Met Gly
            740                 745                 750

Tyr Glu Pro Glu His Ile Val Val Glu Met Ala Arg Glu Asn Gln Phe
        755                 760                 765

Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Ile Asn Arg Leu Glu
    770                 775                 780

Asn Ala Leu Lys Asp Phe Gly Ser Lys Ile Leu Glu Glu Gln Lys Pro
785                 790                 795                 800

Tyr Gly Val Ser Lys Val Asn Asn Ile His Leu Gln Ser Asp Arg Leu
                805                 810                 815
```

```
Phe Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Asp Glu Glu
            820                 825                 830

Leu Asp Ile Asp His Leu Ser Glu Tyr Asp Ile Asp His Ile Ile Pro
        835                 840                 845

Gln Ala Phe Ile Lys Asp Asp Ser Leu Asp Asn Lys Val Leu Thr Lys
    850                 855                 860

Ser Ala Lys Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Met Glu Ile
865                 870                 875                 880

Val His Asn Arg Lys Asn Phe Trp Arg Gln Leu Leu Lys Ser Lys Leu
                885                 890                 895

Ile Ser Gln Arg Lys Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly
            900                 905                 910

Leu Thr Asn Glu Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu
        915                 920                 925

Thr Arg Gln Ile Thr Lys His Val Ala Arg Met Leu Asp Thr Arg Phe
    930                 935                 940

Asn Thr Lys Leu Asp Glu Ala Gly Asn Arg Ile Arg Asp Pro Lys Val
945                 950                 955                 960

Asn Ile Ile Thr Leu Lys Ser Asn Leu Val Ser Gln Phe Arg Lys Asp
                965                 970                 975

Tyr Gln Leu Tyr Lys Ile Arg Glu Ile Asn Asn Tyr His His Ala His
            980                 985                 990

Asp Ala Tyr Ile Asn Ala Val Val  Ala Thr Ala Leu Leu  Lys Lys Tyr
        995                 1000                1005
```

```
Pro Gln  Leu Ala Pro Glu Phe  Val Tyr Gly Glu Tyr  Pro Thr Tyr
    1010                1015                1020

Asn Ser  Tyr Asn Ser Arg Lys  Ser Ala Thr Glu Lys  Val Leu Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Arg Ile Val  Val His Ser
    1040                1045                1050

Lys Thr  Gly Glu Val Arg Ile  Arg Pro Val Ile Glu  Val Asn Lys
    1055                1060                1065

Glu Thr  Gly Glu Ile Val Trp  Asp Lys Lys Ser Asp  Phe Arg Thr
    1070                1075                1080

Val Arg  Lys Val Leu Ser Tyr  Pro Gln Val Asn Val  Val Lys Lys
    1085                1090                1095

Thr Glu  Val Gln Asn His Gly  Leu Asp Arg Gly Lys  Pro Lys Gly
    1100                1105                1110

Phe Tyr  Asn Ala Asn Leu Ser  Pro Arg Pro Lys Glu  Gly Ser Val
    1115                1120                1125

Glu Asn  Leu Val Pro Ala Lys  Gln Ser Phe Asp Thr  Lys Arg Tyr
    1130                1135                1140

Gly Gly  Tyr Ala Gly Ile Ser  Asn Ser Tyr Ala Val  Leu Val Asn
    1145                1150                1155

Gly Ile  Ile Glu Lys Gly Lys  Lys Lys Ser Lys Ala  Glu Val Thr
    1160                1165                1170

Glu Phe  Gln Gly Ile Ser Ile  Leu Ala Arg Lys Asp  Phe Asp Lys
    1175                1180                1185

Asn Pro  Lys Gln Tyr Leu Leu  Asn Leu Gly Tyr Lys  Asp Ile Lys
    1190                1195                1200
```

```
Ser Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu Phe Glu  Leu Glu Asn
    1205                 1210                 1215

Gly Ser  Arg Arg Met Leu Ala  Ser Ile Leu Ser Thr  Asn Asn Lys
    1220                 1225                 1230

Arg Gly  Glu Ile His Lys Gly  Asn Glu Met Tyr Leu  Pro Asp Lys
    1235                 1240                 1245

Phe Val  Thr Leu Leu Tyr His  Ala Met Arg Val Asn  Arg Thr Leu
    1250                 1255                 1260

Glu Pro  Gly His Lys Lys Tyr  Val Glu Thr His Arg  His Val Phe
    1265                 1270                 1275

Asp Glu  Leu Leu Ile Tyr Ile  Leu Glu Tyr Asn Glu  Lys Ile Val
    1280                 1285                 1290

Gly Ala  Lys Ala Asn Gly Lys  Arg Ile Val Glu Ala  Tyr Ser Ala
    1295                 1300                 1305

Arg Lys  Asp Thr Asp Asn Leu  Glu Glu Leu Cys Asn  Ser Phe Ile
    1310                 1315                 1320

Asn Leu  Leu Asn Leu Thr Ala  Leu Gly Ser Ala Val  Asp Phe Glu
    1325                 1330                 1335

Phe Leu  Gly Thr Lys Ile Pro  Arg Tyr Arg Asp Tyr  Thr Pro Ser
    1340                 1345                 1350

Ser Leu  Leu Lys Ala Thr Leu  Ile His Gln Ser Val  Thr Gly Leu
    1355                 1360                 1365

Tyr Glu  Thr Arg Ile Asp Leu  Ser Lys Leu Gly Gly  Asp
    1370                 1375                 1380
```

<210> 778
<211> 39
<212> PRT
<213> Streptococcus thermophilus

<400> 778

Gly Arg Cys Ile Lys Gly Leu Gly Lys Ser Asn Ile Ser Ile Tyr Lys
1 5 10 15

Val Arg Thr Asp Val Leu Gly Asn Gln His Ile Ile Lys Asn Glu Gly
20 25 30

Asp Lys Pro Lys Leu Asp Phe
35

<210> 779
<211> 302
<212> PRT
<213> Streptococcus thermophilus

<400> 779

Met Ile Arg Arg Lys Lys His Arg Ile Val Arg Leu Asn Arg Leu Phe
1 5 10 15

Glu Glu Ser Gly Leu Ile Thr Asp Phe Thr Lys Ile Ser Ile Asn Leu
20 25 30

Asn Pro Tyr Gln Leu Arg Val Lys Gly Leu Thr Asp Glu Leu Ser Asn
35 40 45

Glu Glu Leu Phe Ile Ala Leu Lys Asn Met Val Lys His Arg Gly Ile
50 55 60

Ser Tyr Leu Asp Asp Ala Ser Asp Asp Gly Asn Ser Ser Val Gly Asp
65 70 75 80

Tyr Ala Gln Ile Val Lys Glu Asn Ser Lys Gln Leu Glu Thr Lys Thr
85 90 95

```
Pro Gly Gln Ile Gln Leu Glu Arg Tyr Gln Thr Tyr Gly Gln Leu Arg
            100                 105                 110

Gly Asp Phe Thr Val Glu Lys Asp Gly Lys Lys His Arg Leu Ile Asn
        115                 120                 125

Val Phe Pro Thr Ser Ala Tyr Arg Ser Glu Ala Leu Arg Ile Leu Gln
    130                 135                 140

Thr Gln Gln Glu Phe Asn Pro Gln Ile Thr Asp Glu Phe Ile Asn Arg
145                 150                 155                 160

Tyr Leu Glu Ile Leu Thr Gly Lys Arg Lys Tyr Tyr His Gly Pro Gly
                165                 170                 175

Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg Tyr Arg Thr Ser Gly Glu
            180                 185                 190

Thr Leu Asp Asn Ile Phe Gly Ile Leu Ile Gly Lys Cys Thr Phe Tyr
        195                 200                 205

Pro Asp Glu Phe Arg Ala Ala Lys Ala Ser Tyr Thr Ala Gln Glu Phe
    210                 215                 220

Asn Leu Leu Asn Asp Leu Asn Asn Leu Thr Val Pro Thr Glu Thr Lys
225                 230                 235                 240

Lys Leu Ser Lys Glu Gln Lys Asn Gln Ile Ile Asn Tyr Val Lys Asn
                245                 250                 255

Glu Lys Ala Met Gly Pro Ala Lys Leu Phe Lys Tyr Ile Ala Lys Leu
            260                 265                 270

Leu Ser Cys Asp Val Ala Asp Ile Lys Gly Tyr Arg Ile Asp Lys Ser
        275                 280                 285

Gly Lys Ala Glu Arg Phe Ile Leu Ser Lys Pro Ile Glu Lys
    290                 295                 300
```

<210> 780
<211> 1121
<212> PRT
<213> Streptococcus thermophilus

<400> 780

```
Met Ser Asp Leu Val Leu Gly Leu Asp Ile Gly Ile Gly Ser Val Gly
1               5                   10                  15


Val Gly Ile Leu Asn Lys Val Thr Gly Glu Ile Ile His Lys Asn Ser
            20                  25                  30


Arg Ile Phe Pro Ala Ala Gln Ala Glu Asn Asn Leu Val Arg Arg Thr
        35                  40                  45


Asn Arg Gln Gly Arg Arg Leu Thr Arg Arg Lys Lys His Arg Ile Val
    50                  55                  60


Arg Leu Asn Arg Leu Phe Glu Glu Ser Gly Leu Ile Thr Asp Phe Thr
65                  70                  75                  80


Lys Ile Ser Ile Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly Leu
                85                  90                  95


Thr Asp Glu Leu Ser Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Met
            100                 105                 110


Val Lys His Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Asp Asp Gly
        115                 120                 125


Asn Ser Ser Val Gly Asp Tyr Ala Gln Ile Val Lys Glu Asn Ser Lys
    130                 135                 140


Gln Leu Glu Thr Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Tyr Gln
145                 150                 155                 160


Thr Tyr Gly Gln Leu Arg Gly Asp Phe Thr Val Glu Lys Asp Gly Lys
```

```
                165                 170                 175

Lys His Arg Leu Ile Asn Val Phe Pro Thr Ser Ala Tyr Arg Ser Glu
            180                 185                 190

Ala Leu Arg Ile Leu Gln Thr Gln Gln Glu Phe Asn Pro Gln Ile Thr
        195                 200                 205

Asp Glu Phe Ile Asn Arg Tyr Leu Glu Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240

Tyr Arg Thr Ser Gly Glu Thr Leu Asp Asn Ile Phe Gly Ile Leu Ile
                245                 250                 255

Gly Lys Cys Thr Phe Tyr Pro Asp Glu Phe Arg Ala Ala Lys Ala Ser
            260                 265                 270

Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285

Val Pro Thr Glu Thr Lys Lys Leu Ser Lys Glu Gln Lys Asn Gln Ile
    290                 295                 300

Ile Asn Tyr Val Lys Asn Glu Lys Ala Met Gly Pro Ala Lys Leu Phe
305                 310                 315                 320

Lys Tyr Ile Ala Lys Leu Leu Ser Cys Asp Val Ala Asp Ile Lys Gly
                325                 330                 335

Tyr Arg Ile Asp Lys Ser Gly Lys Ala Glu Ile His Thr Phe Glu Ala
            340                 345                 350

Tyr Arg Lys Met Lys Thr Leu Glu Thr Leu Asp Ile Glu Gln Met Asp
        355                 360                 365
```

```
Arg Glu Thr Leu Asp Lys Leu Ala Tyr Val Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Gln Glu Ala Leu Glu His Glu Phe Ala Asp Gly Ser
385                 390                 395                 400

Phe Ser Gln Lys Gln Val Asp Glu Leu Val Gln Phe Arg Lys Ala Asn
                405                 410                 415

Ser Ser Ile Phe Gly Lys Gly Trp His Asn Phe Ser Val Lys Leu Met
            420                 425                 430

Met Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr
        435                 440                 445

Ile Leu Thr Arg Leu Gly Lys Gln Lys Thr Thr Ser Ser Ser Asn Lys
    450                 455                 460

Thr Lys Tyr Ile Asp Glu Lys Leu Leu Thr Glu Glu Ile Tyr Asn Pro
465                 470                 475                 480

Val Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Val Asn Ala Ala
                485                 490                 495

Ile Lys Glu Tyr Gly Asp Phe Asp Asn Ile Val Ile Glu Met Ala Arg
            500                 505                 510

Glu Thr Asn Glu Asp Asp Glu Lys Lys Ala Ile Gln Lys Ile Gln Lys
        515                 520                 525

Ala Asn Lys Asp Glu Lys Asp Ala Ala Met Leu Lys Ala Ala Asn Gln
    530                 535                 540

Tyr Asn Gly Lys Ala Glu Leu Pro His Ser Val Phe His Gly His Lys
545                 550                 555                 560

Gln Leu Ala Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Arg Cys
```

```
                565                 570                 575

Leu Tyr Thr Gly Lys Thr Ile Ser Ile His Asp Leu Ile Asn Asn Ser
            580                 585                 590

Asn Gln Phe Glu Val Asp His Ile Leu Pro Leu Ser Ile Thr Phe Asp
        595                 600                 605

Asp Ser Leu Ala Asn Lys Val Leu Val Tyr Ala Thr Ala Asn Gln Glu
    610                 615                 620

Lys Gly Gln Arg Thr Pro Tyr Gln Ala Leu Asp Ser Met Asp Asp Ala
625                 630                 635                 640

Trp Ser Phe Arg Glu Leu Lys Ala Phe Val Arg Glu Ser Lys Thr Leu
                645                 650                 655

Ser Asn Lys Lys Lys Glu Tyr Leu Leu Thr Glu Glu Asp Ile Ser Lys
            660                 665                 670

Phe Asp Val Arg Lys Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Ala Ser Arg Val Val Leu Asn Ala Leu Gln Glu His Phe Arg Ala
    690                 695                 700

His Lys Ile Asp Thr Lys Val Ser Val Val Arg Gly Gln Phe Thr Ser
705                 710                 715                 720

Gln Leu Arg Arg His Trp Gly Ile Glu Lys Thr Arg Asp Thr Tyr His
                725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Asn
            740                 745                 750

Leu Trp Lys Lys Gln Lys Asn Thr Leu Val Ser Tyr Ser Glu Asp Gln
        755                 760                 765
```

```
Leu Leu Asp Ile Glu Thr Gly Glu Leu Ile Ser Asp Asp Glu Tyr Lys
    770                 775                 780

Glu Ser Val Phe Lys Ala Pro Tyr Gln His Phe Val Asp Thr Leu Lys
785                 790                 795                 800

Ser Lys Glu Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln Val Asp Ser
                805                 810                 815

Lys Phe Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg Gln
            820                 825                 830

Ala Lys Val Gly Lys Asp Lys Ala Asp Glu Thr Tyr Val Leu Gly Lys
        835                 840                 845

Ile Lys Asp Ile Tyr Thr Gln Asp Gly Tyr Asp Ala Phe Met Lys Ile
    850                 855                 860

Tyr Lys Lys Asp Lys Ser Lys Phe Leu Met Tyr Arg His Asp Pro Gln
865                 870                 875                 880

Thr Phe Glu Lys Val Ile Glu Pro Ile Leu Glu Asn Tyr Pro Asn Lys
                885                 890                 895

Gln Met Asn Glu Lys Gly Lys Glu Val Pro Cys Asn Pro Phe Leu Lys
            900                 905                 910

Tyr Lys Glu Glu His Gly Tyr Ile Arg Lys Tyr Ser Lys Lys Gly Asn
        915                 920                 925

Gly Pro Glu Ile Lys Ser Leu Lys Tyr Tyr Asp Ser Lys Leu Gly Asn
    930                 935                 940

His Ile Asp Ile Thr Pro Lys Asp Ser Asn Asn Lys Val Val Leu Gln
945                 950                 955                 960

Ser Val Ser Pro Trp Arg Ala Asp Ile Tyr Phe Asn Asn Thr Thr Gly
```

```
               965                 970                 975

Lys Tyr Glu Ile Leu Gly Leu Lys Tyr Ala Asp Leu Gln Phe Glu Lys
            980                 985                 990

Gly Thr Gly Thr Tyr Lys Ile Ser  Gln Glu Lys Tyr Asn  Asp Ile Lys
        995                 1000                1005

Lys Lys  Glu Gly Val Asp Ser  Asp Ser Glu Phe Lys  Phe Thr Leu
    1010                1015                1020

Tyr Lys  Asn Asp Leu Leu Leu  Val Lys Glu Thr Glu  Thr Lys Glu
    1025                1030                1035

Gln Gln  Leu Phe Arg Phe Leu  Ser Arg Thr Met Pro  Lys Gln Lys
    1040                1045                1050

His Tyr  Val Glu Leu Lys Pro  Tyr Asp Lys Gln Lys  Phe Glu Gly
    1055                1060                1065

Gly Glu  Ala Leu Ile Lys Val  Leu Gly Asn Val Ala  Asn Gly Gly
    1070                1075                1080

Gln Cys  Ile Lys Gly Leu Gly  Lys Ser Asn Ile Ser  Ile Tyr Lys
    1085                1090                1095

Val Arg  Thr Asp Val Leu Gly  Asn Gln His Ile Ile  Lys Asn Glu
    1100                1105                1110

Gly Asp  Lys Pro Lys Leu Asp  Phe
    1115                1120
```

<210> 781
<211> 1121
<212> PRT
<213> Streptococcus thermophilus

<400> 781

```
Met Ser Asp Leu Val Leu Gly Leu Asp Ile Gly Ile Gly Ser Val Gly
1               5                  10                  15

Val Gly Ile Leu Asn Lys Val Thr Gly Glu Ile Ile His Lys Asn Ser
            20                  25                  30

Arg Ile Phe Pro Ala Ala Gln Ala Glu Asn Asn Leu Val Arg Arg Thr
        35                  40                  45

Asn Arg Gln Gly Arg Arg Leu Thr Arg Arg Lys Lys His Arg Ile Val
    50                  55                  60

Arg Leu Asn Arg Leu Phe Glu Glu Ser Gly Leu Ile Thr Asp Phe Thr
65                  70                  75                  80

Lys Ile Ser Ile Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly Leu
                85                  90                  95

Thr Asp Glu Leu Ser Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Met
            100                 105                 110

Val Lys His Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Asp Asp Gly
        115                 120                 125

Asn Ser Ser Val Gly Asp Tyr Ala Gln Ile Val Lys Glu Asn Ser Lys
    130                 135                 140

Gln Leu Glu Thr Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Tyr Gln
145                 150                 155                 160

Thr Tyr Gly Gln Leu Arg Gly Asp Phe Thr Val Glu Lys Asp Gly Lys
                165                 170                 175

Lys His Arg Leu Ile Asn Val Phe Pro Thr Ser Ala Tyr Arg Ser Glu
            180                 185                 190

Ala Leu Arg Ile Leu Gln Thr Gln Gln Glu Phe Asn Pro Gln Ile Thr
        195                 200                 205
```

```
Asp Glu Phe Ile Asn Arg Tyr Leu Glu Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240

Tyr Arg Thr Ser Gly Glu Thr Leu Asp Asn Ile Phe Gly Ile Leu Ile
                245                 250                 255

Gly Lys Cys Thr Phe Tyr Pro Asp Glu Phe Arg Ala Ala Lys Ala Ser
            260                 265                 270

Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285

Val Pro Thr Glu Thr Lys Lys Leu Ser Lys Glu Gln Lys Asn Gln Ile
    290                 295                 300

Ile Asn Tyr Val Lys Asn Glu Lys Ala Met Gly Pro Ala Lys Leu Phe
305                 310                 315                 320

Lys Tyr Ile Ala Lys Leu Leu Ser Cys Asp Val Ala Asp Ile Lys Glu
                325                 330                 335

Tyr Arg Ile Asp Lys Ser Gly Lys Ala Glu Ile His Thr Phe Glu Ala
            340                 345                 350

Tyr Arg Lys Met Lys Thr Leu Glu Thr Leu Asp Ile Glu Gln Met Asp
        355                 360                 365

Arg Glu Thr Leu Asp Lys Leu Ala Tyr Val Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Gln Glu Ala Leu Glu His Glu Phe Ala Asp Gly Ser
385                 390                 395                 400
```

```
Phe Ser Gln Lys Gln Val Asp Glu Leu Val Gln Phe Arg Lys Ala Asn
                405                 410                 415

Ser Ser Ile Phe Gly Lys Gly Trp His Asn Phe Ser Val Lys Leu Met
            420                 425                 430

Met Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr
        435                 440                 445

Ile Leu Thr Arg Leu Gly Lys Gln Lys Thr Thr Ser Ser Ser Asn Lys
    450                 455                 460

Thr Lys Tyr Ile Asp Glu Lys Leu Leu Thr Glu Glu Ile Tyr Asn Pro
465                 470                 475                 480

Val Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Val Asn Ala Ala
                485                 490                 495

Ile Lys Glu Tyr Gly Asp Phe Asp Asn Ile Val Ile Glu Met Ala Arg
            500                 505                 510

Glu Thr Asn Glu Asp Asp Glu Lys Lys Ala Ile Gln Lys Ile Gln Lys
        515                 520                 525

Ala Asn Lys Asp Glu Lys Asp Ala Ala Met Leu Lys Ala Ala Asn Gln
    530                 535                 540

Tyr Asn Gly Lys Ala Glu Leu Pro His Ser Val Phe His Gly His Lys
545                 550                 555                 560

Gln Leu Ala Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Arg Cys
                565                 570                 575

Leu Tyr Thr Gly Lys Thr Ile Ser Ile His Asp Leu Ile Asn Asn Ser
            580                 585                 590

Asn Gln Phe Glu Val Asp His Ile Leu Pro Leu Ser Ile Thr Phe Asp
        595                 600                 605
```

```
Asp Ser Leu Ala Asn Lys Val Leu Val Tyr Ala Thr Ala Asn Gln Glu
    610                 615                 620

Lys Gly Gln Arg Thr Pro Tyr Gln Ala Leu Asp Ser Met Asp Asp Ala
625                 630                 635                 640

Trp Ser Phe Arg Glu Leu Lys Ala Phe Val Arg Glu Ser Lys Thr Leu
                645                 650                 655

Ser Asn Lys Lys Lys Glu Tyr Leu Leu Thr Glu Glu Asp Ile Ser Lys
            660                 665                 670

Phe Asp Val Arg Lys Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Ala Ser Arg Val Val Leu Asn Ala Leu Gln Glu His Phe Arg Ala
    690                 695                 700

His Lys Ile Asp Thr Lys Val Ser Val Val Arg Gly Gln Phe Thr Ser
705                 710                 715                 720

Gln Leu Arg Arg His Trp Gly Ile Glu Lys Thr Arg Asp Thr Tyr His
                725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ile Gln Leu Asn
            740                 745                 750

Leu Trp Lys Lys Gln Lys Asn Thr Leu Val Ser Tyr Ser Glu Asp Gln
        755                 760                 765

Leu Leu Asp Ile Glu Thr Gly Glu Leu Ile Ser Asp Asp Glu Tyr Lys
    770                 775                 780

Glu Ser Val Phe Lys Ala Pro Tyr Gln His Phe Val Asp Thr Leu Lys
785                 790                 795                 800
```

```
Ser Lys Glu Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln Val Asp Ser
                805                 810                 815

Lys Phe Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg Gln
            820                 825                 830

Ala Lys Val Gly Lys Asp Lys Ala Asp Glu Thr Tyr Val Leu Gly Lys
        835                 840                 845

Ile Lys Asp Ile Tyr Thr Gln Asp Gly Tyr Asp Ala Phe Met Lys Ile
    850                 855                 860

Tyr Lys Lys Asp Lys Ser Lys Phe Leu Met Tyr Arg His Asp Pro Gln
865                 870                 875                 880

Thr Phe Glu Lys Val Ile Glu Pro Ile Leu Glu Asn Tyr Pro Asn Lys
                885                 890                 895

Gln Ile Asn Glu Lys Gly Lys Glu Val Pro Val Asn Pro Phe Leu Lys
            900                 905                 910

Tyr Lys Glu Glu His Gly Tyr Ile Arg Lys Tyr Ser Lys Lys Gly Asn
        915                 920                 925

Gly Pro Glu Ile Lys Ser Leu Lys Tyr Tyr Asp Ser Lys Leu Gly Asn
    930                 935                 940

His Ile Asp Ile Thr Pro Lys Asp Ser Asn Asn Lys Val Val Leu Gln
945                 950                 955                 960

Ser Val Ser Pro Trp Arg Ala Asp Val Tyr Phe Asn Lys Thr Thr Gly
                965                 970                 975

Lys Tyr Glu Ile Leu Gly Leu Lys Tyr Ala Asp Leu Gln Phe Glu Lys
            980                 985                 990

Gly Thr Gly Thr Tyr Lys Ile Ser  Gln Glu Lys Tyr Asn  Asp Ile Lys
        995                 1000                1005
```

```
Lys Lys  Glu Gly Val Asp Ser  Asp Ser Glu Phe Lys  Phe Thr Leu
    1010                1015                1020


Tyr Lys  Asn Asp Leu Leu Leu  Val Lys Asp Thr Glu  Thr Lys Glu
    1025                1030                1035


Gln Gln  Leu Phe Arg Phe Leu  Ser Arg Thr Met Pro  Lys Gln Lys
    1040                1045                1050


His Tyr  Val Glu Leu Lys Pro  Tyr Asp Lys Gln Lys  Phe Glu Gly
    1055                1060                1065


Gly Glu  Ala Leu Ile Lys Val  Leu Gly Asn Val Ala  Asn Ser Gly
    1070                1075                1080


Gln Cys  Lys Lys Gly Leu Gly  Lys Ser Asn Ile Ser  Ile Tyr Lys
    1085                1090                1095


Val Arg  Thr Asp Val Leu Gly  Asn Gln His Ile Ile  Lys Asn Glu
    1100                1105                1110


Gly Asp  Lys Pro Lys Leu Asp  Phe
    1115                1120
```

<210> 782
<211> 1121
<212> PRT
<213> Streptococcus thermophilus

<400> 782

```
Met Ser Asp Leu Val Leu Gly Leu Asp Ile Gly Ile Gly Ser Val Gly
1               5                   10                  15


Val Gly Ile Leu Asn Lys Val Thr Gly Glu Ile Ile His Lys Asn Ser
            20                  25                  30


Arg Ile Phe Pro Ala Ala Gln Ala Glu Asn Asn Leu Val Arg Arg Thr
```

```
        35                  40                  45

Asn Arg Gln Gly Arg Arg Leu Thr Arg Arg Lys Lys His Arg Arg Val
    50                  55                  60

Arg Leu Asn Arg Leu Phe Glu Glu Ser Gly Leu Ile Thr Asp Phe Thr
65                  70                  75                  80

Lys Ile Ser Ile Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly Leu
                85                  90                  95

Thr Asp Glu Leu Ser Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Met
            100                 105                 110

Val Lys His Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Asp Asp Gly
        115                 120                 125

Asn Ser Ser Val Gly Asp Tyr Ala Gln Ile Val Lys Glu Asn Ser Lys
    130                 135                 140

Gln Leu Glu Thr Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Tyr Gln
145                 150                 155                 160

Thr Tyr Gly Gln Leu Arg Gly Asp Phe Thr Val Glu Lys Asp Gly Lys
                165                 170                 175

Lys His Arg Leu Ile Asn Val Phe Pro Thr Ser Ala Tyr Arg Ser Glu
            180                 185                 190

Ala Leu Arg Ile Leu Gln Thr Gln Gln Glu Phe Asn Pro Gln Ile Thr
        195                 200                 205

Asp Glu Phe Val Asn Arg Tyr Leu Glu Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240
```

```
Tyr Arg Thr Asn Gly Glu Thr Leu Asp Asn Ile Phe Gly Ile Leu Ile
                245                 250                 255

Gly Lys Cys Thr Phe Tyr Pro Glu Glu Phe Arg Ala Ala Lys Ala Ser
            260                 265                 270

Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285

Val Pro Thr Glu Thr Lys Lys Leu Ser Lys Glu Gln Lys Asn Gln Ile
    290                 295                 300

Ile Asn Tyr Val Lys Asn Glu Lys Ala Met Gly Pro Ala Lys Leu Phe
305                 310                 315                 320

Lys Tyr Ile Ala Lys Leu Leu Ser Cys Asp Val Ala Asp Ile Lys Gly
                325                 330                 335

Tyr Arg Ile Asp Lys Ser Gly Lys Ala Glu Ile His Thr Phe Glu Ala
            340                 345                 350

Tyr Arg Lys Met Lys Thr Leu Glu Thr Leu Asp Ile Glu Gln Met Asp
        355                 360                 365

Arg Glu Thr Leu Asp Lys Leu Ala Tyr Val Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Gln Glu Ala Leu Glu His Glu Phe Ala Asp Gly Ser
385                 390                 395                 400

Phe Ser Gln Lys Gln Val Asp Glu Leu Val Gln Phe Arg Lys Ala Asn
                405                 410                 415

Ser Ser Ile Phe Gly Lys Gly Trp His Asn Phe Ser Val Lys Leu Met
            420                 425                 430

Met Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr
```

```
        435                 440                 445

Ile Leu Lys Arg Leu Gly Lys Gln Lys Thr Thr Ser Ser Ser Asn Lys
    450                 455                 460

Thr Lys Tyr Ile Asp Glu Lys Leu Leu Thr Glu Glu Ile Tyr Asn Pro
465                 470                 475                 480

Val Val Ala Lys Ser Ile Arg Gln Ala Ile Lys Ile Val Asn Ala Ala
                485                 490                 495

Ile Lys Glu Tyr Gly Asp Phe Asp Asn Ile Val Ile Glu Met Ala Arg
            500                 505                 510

Glu Thr Asn Glu Asp Asp Glu Lys Lys Ala Ile Gln Lys Ile Gln Lys
        515                 520                 525

Ala Asn Lys Asp Glu Lys Asp Ala Ala Met Leu Lys Ala Ala Asn Gln
    530                 535                 540

Tyr Asn Gly Lys Ala Glu Leu Pro His Ser Val Phe His Gly His Lys
545                 550                 555                 560

Gln Leu Ala Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Arg Cys
                565                 570                 575

Leu Tyr Thr Gly Lys Thr Ile Ser Ile His Asp Leu Ile Asn Asn Pro
            580                 585                 590

Asn Gln Phe Glu Val Asp His Ile Leu Pro Leu Ser Ile Thr Phe Asp
        595                 600                 605

Asp Ser Leu Ala Asn Lys Val Leu Val Tyr Ala Thr Ala Asn Gln Glu
    610                 615                 620

Lys Gly Gln Arg Thr Pro Tyr Gln Ala Leu Asp Ser Met Asp Asp Ala
625                 630                 635                 640
```

```
Trp Ser Phe Arg Glu Leu Lys Ala Phe Val Arg Glu Ser Lys Thr Leu
                645                 650                 655

Ser Asn Lys Lys Lys Glu Tyr Leu Leu Thr Glu Glu Asp Ile Ser Lys
            660                 665                 670

Phe Asp Val Arg Lys Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Ala Ser Arg Val Val Leu Asn Ala Leu Gln Glu His Phe Arg Ala
    690                 695                 700

His Lys Ile Asp Thr Lys Val Ser Val Val Arg Gly Gln Phe Thr Ser
705                 710                 715                 720

Gln Leu Arg Arg His Trp Gly Ile Glu Lys Thr Arg Asp Thr Tyr His
                725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Asn
            740                 745                 750

Leu Trp Lys Lys Gln Lys Asn Thr Leu Val Ser Tyr Ser Glu Asp Gln
        755                 760                 765

Leu Leu Asp Ile Glu Thr Gly Glu Leu Ile Ser Asp Asp Glu Tyr Lys
    770                 775                 780

Glu Ser Val Phe Lys Ala Pro Tyr Gln His Phe Val Asp Thr Leu Lys
785                 790                 795                 800

Ser Lys Glu Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln Val Asp Ser
                805                 810                 815

Lys Phe Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg Gln
            820                 825                 830

Ala Lys Val Gly Lys Asp Lys Lys Asp Glu Thr Tyr Val Leu Gly Lys
```

```
        835                 840                 845

Ile Lys Asp Ile Tyr Thr Gln Asp Gly Tyr Asp Ala Phe Met Lys Ile
    850                 855                 860

Tyr Lys Lys Asp Lys Ser Lys Phe Leu Met Tyr Arg His Asp Pro Gln
865                 870                 875                 880

Thr Phe Glu Lys Val Ile Glu Pro Ile Leu Glu Asn Tyr Pro Asn Lys
                885                 890                 895

Glu Met Asn Glu Lys Gly Lys Glu Val Pro Cys Asn Pro Phe Leu Lys
            900                 905                 910

Tyr Lys Glu Glu His Gly Tyr Ile Arg Lys Tyr Ser Lys Lys Gly Asn
        915                 920                 925

Asp Pro Glu Ile Lys Ser Leu Lys Tyr Tyr Asp Ser Lys Leu Gly Asn
    930                 935                 940

His Ile Asp Ile Thr Pro Lys Asp Ser Asn Asn Lys Val Val Leu Gln
945                 950                 955                 960

Ser Val Ser Pro Trp Arg Ala Asp Val Tyr Phe Asn Lys Thr Thr Gly
                965                 970                 975

Lys Tyr Glu Ile Leu Gly Leu Lys Tyr Ala Asp Leu Gln Phe Glu Lys
            980                 985                 990

Gly Thr Gly Thr Tyr Lys Ile Ser  Gln Glu Lys Tyr Asn  Asp Ile Lys
        995                 1000                1005

Lys Lys  Glu Gly Val Asp Ser  Asp Ser Glu Phe Lys  Phe Thr Leu
    1010                1015                1020

Tyr Lys  Asn Asp Leu Leu Leu  Val Lys Asp Thr Glu  Thr Lys Glu
    1025                1030                1035
```

```
Gln Gln  Leu Phe Arg Phe Leu  Ser Arg Thr Met Pro  Lys Gln Lys
    1040                1045                1050


His Tyr  Val Glu Leu Lys Pro  Tyr Asp Lys Gln Lys  Phe Glu Gly
    1055                1060                1065


Gly Glu  Ala Leu Ile Lys Val  Leu Gly Asn Val Ala  Asn Ser Gly
    1070                1075                1080


Gln Cys  Lys Lys Gly Leu Gly  Lys Ser Asn Ile Ser  Ile Tyr Lys
    1085                1090                1095


Val Arg  Thr Asp Val Leu Gly  Asn Gln His Ile Ile  Lys Asn Glu
    1100                1105                1110


Gly Asp  Lys Pro Lys Leu Asp  Phe
    1115                1120
```

<210> 783
<211> 1122
<212> PRT
<213> Streptococcus thermophilus

<400> 783

```
Met Ser Asp Leu Val Leu Gly Leu Asp Ile Gly Ile Gly Ser Val Gly
1               5                   10                  15


Val Gly Ile Leu Asn Lys Val Thr Gly Glu Ile Ile His Lys Asn Ser
            20                  25                  30


Arg Ile Phe Pro Ala Ala Gln Ala Glu Asn Asn Val Glu Arg Arg Thr
        35                  40                  45


Asn Arg Gln Gly Arg Arg Leu Thr Arg Arg Lys Lys His Arg Arg Val
    50                  55                  60


Arg Leu Asn Arg Leu Phe Glu Glu Ser Gly Leu Ile Thr Asp Phe Thr
65                  70                  75                  80
```

```
Lys Ile Ser Ile Asn Leu Asn Pro Tyr Gln Leu Arg Val Arg Gly Leu
                85                  90                  95

Thr Asp Glu Leu Ser Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Met
            100                 105                 110

Val Lys His Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Asp Asp Gly
        115                 120                 125

Asn Ser Ser Val Gly Asp Tyr Ala Gln Ile Val Lys Glu Asn Ser Lys
    130                 135                 140

Gln Leu Glu Thr Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Tyr Gln
145                 150                 155                 160

Thr Tyr Gly Gln Leu Arg Gly Asp Phe Thr Val Glu Lys Asp Gly Lys
                165                 170                 175

Lys His Arg Leu Ile Asn Val Phe Pro Thr Ser Ala Tyr Arg Ser Glu
            180                 185                 190

Ala Leu Arg Ile Leu Gln Thr Gln Gln Glu Phe Asn Ser Gln Ile Thr
        195                 200                 205

Asp Glu Phe Ile Asn Arg Tyr Leu Glu Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240

Tyr Arg Thr Ser Gly Glu Thr Leu Asp Asn Ile Phe Gly Ile Leu Ile
                245                 250                 255

Gly Lys Cys Thr Phe Tyr Pro Glu Glu Phe Arg Ala Ala Lys Ala Ser
            260                 265                 270
```

```
Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285

Val Pro Thr Glu Thr Lys Lys Leu Ser Lys Glu Gln Lys Asn Gln Ile
    290                 295                 300

Ile Asn Tyr Val Lys Asn Glu Lys Ala Met Gly Pro Ala Lys Leu Phe
305                 310                 315                 320

Lys Tyr Ile Ala Lys Leu Leu Ser Cys Asp Val Ala Asp Ile Lys Gly
                325                 330                 335

Tyr Arg Ile Asp Lys Ser Gly Lys Ala Glu Ile His Thr Phe Glu Ala
            340                 345                 350

Tyr Arg Lys Met Lys Thr Leu Glu Thr Leu Asp Ile Glu Gln Met Asp
        355                 360                 365

Arg Glu Thr Leu Asp Lys Leu Ala Tyr Val Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Gln Glu Ala Leu Glu His Glu Phe Ala Asp Gly Ser
385                 390                 395                 400

Phe Ser Gln Lys Gln Val Asp Glu Leu Val Gln Phe Arg Lys Ala Ser
                405                 410                 415

Ser Ser Ile Phe Gly Lys Gly Trp His Asn Phe Ser Val Lys Leu Met
            420                 425                 430

Met Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr
        435                 440                 445

Ile Leu Thr Arg Leu Gly Lys Gln Lys Thr Thr Ser Ser Ser Asn Lys
    450                 455                 460

Thr Lys Tyr Ile Asp Glu Lys Leu Leu Thr Glu Glu Ile Tyr Asn Pro
465                 470                 475                 480
```

```
Val Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Val Asn Ala Ala
                485                 490                 495

Ile Lys Glu Tyr Gly Asp Phe Asp Asn Ile Val Ile Glu Met Ala Arg
            500                 505                 510

Glu Thr Asn Glu Asp Asp Glu Lys Lys Ala Ile Gln Lys Ile Gln Lys
        515                 520                 525

Ala Asn Lys Asp Glu Lys Asp Ala Ala Met Leu Lys Ala Ala Asn Gln
    530                 535                 540

Tyr Asn Gly Lys Ala Glu Leu Pro His Ser Val Phe His Gly His Lys
545                 550                 555                 560

Gln Leu Ala Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Arg Cys
                565                 570                 575

Leu Tyr Thr Gly Lys Thr Ile Ser Ile His Asp Leu Ile Asn Asn Pro
            580                 585                 590

Asn Gln Phe Glu Val Asp His Ile Leu Pro Leu Ser Ile Thr Phe Asp
        595                 600                 605

Asp Ser Leu Ala Asn Lys Val Leu Val Tyr Ala Thr Ala Asn Gln Glu
    610                 615                 620

Lys Gly Gln Arg Thr Pro Tyr Gln Ala Leu Asp Ser Met Asp Asp Ala
625                 630                 635                 640

Trp Ser Phe Arg Glu Leu Lys Ala Phe Val Arg Glu Ser Lys Thr Leu
                645                 650                 655

Ser Asn Lys Lys Lys Glu Tyr Leu Leu Thr Glu Glu Asp Ile Ser Lys
            660                 665                 670
```

```
Phe Asp Val Arg Lys Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Ala Ser Arg Val Val Leu Asn Ala Leu Gln Glu His Phe Arg Ala
    690                 695                 700

His Lys Ile Asp Thr Lys Val Ser Val Val Arg Gly Gln Phe Thr Ser
705                 710                 715                 720

Gln Leu Arg Arg His Trp Gly Ile Glu Lys Thr Arg Asp Thr Tyr His
                725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Asn
            740                 745                 750

Leu Trp Lys Lys Gln Lys Asn Thr Leu Val Ser Tyr Ser Glu Asp Gln
        755                 760                 765

Leu Leu Asp Ile Glu Thr Gly Glu Leu Ile Ser Asp Asp Glu Tyr Lys
    770                 775                 780

Glu Ser Val Phe Lys Ala Pro Tyr Gln His Phe Val Asp Thr Leu Lys
785                 790                 795                 800

Ser Lys Glu Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln Val Asp Ser
                805                 810                 815

Lys Phe Asn Arg Lys Leu Ser Asp Ala Thr Ile Tyr Ala Thr Arg Gln
            820                 825                 830

Ala Lys Val Gly Lys Asp Lys Lys Asp Glu Thr Tyr Val Leu Gly Lys
        835                 840                 845

Ile Lys Asp Ile Tyr Thr Gln Asp Gly Tyr Asp Ala Phe Met Lys Ile
    850                 855                 860

Tyr Lys Lys Asp Lys Ser Lys Phe Leu Met Tyr Arg His Asp Pro Gln
865                 870                 875                 880
```

```
Thr Phe Glu Lys Val Ile Glu Pro Ile Leu Glu Asn Tyr Pro Asn Lys
               885                 890                 895


Glu Met Asn Glu Lys Gly Lys Glu Val Pro Cys Asn Pro Phe Leu Lys
            900                 905                 910


Tyr Lys Glu Glu His Gly Tyr Ile Arg Lys Tyr Ser Lys Lys Gly Asn
        915                 920                 925


Gly Pro Glu Ile Lys Ser Leu Lys Tyr Tyr Asp Ser Lys Leu Leu Gly
    930                 935                 940


Asn Pro Ile Asp Ile Thr Pro Glu Asn Ser Lys Asn Lys Val Val Leu
945                 950                 955                 960


Gln Ser Leu Lys Pro Trp Arg Ala Asp Val Tyr Phe Asn Lys Thr Thr
               965                 970                 975


Gly Lys Tyr Glu Ile Leu Gly Leu Lys Tyr Ala Asp Leu Gln Phe Glu
            980                 985                 990


Lys Lys Thr Gly Thr Tyr Lys Ile  Ser Gln Glu Lys Tyr  Asn Gly Ile
        995                 1000                1005


Met Lys  Glu Glu Gly Val Asp  Ser Asp Ser Glu Phe  Lys Phe Thr
    1010                1015                1020


Leu Tyr  Lys Asn Asp Leu Leu  Leu Val Lys Asp Thr  Glu Thr Lys
    1025                1030                1035


Glu Gln  Gln Leu Phe Arg Phe  Leu Ser Arg Thr Met  Pro Asn Val
    1040                1045                1050


Lys Tyr  Tyr Val Glu Leu Lys  Pro Tyr Ser Lys Asp  Lys Phe Glu
    1055                1060                1065
```

```
Lys Asn  Glu Ser Leu Ile Glu  Ile Leu Gly Ser Ala  Asp Lys Ser
    1070                1075                1080


Gly Arg  Cys Ile Lys Gly Leu  Gly Lys Ser Asn Ile  Ser Ile Tyr
    1085                1090                1095


Lys Val  Arg Thr Asp Val Leu  Gly Asn Gln His Ile  Ile Lys Asn
    1100                1105                1110


Glu Gly  Asp Lys Pro Lys Leu  Asp Phe
    1115                1120
```

<210> 784
<211> 1388
<212> PRT
<213> Streptococcus thermophilus

<400> 784

```
Met Thr Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asn Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Ser Lys Lys Tyr Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Val Leu Leu Phe Asp Ser Gly Ile Thr Ala Glu Gly Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Thr Glu Met Ala Thr Leu Asp Asp Ala
                85                  90                  95


Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Pro Asp Asp Lys Arg
            100                 105                 110
```

```
Asp Ser Lys Tyr Pro Ile Phe Gly Asn Leu Val Glu Glu Lys Ala Tyr
        115                 120                 125

His Asp Glu Phe Pro Thr Ile Tyr His Leu Arg Lys Tyr Leu Ala Asp
    130                 135                 140

Ser Thr Lys Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Phe Asn Ser
                165                 170                 175

Lys Asn Asn Asp Ile Gln Lys Asn Phe Gln Asp Phe Leu Asp Thr Tyr
            180                 185                 190

Asn Ala Ile Phe Glu Ser Asp Leu Ser Leu Glu Asn Ser Lys Gln Leu
        195                 200                 205

Glu Glu Ile Val Lys Asp Lys Ile Ser Lys Leu Glu Lys Lys Asp Arg
    210                 215                 220

Ile Leu Lys Leu Phe Pro Gly Glu Lys Asn Ser Gly Ile Phe Ser Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Arg Lys Cys Phe
                245                 250                 255

Asn Leu Asp Glu Lys Ala Ser Leu His Phe Ser Lys Glu Ser Tyr Asp
            260                 265                 270

Glu Asp Leu Glu Thr Leu Leu Gly Tyr Ile Gly Asp Asp Tyr Ser Asp
        275                 280                 285

Val Phe Leu Lys Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Phe Leu Thr Val Thr Asp Asn Glu Thr Glu Ala Pro Leu Ser Ser Ala
```

```
305                 310                 315                 320

Met Ile Lys Arg Tyr Asn Glu His Lys Glu Asp Leu Ala Leu Leu Lys
                325                 330                 335

Glu Tyr Ile Arg Asn Ile Ser Leu Lys Thr Tyr Asn Glu Val Phe Lys
            340                 345                 350

Asp Asp Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Asp Phe Tyr Val Tyr Leu Lys Asn Leu Leu Ala Glu Phe Glu
    370                 375                 380

Gly Ala Asp Tyr Phe Leu Glu Lys Ile Asp Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Leu Asp Lys Gln Ala Lys Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Lys Asn Lys Glu Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Asp Phe Ala Trp
    450                 455                 460

Ser Ile Arg Lys Arg Asn Glu Lys Ile Thr Pro Trp Asn Phe Glu Asp
465                 470                 475                 480

Val Ile Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Ser Phe Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510
```

```
Leu Leu Tyr Glu Thr Phe Asn Val Tyr Asn Glu Leu Thr Lys Val Arg
        515                 520                 525

Phe Ile Ala Glu Ser Met Arg Asp Tyr Gln Phe Leu Asp Ser Lys Gln
    530                 535                 540

Lys Lys Asp Ile Val Arg Leu Tyr Phe Lys Asp Lys Arg Lys Val Thr
545                 550                 555                 560

Asp Lys Asp Ile Ile Glu Tyr Leu His Ala Ile Tyr Gly Tyr Asp Gly
                565                 570                 575

Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ser Ser Leu Ser Thr
            580                 585                 590

Tyr His Asp Leu Leu Asn Ile Ile Asn Asp Lys Glu Phe Leu Asp Asp
        595                 600                 605

Ser Ser Asn Glu Ala Ile Ile Glu Glu Ile Ile His Thr Leu Thr Ile
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ser Lys Phe Glu Asn
625                 630                 635                 640

Ile Phe Asp Lys Ser Val Leu Lys Lys Leu Ser Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asp Glu
            660                 665                 670

Lys Ser Gly Asn Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Ile Ser
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ala Leu Ser Phe Lys
    690                 695                 700

Lys Lys Ile Gln Lys Ala Gln Ile Ile Gly Asp Glu Asp Lys Gly Asn
```

```
705                 710                 715                 720

Ile Lys Glu Val Val Lys Ser Leu Pro Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met
            740                 745                 750

Gly Gly Arg Lys Pro Glu Ser Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Tyr Thr Asn Gln Gly Lys Ser Asn Ser Gln Gln Arg Leu Lys Arg
    770                 775                 780

Leu Glu Lys Ser Leu Lys Glu Leu Gly Ser Lys Ile Leu Lys Glu Asn
785                 790                 795                 800

Ile Pro Ala Lys Leu Ser Lys Ile Asp Asn Asn Ala Leu Gln Asn Asp
                805                 810                 815

Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly
            820                 825                 830

Asp Asp Leu Asp Ile Asp Arg Leu Ser Asn Tyr Asp Ile Asp His Ile
        835                 840                 845

Ile Pro Gln Ala Phe Leu Lys Asp Asn Ser Ile Asp Asn Lys Val Leu
    850                 855                 860

Val Ser Ser Ala Ser Asn Arg Gly Lys Ser Asp Asp Phe Pro Ser Leu
865                 870                 875                 880

Glu Val Val Lys Lys Arg Lys Thr Phe Trp Tyr Gln Leu Leu Lys Ser
                885                 890                 895

Lys Leu Ile Ser Gln Arg Lys Phe Asp Asn Leu Thr Lys Ala Glu Arg
            900                 905                 910
```

```
Gly Gly Leu Leu Pro Glu Asp Lys Ala Gly Phe Ile Gln Arg Gln Leu
        915                 920                 925

Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Arg Leu Leu Asp Glu
    930                 935                 940

Lys Phe Asn Asn Lys Lys Asp Glu Asn Asn Arg Ala Val Arg Thr Val
945                 950                 955                 960

Lys Ile Ile Thr Leu Lys Ser Thr Leu Val Ser Gln Phe Arg Lys Asp
                965                 970                 975

Phe Glu Leu Tyr Lys Val Cys Glu Ile Asn Asp Phe His His Ala His
            980                 985                 990

Asp Ala Tyr Leu Asn Ala Val Ile  Ala Ser Ala Leu Leu  Lys Lys Tyr
        995                 1000                1005

Pro Lys  Leu Glu Pro Glu Phe  Val Tyr Gly Asp Tyr  Pro Lys Tyr
    1010                1015                1020

Asn Ser  Phe Arg Glu Arg Lys  Ser Ala Thr Glu Lys  Val Tyr Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Ile  Phe Lys Lys Ser Ile  Ser Leu Ala
    1040                1045                1050

Asp Gly  Arg Val Ile Glu Arg  Pro Leu Ile Glu Val  Asn Glu Glu
    1055                1060                1065

Thr Gly  Glu Ser Val Trp Asn  Lys Glu Ser Asp Leu  Ala Thr Val
    1070                1075                1080

Arg Arg  Val Leu Ser Tyr Pro  Gln Val Asn Val Val  Lys Lys Val
    1085                1090                1095

Glu Glu  Gln Asn His Gly Leu  Asp Arg Gly Lys Pro  Lys Gly Leu
```

```
    1100                1105                1110

Phe Asn  Ala Asn Leu Ser Ser  Lys Pro Lys Pro Asn  Ser Asn Glu
    1115                1120                1125

Asn Leu  Val Gly Ala Lys Glu  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1130                1135                1140

Gly Tyr  Ala Gly Ile Ser Asn  Ser Phe Ala Val Leu  Val Lys Gly
    1145                1150                1155

Thr Ile  Glu Lys Gly Ala Lys  Lys Lys Ile Thr Asn  Val Leu Glu
    1160                1165                1170

Phe Gln  Gly Ile Ser Ile Leu  Asp Arg Ile Asn Tyr  Arg Lys Asp
    1175                1180                1185

Lys Leu  Asn Phe Leu Leu Glu  Lys Gly Tyr Lys Asp  Ile Glu Leu
    1190                1195                1200

Ile Ile  Glu Leu Pro Lys Tyr  Ser Leu Phe Glu Leu  Ser Asp Gly
    1205                1210                1215

Ser Arg  Arg Met Leu Ala Ser  Ile Leu Ser Thr Asn  Asn Lys Arg
    1220                1225                1230

Gly Glu  Ile His Lys Gly Asn  Gln Ile Phe Leu Ser  Gln Lys Phe
    1235                1240                1245

Val Lys  Leu Leu Tyr His Ala  Lys Arg Ile Ser Asn  Thr Ile Asn
    1250                1255                1260

Glu Asn  His Arg Lys Tyr Val  Glu Asn His Lys Lys  Glu Phe Glu
    1265                1270                1275

Glu Leu  Phe Tyr Tyr Ile Leu  Glu Phe Asn Glu Asn  Tyr Val Gly
    1280                1285                1290
```

```
Ala Lys  Lys Asn Gly Lys Leu  Leu Asn Ser Ala Phe  Gln Ser Trp
    1295                1300                1305


Gln Asn  His Ser Ile Asp Glu  Leu Cys Ser Ser Phe  Ile Gly Pro
    1310                1315                1320


Thr Gly  Ser Glu Arg Lys Gly  Leu Phe Glu Leu Thr  Ser Arg Gly
    1325                1330                1335


Ser Ala  Ala Asp Phe Glu Phe  Leu Gly Val Lys Ile  Pro Arg Tyr
    1340                1345                1350


Arg Asp  Tyr Thr Pro Ser Ser  Leu Leu Lys Asp Ala  Thr Leu Ile
    1355                1360                1365


His Gln  Ser Val Thr Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ala
    1370                1375                1380


Lys Leu  Gly Glu Gly
    1385
```

<210> 785
<211> 1388
<212> PRT
<213> Streptococcus thermophilus

<400> 785

```
Met Thr Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Ile Thr Asp Asn Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Ser Lys Lys Tyr Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Val Leu Leu Phe Asp Ser Gly Ile Thr Ala Glu Gly Arg Arg Leu
    50                  55                  60
```

```
Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Thr Glu Met Ala Thr Leu Asp Asp Ala
                85                  90                  95

Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Pro Asp Asp Lys Arg
            100                 105                 110

Asp Ser Lys Tyr Pro Ile Phe Gly Asn Leu Val Glu Glu Lys Ala Tyr
        115                 120                 125

His Asp Glu Phe Pro Thr Ile Tyr His Leu Arg Lys Tyr Leu Ala Asp
    130                 135                 140

Ser Thr Lys Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Phe Asn Ser
                165                 170                 175

Lys Asn Asn Asp Ile Gln Lys Asn Phe Gln Asp Phe Leu Asp Thr Tyr
            180                 185                 190

Asn Ala Ile Phe Glu Ser Asp Leu Ser Leu Glu Asn Ser Lys Gln Leu
        195                 200                 205

Glu Glu Ile Val Lys Asp Lys Ile Ser Lys Leu Glu Lys Lys Asp Arg
    210                 215                 220

Ile Leu Lys Leu Phe Pro Gly Glu Lys Asn Ser Gly Ile Phe Ser Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Arg Lys Cys Phe
                245                 250                 255
```

```
Asn Leu Asp Glu Lys Ala Ser Leu His Phe Ser Lys Glu Ser Tyr Asp
            260                 265                 270

Glu Asp Leu Glu Thr Leu Leu Gly Tyr Ile Gly Asp Asp Tyr Ser Asp
        275                 280                 285

Val Phe Leu Lys Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Phe Leu Thr Val Thr Asp Asn Glu Thr Glu Ala Pro Leu Ser Ser Ala
305                 310                 315                 320

Met Ile Lys Arg Tyr Asn Glu His Lys Glu Asp Leu Ala Leu Leu Lys
                325                 330                 335

Glu Tyr Ile Arg Asn Ile Ser Leu Lys Thr Tyr Asn Glu Val Phe Lys
            340                 345                 350

Asp Asp Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Asp Phe Tyr Val Tyr Leu Lys Asn Leu Leu Ala Glu Phe Glu
    370                 375                 380

Gly Ala Asp Tyr Phe Leu Glu Lys Ile Asp Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Leu Asp Lys Gln Ala Lys Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Lys Asn Lys Glu Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Asp Phe Ala Trp
    450                 455                 460
```

```
Ser Ile Arg Lys Arg Asn Glu Lys Ile Thr Pro Trp Asn Phe Glu Asp
465                 470                 475                 480

Val Ile Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Ser Phe Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Thr Phe Asn Val Tyr Asn Glu Leu Thr Lys Val Arg
        515                 520                 525

Phe Ile Ala Glu Ser Met Arg Asp Tyr Gln Phe Leu Asp Ser Lys Gln
    530                 535                 540

Lys Lys Asp Ile Val Arg Leu Tyr Phe Lys Asp Lys Arg Lys Val Thr
545                 550                 555                 560

Asp Lys Asp Ile Ile Glu Tyr Leu His Ala Ile Tyr Gly Tyr Asp Gly
                565                 570                 575

Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ser Ser Leu Ser Thr
            580                 585                 590

Tyr His Asp Leu Leu Asn Ile Ile Asn Asp Lys Glu Phe Leu Asp Asp
        595                 600                 605

Ser Ser Asn Glu Ala Ile Ile Glu Glu Ile Ile His Thr Leu Thr Ile
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ser Lys Phe Glu Asn
625                 630                 635                 640

Ile Phe Asp Lys Ser Val Leu Lys Lys Leu Ser Arg Arg His Tyr Thr
                645                 650                 655
```

```
Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asp Glu
            660                 665                 670

Lys Ser Gly Asn Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Ile Ser
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ala Leu Ser Phe Lys
    690                 695                 700

Lys Lys Ile Gln Lys Ala Gln Ile Ile Gly Asp Glu Asp Lys Gly Asn
705                 710                 715                 720

Ile Lys Glu Val Val Lys Ser Leu Pro Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met
            740                 745                 750

Gly Gly Arg Lys Pro Glu Ser Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Tyr Thr Asn Gln Gly Lys Ser Asn Ser Gln Gln Arg Leu Lys Arg
    770                 775                 780

Leu Glu Lys Ser Leu Lys Glu Leu Gly Ser Lys Ile Leu Lys Glu Asn
785                 790                 795                 800

Ile Pro Ala Lys Leu Ser Lys Ile Asp Asn Asn Ala Leu Gln Asn Asp
                805                 810                 815

Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly
            820                 825                 830

Asp Asp Leu Asp Ile Asp Arg Leu Ser Asn Tyr Asp Ile Asp His Ile
        835                 840                 845

Ile Pro Gln Ala Phe Leu Lys Asp Asn Ser Ile Asp Asn Lys Val Leu
    850                 855                 860
```

```
Val Ser Ser Ala Ser Asn Arg Gly Lys Ser Asp Asp Phe Pro Ser Leu
865                 870                 875                 880


Glu Val Val Lys Lys Arg Lys Thr Phe Trp Tyr Gln Leu Leu Lys Ser
                885                 890                 895


Lys Leu Ile Ser Gln Arg Lys Phe Asp Asn Leu Thr Lys Ala Glu Arg
            900                 905                 910


Gly Gly Leu Leu Pro Glu Asp Lys Ala Gly Phe Ile Gln Arg Gln Leu
        915                 920                 925


Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Arg Leu Leu Asp Glu
    930                 935                 940


Lys Phe Asn Asn Lys Lys Asp Glu Asn Asn Arg Ala Val Arg Thr Val
945                 950                 955                 960


Lys Ile Ile Thr Leu Lys Ser Thr Leu Val Ser Gln Phe Arg Lys Asp
                965                 970                 975


Phe Glu Leu Tyr Lys Val Arg Glu Ile Asn Asp Phe His His Ala His
            980                 985                 990


Asp Ala Tyr Leu Asn Ala Val Ile  Ala Ser Ala Leu Leu  Lys Lys Tyr
        995                 1000                1005


Pro Lys  Leu Glu Pro Glu Phe  Val Tyr Gly Asp Tyr  Pro Lys Tyr
    1010                1015                1020


Asn Ser  Phe Arg Glu Arg Lys  Ser Ala Thr Glu Lys  Val Tyr Phe
    1025                1030                1035


Tyr Ser  Asn Ile Met Asn Ile  Phe Lys Lys Ser Ile  Ser Leu Ala
    1040                1045                1050
```

```
Asp Gly  Arg Val Ile Glu Arg  Pro Leu Ile Glu Val  Asn Glu Glu
    1055                1060                1065

Thr Gly  Glu Ser Val Trp Asn  Lys Glu Ser Asp Leu  Ala Thr Val
    1070                1075                1080

Arg Arg  Val Leu Ser Tyr Pro  Gln Val Asn Val Val  Lys Lys Val
    1085                1090                1095

Glu Glu  Gln Asn His Gly Leu  Asp Arg Gly Lys Pro  Lys Gly Leu
    1100                1105                1110

Phe Asn  Ala Asn Leu Ser Ser  Lys Pro Lys Pro Asn  Ser Asn Glu
    1115                1120                1125

Asn Leu  Val Gly Ala Lys Glu  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1130                1135                1140

Gly Tyr  Ala Gly Ile Ser Asn  Ser Phe Ala Val Leu  Val Lys Gly
    1145                1150                1155

Thr Ile  Glu Lys Gly Ala Lys  Lys Lys Ile Thr Asn  Val Leu Glu
    1160                1165                1170

Phe Gln  Gly Ile Ser Ile Leu  Asp Arg Ile Asn Tyr  Arg Lys Asp
    1175                1180                1185

Lys Leu  Asn Phe Leu Leu Glu  Lys Gly Tyr Lys Asp  Ile Glu Leu
    1190                1195                1200

Ile Ile  Glu Leu Pro Lys Tyr  Ser Leu Phe Glu Leu  Ser Asp Gly
    1205                1210                1215

Ser Arg  Arg Met Leu Ala Ser  Ile Leu Ser Thr Asn  Asn Lys Arg
    1220                1225                1230

Gly Glu  Ile His Lys Gly Asn  Gln Ile Phe Leu Ser  Gln Lys Phe
    1235                1240                1245
```

```
Val Lys  Leu Leu Tyr His Ala  Lys Arg Ile Ser Asn  Thr Ile Asn
    1250                1255                1260

Glu Asn  His Arg Lys Tyr Val  Glu Asn His Lys Lys  Glu Phe Glu
    1265                1270                1275

Glu Leu  Phe Tyr Tyr Ile Leu  Glu Phe Asn Glu Asn  Tyr Val Gly
    1280                1285                1290

Ala Lys  Lys Asn Gly Lys Leu  Leu Asn Ser Ala Phe  Gln Ser Trp
    1295                1300                1305

Gln Asn  His Ser Ile Asp Glu  Leu Cys Ser Ser Phe  Ile Gly Pro
    1310                1315                1320

Thr Gly  Ser Glu Arg Lys Gly  Leu Phe Glu Leu Thr  Ser Arg Gly
    1325                1330                1335

Ser Ala  Ala Asp Phe Glu Phe  Leu Gly Val Lys Ile  Pro Arg Tyr
    1340                1345                1350

Arg Asp  Tyr Thr Pro Ser Ser  Leu Leu Lys Asp Ala  Thr Leu Ile
    1355                1360                1365

His Gln  Ser Val Thr Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ala
    1370                1375                1380

Lys Leu  Gly Glu Gly
    1385
```

<210> 786
<211> 595
<212> PRT
<213> Streptococcus thermophilus

<400> 786

```
Met Val Gln Phe Arg Lys Ala Asn Ser Ser Ile Phe Gly Lys Gly Trp
```

```
1               5                   10                  15

His Asn Phe Ser Val Lys Leu Met Met Glu Leu Ile Pro Glu Leu Tyr
            20                  25                  30

Glu Thr Ser Glu Glu Gln Met Thr Ile Leu Lys Arg Leu Gly Lys Gln
        35                  40                  45

Lys Thr Thr Ser Ser Ser Asn Lys Thr Lys Tyr Ile Asp Glu Lys Leu
    50                  55                  60

Leu Thr Glu Glu Ile Tyr Asn Pro Val Val Ala Lys Ser Val Arg Gln
65                  70                  75                  80

Ala Ile Lys Ile Val Asn Ala Ala Ile Lys Glu Tyr Gly Asp Phe Asp
                85                  90                  95

Asn Ile Val Ile Glu Met Ala Arg Glu Thr Asn Glu Asp Asp Glu Lys
            100                 105                 110

Lys Ala Ile Gln Lys Ile Gln Lys Ala Asn Lys Asp Glu Lys Asp Ala
        115                 120                 125

Ala Met Leu Lys Ala Ala Asn Gln Tyr Asn Gly Lys Ala Glu Leu Pro
    130                 135                 140

His Ser Val Phe His Gly His Lys Gln Leu Ala Thr Lys Ile Arg Leu
145                 150                 155                 160

Trp His Gln Gln Gly Glu Arg Cys Leu Tyr Thr Gly Lys Thr Ile Ser
                165                 170                 175

Ile His Asp Leu Ile Asn Asn Pro Asn Gln Phe Glu Val Asp His Ile
            180                 185                 190

Leu Pro Leu Ser Ile Thr Phe Asp Asp Ser Leu Ala Asn Lys Val Leu
        195                 200                 205
```

```
Val Tyr Ala Thr Ala Asn Gln Glu Lys Gly Gln Arg Thr Pro Tyr Gln
    210                 215                 220

Ala Leu Asp Ser Met Asp Asp Ala Trp Ser Phe Arg Glu Leu Lys Ala
225                 230                 235                 240

Phe Val Arg Glu Ser Lys Thr Leu Ser Asn Lys Lys Lys Glu Tyr Leu
                245                 250                 255

Leu Thr Glu Glu Asp Ile Ser Lys Phe Asp Val Arg Lys Lys Phe Ile
            260                 265                 270

Glu Arg Asn Leu Val Asp Thr Arg Tyr Ala Ser Arg Val Val Leu Asn
        275                 280                 285

Ala Leu Gln Glu His Phe Arg Ala His Lys Ile Asp Thr Lys Val Ser
    290                 295                 300

Val Val Arg Gly Gln Phe Thr Ser Gln Leu Arg Arg His Trp Gly Ile
305                 310                 315                 320

Glu Lys Thr Arg Asp Thr Tyr His His His Ala Val Asp Ala Leu Ile
                325                 330                 335

Ile Ala Ala Ser Ser Gln Leu Asn Leu Trp Lys Lys Gln Lys Asn Thr
            340                 345                 350

Leu Val Ser Tyr Ser Glu Asp Gln Phe Leu Asp Ile Glu Thr Gly Glu
        355                 360                 365

Leu Ile Ser Asp Asp Glu Tyr Lys Glu Ser Val Phe Lys Ala Pro Tyr
    370                 375                 380

Gln His Phe Val Asp Thr Leu Lys Ser Lys Glu Phe Glu Asp Ser Ile
385                 390                 395                 400

Leu Phe Ser Tyr Gln Val Asp Ser Lys Phe Asn Arg Lys Ile Ser Asp
```

```
                405                 410                 415

Ala Thr Ile Tyr Ala Thr Arg Lys Ala Lys Leu Asp Lys Glu Lys Lys
            420                 425                 430

Glu Tyr Thr Tyr Thr Leu Gly Lys Ile Lys Asp Ile Tyr Thr Gln Ala
        435                 440                 445

Gly Tyr Asp Ala Phe Ile Lys Ile Tyr Lys Lys Asp Lys Ser Lys Phe
    450                 455                 460

Leu Met Tyr His His Asp Pro Gln Thr Phe Glu Lys Val Ile Glu Pro
465                 470                 475                 480

Ile Leu Glu Asn Tyr Pro Asn Lys Glu Ile Asn Glu Lys Gly Lys Glu
                485                 490                 495

Val Pro Cys Asn Pro Phe Leu Lys Tyr Lys Glu Glu His Gly Tyr Ile
            500                 505                 510

Arg Lys Tyr Ser Lys Lys Gly Asn Gly Pro Glu Ile Lys Ser Phe Lys
        515                 520                 525

Tyr Tyr Asp Asn Leu Leu Gly Arg His Ile Asp Ile Thr Pro Lys Asn
    530                 535                 540

Ser Lys Asn Ile Val Ala Leu Arg Lys Leu Asn Pro Trp Arg Thr Asp
545                 550                 555                 560

Val Tyr Phe Asn His Glu Thr Met Lys Tyr Glu Phe Leu Gly Leu Lys
                565                 570                 575

Tyr Ala Asp Ile Ser Tyr Lys Lys Ser Lys Asn Lys Ala Gly Asp Phe
            580                 585                 590

Leu Pro Lys
        595
```

<210> 787
<211> 1388
<212> PRT
<213> Streptococcus thermophilus]

<400> 787

```
Met Thr Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asn Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Ser Lys Lys Tyr Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Val Leu Leu Phe Asp Ser Gly Ile Thr Ala Glu Gly Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Thr Glu Met Ala Thr Leu Asp Asp Ala
                85                  90                  95


Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Pro Asp Asp Lys Arg
            100                 105                 110


Asp Ser Lys Tyr Pro Ile Phe Gly Asn Leu Val Glu Glu Lys Val Tyr
        115                 120                 125


His Asp Glu Phe Pro Thr Ile Tyr His Leu Arg Lys Tyr Leu Ala Asp
    130                 135                 140


Ser Thr Lys Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Met Ile Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Phe Asn Ser
                165                 170                 175
```

```
Lys Asn Asn Asp Ile Gln Lys Asn Phe Gln Asp Phe Leu Asp Thr Tyr
            180                 185                 190

Asn Ala Ile Phe Glu Ser Asp Leu Ser Leu Glu Asn Ser Lys Gln Leu
        195                 200                 205

Glu Glu Ile Val Lys Asp Lys Ile Ser Lys Leu Glu Lys Lys Asp Arg
    210                 215                 220

Ile Leu Lys Leu Phe Pro Gly Glu Lys Asn Ser Gly Ile Phe Ser Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Arg Lys Cys Phe
                245                 250                 255

Asn Leu Asp Glu Lys Ala Ser Leu His Phe Ser Lys Glu Ser Tyr Asp
            260                 265                 270

Glu Asp Leu Glu Thr Leu Leu Gly Tyr Ile Gly Asp Asp Tyr Ser Asp
        275                 280                 285

Val Phe Leu Lys Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Phe Leu Thr Val Thr Asp Asn Glu Thr Glu Ala Pro Leu Ser Ser Ala
305                 310                 315                 320

Met Ile Lys Arg Tyr Asn Glu His Lys Glu Asp Leu Ala Leu Leu Lys
                325                 330                 335

Glu Tyr Ile Arg Asn Ile Ser Leu Lys Thr Tyr Asn Glu Val Phe Lys
            340                 345                 350

Asp Asp Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365
```

```
Gln Glu Asp Phe Tyr Val Tyr Leu Lys Asn Leu Leu Ala Glu Phe Glu
    370                 375                 380

Gly Ala Asp Tyr Phe Leu Glu Lys Ile Asp Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Leu Asp Lys Gln Ala Lys Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Lys Asn Lys Glu Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Asp Phe Ala Trp
    450                 455                 460

Ser Ile Arg Lys Arg Asn Glu Lys Ile Thr Pro Trp Asn Phe Glu Asp
465                 470                 475                 480

Val Ile Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Ser Phe Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Thr Phe Asn Val Tyr Asn Glu Leu Thr Lys Val Arg
        515                 520                 525

Phe Ile Ala Glu Ser Met Arg Asp Tyr Gln Phe Leu Asp Ser Lys Gln
    530                 535                 540

Lys Lys Asp Ile Val Arg Leu Tyr Phe Lys Asp Lys Arg Lys Val Thr
545                 550                 555                 560

Asp Lys Asp Ile Ile Glu Tyr Leu His Ala Ile Tyr Gly Tyr Asp Gly
                565                 570                 575
```

```
Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ser Ser Leu Ser Thr
            580                 585                 590

Tyr His Asp Leu Leu Asn Ile Ile Asn Asp Lys Glu Phe Leu Asp Asp
        595                 600                 605

Ser Ser Asn Glu Ala Ile Ile Glu Glu Ile Ile His Thr Leu Thr Ile
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ser Lys Phe Glu Asn
625                 630                 635                 640

Ile Phe Asp Lys Ser Val Leu Lys Lys Leu Ser Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asp Glu
            660                 665                 670

Lys Ser Gly Asn Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Ile Ser
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ala Leu Ser Phe Lys
    690                 695                 700

Lys Lys Ile Gln Lys Ala Gln Ile Ile Gly Asp Glu Asp Lys Gly Asn
705                 710                 715                 720

Ile Lys Glu Val Val Lys Ser Leu Pro Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met
            740                 745                 750

Gly Gly Arg Lys Pro Glu Ser Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765
```

```
Gln Tyr Thr Asn Gln Gly Lys Ser Asn Ser Gln Gln Arg Leu Lys Arg
    770                 775                 780

Leu Glu Lys Ser Leu Lys Glu Leu Gly Ser Lys Ile Leu Lys Glu Asn
785                 790                 795                 800

Ile Pro Ala Lys Leu Ser Lys Ile Asp Asn Asn Ala Leu Gln Asn Asp
                805                 810                 815

Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly
            820                 825                 830

Asp Asp Leu Asp Ile Asp Arg Leu Ser Asn Tyr Asp Ile Asp His Ile
        835                 840                 845

Ile Pro Gln Ala Phe Leu Lys Asp Asn Ser Ile Asp Asn Lys Val Leu
    850                 855                 860

Val Ser Ser Ala Ser Asn Arg Gly Lys Ser Asp Asp Phe Pro Ser Leu
865                 870                 875                 880

Glu Val Val Lys Lys Arg Lys Thr Phe Trp Tyr Gln Leu Leu Lys Ser
                885                 890                 895

Lys Leu Ile Ser Gln Arg Lys Phe Asp Asn Leu Thr Lys Ala Glu Arg
            900                 905                 910

Gly Gly Leu Leu Pro Glu Asp Lys Ala Gly Phe Ile Gln Arg Gln Leu
        915                 920                 925

Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Arg Leu Leu Asp Glu
    930                 935                 940

Lys Phe Asn Asn Lys Lys Asp Glu Asn Asn Arg Ala Val Arg Thr Val
945                 950                 955                 960

Lys Ile Ile Thr Leu Lys Ser Thr Leu Val Ser Gln Phe Arg Lys Asp
                965                 970                 975
```

```
Phe Glu Leu Tyr Lys Val Arg Glu Ile Asn Asp Phe His His Ala His
            980                 985                 990

Asp Ala Tyr Leu Asn Ala Val Ile  Ala Ser Ala Leu Leu  Lys Lys Tyr
        995                 1000                1005

Pro Lys  Leu Glu Pro Glu Phe  Val Tyr Gly Asp Tyr  Pro Lys Tyr
    1010                1015                1020

Asn Ser  Phe Arg Glu Arg Lys  Ser Ala Thr Glu Lys  Val Tyr Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Ile  Phe Lys Lys Ser Ile  Ser Leu Ala
    1040                1045                1050

Asp Gly  Arg Val Ile Glu Arg  Pro Leu Ile Glu Val  Asn Glu Glu
    1055                1060                1065

Thr Gly  Glu Ser Val Trp Asn  Lys Glu Ser Asp Leu  Ala Thr Val
    1070                1075                1080

Arg Arg  Val Leu Ser Tyr Pro  Gln Val Asn Val Val  Lys Lys Val
    1085                1090                1095

Glu Glu  Gln Asn His Gly Leu  Asp Arg Gly Lys Pro  Lys Gly Leu
    1100                1105                1110

Phe Asn  Ala Asn Leu Ser Ser  Lys Pro Lys Pro Asn  Ser Asn Glu
    1115                1120                1125

Asn Leu  Val Gly Ala Lys Glu  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1130                1135                1140

Gly Tyr  Ala Gly Ile Ser Asn  Ser Phe Ala Val Leu  Val Lys Gly
    1145                1150                1155
```

```
Thr Ile  Glu Lys Gly Ala Lys  Lys Lys Ile Thr Asn  Val Leu Glu
    1160                1165                1170

Phe Gln  Gly Ile Ser Ile Leu  Asp Arg Ile Asn Tyr  Arg Lys Asp
    1175                1180                1185

Lys Leu  Asn Phe Leu Leu Glu  Lys Gly Tyr Lys Asp  Ile Glu Leu
    1190                1195                1200

Ile Ile  Glu Leu Pro Lys Tyr  Ser Leu Phe Glu Leu  Ser Asp Gly
    1205                1210                1215

Ser Arg  Arg Met Leu Ala Ser  Ile Leu Ser Thr Asn  Asn Lys Arg
    1220                1225                1230

Gly Glu  Ile His Lys Gly Asn  Gln Ile Phe Leu Ser  Gln Lys Phe
    1235                1240                1245

Val Lys  Leu Leu Tyr His Ala  Lys Arg Ile Ser Asn  Thr Ile Asn
    1250                1255                1260

Glu Asn  His Arg Lys Tyr Val  Glu Asn His Lys Lys  Glu Phe Glu
    1265                1270                1275

Glu Leu  Phe Tyr Tyr Ile Leu  Glu Phe Asn Glu Asn  Tyr Val Gly
    1280                1285                1290

Ala Lys  Lys Asn Gly Lys Leu  Leu Asn Ser Ala Phe  Gln Ser Trp
    1295                1300                1305

Gln Asn  His Ser Ile Asp Glu  Leu Cys Ser Ser Phe  Ile Gly Pro
    1310                1315                1320

Thr Gly  Ser Glu Arg Lys Gly  Leu Phe Glu Leu Thr  Ser Arg Gly
    1325                1330                1335

Ser Ala  Ala Asp Phe Glu Phe  Leu Gly Val Lys Ile  Pro Arg Tyr
    1340                1345                1350
```

Arg Asp Tyr Thr Pro Ser Ser Leu Leu Lys Asp Ala Thr Leu Ile
    1355   1360   1365

His Gln Ser Val Thr Gly Leu Tyr Glu Thr Arg Ile Asp Leu Ala
    1370   1375   1380

Lys Leu Gly Glu Gly
    1385

<210> 788
<211> 1038
<212> PRT
<213> Streptococcus vestibularis

<400> 788

Met Ile Asp Glu Leu Ser Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn
1   5   10   15

Met Val Lys His Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Asp Asp
            20   25   30

Gly Asn Ser Ser Val Gly Asp Tyr Ala Gln Ile Val Lys Glu Asn Ser
        35   40   45

Lys Gln Leu Glu Thr Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Tyr
    50   55   60

Gln Lys Tyr Gly Gln Leu Arg Gly Asp Phe Thr Val Glu Glu Asp Gly
65   70   75   80

Lys Lys His Arg Leu Ile Asn Val Phe Pro Thr Ser Ala Tyr Arg Ala
                85   90   95

Glu Ala Leu Arg Ile Leu Gln Thr Gln Gln Glu Phe Asn Ser Gln Ile
            100   105   110

Thr Asp Glu Phe Ile Asn Arg Tyr Leu Glu Ile Leu Thr Gly Lys Arg

```
        115                 120                 125

Lys Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly
    130                 135                 140

Arg Tyr Arg Thr Ser Gly Glu Thr Leu Asp Asn Ile Phe Gly Ile Leu
145                 150                 155                 160

Ile Gly Lys Cys Thr Phe Tyr Pro Glu Glu Phe Arg Ala Ala Lys Ala
                165                 170                 175

Ser Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu
            180                 185                 190

Thr Val Pro Thr Glu Thr Lys Lys Leu Ser Glu Glu Gln Lys Asn Gln
        195                 200                 205

Ile Ile Asn Tyr Val Lys Asn Glu Lys Ala Met Gly Pro Ala Lys Leu
    210                 215                 220

Phe Lys Tyr Ile Ala Lys Leu Leu Ser Cys Asp Ile Ala Asp Ile Lys
225                 230                 235                 240

Gly Tyr Arg Ile Asp Lys Ser Asp Lys Ala Glu Ile His Thr Phe Glu
                245                 250                 255

Ala Tyr Arg Lys Met Lys Thr Leu Glu Thr Ile Asp Ile Glu Lys Met
            260                 265                 270

Ser Arg Glu Glu Leu Asp Lys Leu Ala Tyr Val Leu Thr Leu Asn Thr
        275                 280                 285

Glu Arg Glu Gly Ile Gln Glu Ala Leu Glu His Glu Phe Val Asp Gly
    290                 295                 300

Asn Phe Ser Gln Glu Gln Ile Asp Glu Leu Val Gln Phe Arg Lys Ala
305                 310                 315                 320
```

```
Asn Ser Ser Ile Phe Gly Lys Gly Trp His Asn Phe Ser Val Lys Leu
                325                 330                 335

Met Met Glu Leu Ile Pro Glu Leu Tyr Ala Thr Ser Glu Glu Gln Met
            340                 345                 350

Thr Ile Leu Thr Arg Leu Gly Lys Gln Lys Thr Thr Ser Ser Ser Asn
        355                 360                 365

Lys Thr Lys Tyr Ile Asp Glu Lys Leu Leu Thr Glu Glu Ile Tyr Asn
    370                 375                 380

Pro Val Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Val Asn Ala
385                 390                 395                 400

Ala Ile Lys Glu Tyr Gly Asp Phe Asp Asn Ile Val Ile Glu Met Ala
                405                 410                 415

Arg Ala Thr Asn Glu Asp Asp Glu Lys Lys Ala Ile Gln Lys Ile Gln
            420                 425                 430

Lys Ala Asn Lys Asp Glu Lys Asp Ala Ala Met Leu Lys Ala Ala Asn
        435                 440                 445

Gln Tyr Asn Gly Lys Ala Glu Leu Pro His Ser Val Phe His Gly His
    450                 455                 460

Lys Gln Leu Ala Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Arg
465                 470                 475                 480

Cys Leu Tyr Thr Gly Lys Thr Ile Ser Ile His Asp Leu Ile Asn Asn
                485                 490                 495

Pro Asn Gln Phe Glu Ile Asp His Ile Leu Pro Leu Ser Ile Thr Phe
            500                 505                 510

Asp Asp Ser Leu Ala Asn Lys Val Leu Val Tyr Ala Thr Ala Asn Gln
```

```
        515                 520                 525

Glu Lys Gly Gln Arg Thr Pro Tyr Gln Ala Leu Asp Ser Met Asp Asp
    530                 535                 540

Ala Trp Ser Phe Arg Glu Leu Lys Ala Phe Val Arg Glu Ser Lys Thr
545                 550                 555                 560

Leu Ser Asn Lys Lys Lys Glu Tyr Leu Leu Thr Glu Glu Asp Ile Ser
                565                 570                 575

Lys Phe Asp Val Arg Lys Lys Phe Ile Glu Arg Asn Leu Val Asp Thr
            580                 585                 590

Arg Tyr Ala Ser Arg Val Val Leu Asn Ala Leu Gln Glu His Phe Arg
        595                 600                 605

Ala His Lys Ile Asp Thr Lys Val Ser Val Val Arg Gly Gln Phe Thr
    610                 615                 620

Ser Gln Leu Arg Arg His Trp Gly Ile Glu Lys Thr Arg Asp Thr Tyr
625                 630                 635                 640

His His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu
                645                 650                 655

Asn Leu Trp Lys Lys Gln Lys Asn Thr Leu Val Asn Tyr Ser Glu Asn
            660                 665                 670

Gln Leu Leu Asp Ile Glu Thr Gly Glu Leu Ile Ser Asp Asp Glu Tyr
        675                 680                 685

Lys Glu Ser Val Phe Lys Ala Pro Tyr Gln His Phe Val Asp Thr Leu
    690                 695                 700

Lys Ser Lys Glu Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln Val Asp
705                 710                 715                 720
```

```
Ser Lys Phe Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg
                725                 730                 735

Lys Ala Lys Leu Asp Lys Glu Lys Lys Glu Tyr Thr Tyr Thr Leu Gly
            740                 745                 750

Lys Ile Lys Asp Ile Tyr Ala Leu Gly Thr Lys Thr Pro Ser Lys Thr
        755                 760                 765

Gly Phe Tyr Lys Phe Leu Asp Leu Tyr Lys Lys Asn Lys Ser Gln Phe
    770                 775                 780

Leu Met Tyr Gln Lys Asp Arg Lys Thr Trp Asp Glu Val Ile Glu Lys
785                 790                 795                 800

Ile Leu Glu Gln Tyr Arg Pro Phe Lys Glu Lys Asp Lys Asn Gly Lys
                805                 810                 815

Glu Val Asp Phe Asn Pro Phe Glu Lys Tyr Arg Ile Glu Asn Gly Pro
            820                 825                 830

Ile Arg Lys Tyr Ser Arg Lys Gly Asn Gly Pro Glu Ile Lys Ser Leu
        835                 840                 845

Lys Tyr Tyr Asp Asn Leu Leu Gly Arg Phe Val Asp Ile Thr Pro Ser
    850                 855                 860

Glu Ser Lys Asn Pro Val Ala Leu Leu Ser Leu Asn Pro Trp Arg Thr
865                 870                 875                 880

Asp Val Tyr Tyr Asn Thr Glu Thr Arg Lys Tyr Glu Phe Leu Gly Leu
                885                 890                 895

Lys Tyr Ala Asp Leu Cys Phe Glu Lys Gly Gly Ser Tyr Gly Ile Ser
            900                 905                 910

Lys Val Lys Tyr Asn Lys Ile Arg Glu Lys Glu Gly Ile Gly Lys Asn
```

915 920 925

Ser Glu Phe Lys Phe Thr Leu Tyr Lys Asn Asp Leu Ile Leu Ile Lys
930 935 940

Asp Thr Glu Thr Asn Arg Gln Gln Val Phe Arg Phe Trp Ser Arg Thr
945 950 955 960

Gly Lys Asp Asn Pro Lys Arg Phe Glu Lys His Lys Ile Glu Leu Lys
965 970 975

Pro Tyr Glu Lys Ala Arg Phe Glu Lys Gly Glu Glu Leu Glu Val Leu
980 985 990

Gly Lys Val Pro Pro Ser Ser Asn Gln Leu Gln Lys Asn Met Gln Ile
995 1000 1005

Glu Asn Leu Ser Ile Phe Lys Val Arg Thr Asp Val Leu Gly Asn
1010 1015 1020

Gln His Ile Ile Lys Asn Glu Gly Asp Lys Pro Lys Leu Asp Phe
1025 1030 1035

<210> 789
<211> 97
<212> PRT
<213> Streptococcus vestibularis

<400> 789

Met Ser Asp Leu Val Leu Gly Leu Asp Ile Gly Ile Gly Ser Val Gly
1 5 10 15

Val Gly Ile Leu Asn Lys Val Thr Gly Glu Ile Ile His Lys Asn Ser
20 25 30

Arg Ile Phe Pro Ala Ala Gln Ala Glu Asn Asn Val Glu Arg Arg Thr
35 40 45

Asn Arg Gln Gly Arg Arg Leu Thr Arg Arg Lys Lys His Arg Arg Val
    50   55   60

Arg Leu Asn His Leu Phe Glu Glu Ser Gly Leu Ile Thr Asp Phe Thr
65   70   75   80

Lys Val Ser Ile Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Ile Asp
                85   90   95

Arg

<210> 790
<211> 1084
<212> PRT
<213> Subdoligranulum sp.

<400> 790

Met Lys Asn Thr Leu Tyr Gly Ile Gly Leu Asp Ile Gly Val Ala Ser
1   5   10   15

Val Gly Trp Ala Val Val Gly Leu Asn Gly Thr Gly Glu Pro Val Gly
            20   25   30

Leu His Arg Leu Gly Val Arg Ile Phe Asp Lys Ala Glu Gln Pro Lys
        35   40   45

Thr Gly Glu Ser Leu Ala Ala Pro Arg Arg Met Ala Arg Gly Met Arg
    50   55   60

Arg Arg Leu Arg Arg Lys Ala Leu Arg Arg Ala Asp Val Tyr Ala Leu
65   70   75   80

Leu Glu Arg Ser Gly Leu Ser Thr Arg Glu Glu Leu Ala Gln Met Phe
                85   90   95

Glu Ala Gly Gly Leu Glu Asp Ile Tyr Ala Leu Arg Thr Arg Ala Leu
            100   105   110

```
Asp Glu Pro Val Gly Lys Ala Glu Phe Ser Arg Ile Leu Leu His Leu
        115                 120                 125

Ala Gln Arg Arg Gly Phe Lys Ser Asn Arg Arg Thr Ala Ser Asp Gly
    130                 135                 140

Glu Asp Gly Arg Leu Leu Ala Ala Val Asn Glu Asn Arg Arg Arg Met
145                 150                 155                 160

Ala Gln Gly Gly Trp Arg Thr Val Gly Glu Met Leu Tyr Arg His Glu
                165                 170                 175

Ala Phe Ala Leu His Lys Arg Asn Lys Ala Asp Asp Tyr Leu Ser Thr
            180                 185                 190

Val Gly Arg Asp Met Val Ala Glu Glu Ala Ser Ile Leu Phe Glu Arg
        195                 200                 205

Gln Arg Ala Met Gly Cys Ser Trp Ala Ala Pro Glu Leu Gln Ala Glu
    210                 215                 220

Tyr Leu Ser Ile Leu Leu Arg Gln Arg Ser Phe Asp Glu Gly Pro Gly
225                 230                 235                 240

Gly Asn Ser Pro Tyr Gly Gly Asn Gln Val Glu Lys Met Val Gly Arg
                245                 250                 255

Cys Thr Phe Glu Pro Asp Glu Pro Arg Ala Ala Lys Ala Ala Tyr Ser
            260                 265                 270

Phe Glu Tyr Phe Ser Leu Leu Gln Lys Leu Asn His Ile Arg Leu Ala
        275                 280                 285

Glu Asn Gly Glu Thr Arg Pro Leu Thr Gln Pro Gln Arg Gln Gln Leu
    290                 295                 300

Leu Ser Leu Ala His Lys Thr Pro Asp Ile Ser Leu Ala Arg Ile Arg
```

```
305                 310                 315                 320

Lys Glu Leu Ala Leu Pro Glu Thr Val Gln Phe Asn Gly Val Arg Cys
                325                 330                 335

Arg Ala Asn Glu Thr Leu Glu Glu Ser Glu Lys Lys Glu Lys Phe Ala
            340                 345                 350

Cys Leu Pro Ala Tyr His Lys Met Arg Lys Ala Leu Asp Gly Val Val
        355                 360                 365

Lys Gly Arg Ile Ser Ser Leu Ser Ile Ser Gln Arg Asp Ala Ala Ala
    370                 375                 380

Thr Ala Leu Ser Leu Tyr Lys Asn Glu Asp Thr Leu Arg Ala Lys Leu
385                 390                 395                 400

Thr Glu Ala Gly Phe Gln Ala Pro Glu Ile Asp Ala Leu Ala Gly Leu
                405                 410                 415

Thr Gly Phe Ser Lys Phe Gly His Leu Ser Leu Lys Ala Cys Arg Lys
            420                 425                 430

Leu Ile Pro His Leu Glu Gln Gly Leu Thr Tyr Asp Gln Ala Cys Thr
        435                 440                 445

Ala Ala Gly Tyr Asp Phe Lys Gly His Gly Ala Gly Glu Arg Ala Phe
    450                 455                 460

Thr Leu Pro Ala Ala Ala Pro Glu Met Glu Gln Ile Thr Ser Pro Val
465                 470                 475                 480

Val Arg Arg Ala Val Ala Gln Thr Ile Lys Val Val Asn Gly Ile Ile
                485                 490                 495

Arg Glu Met Asp Ala Ser Pro Ala Trp Val Arg Ile Glu Leu Ala Arg
            500                 505                 510
```

```
Glu Leu Ser Lys Thr Phe Gly Glu Arg Gln Glu Met Asp Arg Ser Met
        515                 520                 525

Arg Glu Asn Ala Ala Gln Asn Glu Arg Leu Met Gln Glu Leu Arg Asp
    530                 535                 540

Thr Phe His Leu Leu Ser Pro Thr Gly Gln Asp Leu Val Lys Tyr Arg
545                 550                 555                 560

Leu Trp Lys Glu Gln Asp Gly Val Cys Ala Tyr Ser Leu Arg Arg Leu
                565                 570                 575

Asp Val Glu Arg Leu Phe Glu Pro Gly Tyr Val Asp Val Asp His Ile
            580                 585                 590

Val Pro Tyr Ser Leu Ser Phe Asp Asp Arg Arg Ser Asn Lys Val Leu
        595                 600                 605

Val Leu Ser Ser Glu Asn Arg Gln Lys Gly Asn Arg Leu Pro Leu Gln
    610                 615                 620

Tyr Leu Gln Gly Lys Arg Arg Glu Asp Phe Ile Val Trp Thr Asn Ser
625                 630                 635                 640

Ser Val His Asp Tyr Arg Lys Arg Gln Asn Leu Leu Arg Glu Lys Leu
                645                 650                 655

Ser Gly Asp Glu Ala Glu Gly Phe Arg Gln Arg Asn Leu Gln Asp Thr
            660                 665                 670

Gln His Met Ala Arg Phe Leu Tyr Asn Tyr Ile Ser Asp His Leu Ala
        675                 680                 685

Phe Ala Gln Ser Glu Ala Leu Gly Lys Lys Arg Val Phe Ala Val Ser
    690                 695                 700

Gly Ala Val Thr Ser His Leu Arg Lys Arg Trp Gly Leu Ser Lys Val
```

```
705                 710                 715                 720

Arg Ala Asp Gly Asp Leu His His Ala Leu Asp Ala Ala Val Val Ala
                725                 730                 735

Cys Thr Thr Asp Gly Met Ile Arg Arg Ile Ser Gly Tyr Tyr Gly His
            740                 745                 750

Ile Glu Gly Glu Tyr Leu Gln Asp Ala Asp Gly Ala Gly Ser Gln His
        755                 760                 765

Ala Arg Thr Lys Glu Arg Phe Pro Ala Pro Trp Pro Arg Phe Arg Asp
    770                 775                 780

Glu Leu Ile Val Arg Leu Ser Glu Gln Pro Ala Glu Pro Leu Leu Asp
785                 790                 795                 800

Ile Asn Pro Glu Phe Tyr Cys Glu Tyr Gly Thr Glu His Ile Arg Pro
                805                 810                 815

Val Phe Val Ser Arg Met Pro Arg Arg Lys Val Thr Gly Pro Gly His
            820                 825                 830

Lys Glu Thr Ile Lys Gly Ala Ala Ala Ala Asp Glu Gly Leu Leu Thr
        835                 840                 845

Val Arg Lys Ala Leu Thr Glu Leu Lys Leu Asp Lys Asp Gly Glu Ile
    850                 855                 860

Lys Asp Tyr Tyr Met Pro Ser Ser Asp Thr Leu Leu Tyr Glu Ala Leu
865                 870                 875                 880

Lys Ala Gln Leu Arg Arg Phe Gly Gly Asp Gly Lys Lys Ala Phe Ala
                885                 890                 895

Glu Pro Phe Tyr Lys Pro Lys Ala Asp Gly Thr Pro Gly Pro Leu Val
            900                 905                 910
```

```
Arg Lys Val Lys Thr Thr Glu Lys Ala Thr Leu Thr Val Pro Val His
        915                 920                 925


Gly Gly Ala Ala Ser Asn Asp Thr Met Val Arg Val Asp Val Phe Leu
    930                 935                 940


Val Pro Gly Asp Gly Tyr Tyr Trp Val Pro Val Tyr Thr Ala Asp Thr
945                 950                 955                 960


Leu Lys Pro Glu Leu Pro Asn Arg Ala Val Val Gln Gly Lys Pro Tyr
                965                 970                 975


Ser Glu Trp Lys Glu Met Arg Glu Glu Asp Phe Ile Phe Ser Leu Tyr
            980                 985                 990


Pro Asn Asp Leu Val Tyr Val Glu  His Lys Ser Gly Leu  Lys Phe Thr
        995                 1000                1005


Leu Gln  Asn Ala Asp Ser Thr  Leu Glu Lys Thr Arg  Thr Gln Thr
    1010                1015                1020


Ser Ala  Phe Ala Tyr Phe Val  Ser Gly Ser Ile Ser  Thr Ala Ser
    1025                1030                1035


Ile Thr  Ile Arg Thr His Asp  Asn Ala Tyr Gly Ile  Pro Ser Leu
    1040                1045                1050


Gly Val  Lys Thr Leu Lys Thr  Phe His Lys Tyr Gln  Val Asp Val
    1055                1060                1065


Leu Gly  Asn Val Phe Pro Val  His Lys Glu Thr Arg  Gln Lys Phe
    1070                1075                1080


Arg
```

<210> 791

<211> 951
<212> PRT
<213> Sutterella parvirubra

<400> 791

```
Met Pro Thr Val Arg Pro Val Phe His Ser Ser Ala Ser Phe Asp Leu
1               5                  10                  15


Gly Ala Lys Asn Thr Gly Leu Phe Leu Val Asn His Pro Ala Gly Ala
            20                  25                  30


Ala Pro Ser Ala Glu Tyr Ala Ala Ala Tyr Thr Ile Val Gln Pro Ala
        35                  40                  45


Asp Gly Asp Gly Leu Asn Tyr Ser Thr Thr Asn Arg Arg Ala Val Arg
    50                  55                  60


His Arg Leu Arg Gly Gly Lys Arg Phe Lys Leu Ala Arg Arg Leu Val
65                  70                  75                  80


Leu Gln Val Ile Asp Ala Leu Arg Lys Leu Lys Pro Gly Leu Ile Arg
                85                  90                  95


Asp Glu Glu Met Arg Arg Thr Val Glu Ala Leu Ser Ser Leu Leu Lys
            100                 105                 110


Arg Arg Gly Phe Thr Arg Ile Glu Ser Glu Ala Gln Val Asp Pro Thr
        115                 120                 125


Thr Leu Asp Ser Val Asp Pro Ala Val Phe Ala Asp His Glu Thr Leu
    130                 135                 140


Gly Gly Phe Phe Ser Leu Gly Ile Pro Ile Ser Thr Gln Trp Asp Ala
145                 150                 155                 160


Leu Ser Gln Asn Pro Gly Ala Val Glu Gln Leu Phe Lys Ala Leu Pro
                165                 170                 175
```

```
Ser Ala Lys Asp Phe Gly Lys Tyr Val Thr Glu Gln Phe Pro Glu Phe
            180                 185                 190

Ala Glu Gln Lys Lys Leu Tyr Ala Asp Ala Ile Lys Val Leu Ser Ser
        195                 200                 205

Glu Ala Lys Ser Ile Val Met Gln Leu Gly Leu Gly His His His Arg
    210                 215                 220

Ser Lys Tyr Phe Glu Met Ile Ala His Asp Met Leu Arg Asp Pro Arg
225                 230                 235                 240

Leu Gln Gly Val Phe Glu Leu Phe Gly Ser Glu Glu Arg Phe Lys Thr
                245                 250                 255

Phe Ile Cys Asn Val Ser Asn Leu Gln Leu Arg Ala Leu Arg Trp Tyr
            260                 265                 270

Phe Asp Glu Pro Asn Pro Glu Val Ala Asn Gln Trp Asn Pro Glu Lys
        275                 280                 285

Phe Gln Val Val Trp Leu Arg Gly Leu Lys Tyr Phe His Pro Asp Ala
    290                 295                 300

Glu Arg Lys Ala Asp Met Lys Lys Leu Ile Asp Glu Leu Thr Ala Ser
305                 310                 315                 320

Lys Asp Ile Leu Asp Ala Leu Cys Thr Thr Asp Pro Arg Arg Thr Ile
                325                 330                 335

Pro Pro Tyr Glu Asp Gln Asn Asn Arg Arg Pro Pro Phe Asp Gln Thr
            340                 345                 350

Leu Trp Leu Ser Ala Ala Glu Leu Thr Arg Arg Tyr Gly Asp Lys Trp
        355                 360                 365

Arg Ile Trp Ser Gln Lys Phe Glu Arg Ala Asp Arg Ala Leu Ser Thr
    370                 375                 380
```

```
Gly Leu Asp Glu Ile Leu Leu Tyr Thr Asp Arg Arg Ser Arg Met Phe
385                 390                 395                 400

Asn Arg Asn Gln Asp Pro Ser Val Tyr Ala Asp Ser Tyr Val Leu Gln
                405                 410                 415

Arg Val Leu Asp Arg Ser Ser Lys Leu Asp Arg Tyr Ala Leu Arg Ala
            420                 425                 430

Leu Ala Ala Gly Tyr Arg Thr Gln Glu Leu His Glu Pro Leu Ala Thr
        435                 440                 445

Leu Ser Asp Thr Leu Gly Thr Gln His Val Glu Thr Phe Leu Thr Phe
    450                 455                 460

Ala Ala Glu Tyr Tyr Glu Glu Val Ala Ala Ala Lys Asn Gly Leu Trp
465                 470                 475                 480

Leu Asp Gly Pro Ser Arg Leu Leu Glu Arg Ala Asp Ile His Pro Pro
                485                 490                 495

Met Lys Lys Lys Val Leu Asp Leu Leu Leu Gly Asn Ile Leu Asp Ala
            500                 505                 510

Thr Pro Glu Ile Gly Arg Ile Leu Arg Thr Val Leu Trp Asn Arg His
        515                 520                 525

Val His Glu Lys Ser Arg Ser Thr Pro Ala Ser Leu Cys Arg Ser Ile
    530                 535                 540

Glu Ala Ile Arg Lys Asp Phe Gly Gly Glu Phe Arg Met Arg Tyr Asp
545                 550                 555                 560

Ala Leu Asp Ala Lys Ile Arg Ala Ala Glu Asp Gln Lys Lys Lys Phe
                565                 570                 575
```

```
Lys Pro Thr Asn Ala Glu Glu Lys Asp Leu Phe Lys Ala Trp Asn Ala
            580                 585                 590

Thr Lys Thr Met His Ala Phe Leu Arg Asp Val Leu Gln Leu Thr Pro
        595                 600                 605

Lys Gln Leu Glu Arg Thr Ala Ser Pro Tyr Val Phe Ala Gln Leu His
    610                 615                 620

Thr Leu Ile Asp Thr Glu Arg Asp Gly Phe Thr Ser Thr Ser Leu Ala
625                 630                 635                 640

Ala His Leu Glu Asn His Trp Arg Met Arg Ala Asn Ala Ala Gly Met
                645                 650                 655

Ala Gln Cys Ser Arg Leu Pro Ala Asp Ala Val Arg Pro Phe Asp Gly
            660                 665                 670

Val Leu Ser Lys Ala Leu Asp Arg Gln Ala Phe Glu Ala Ala Lys Leu
        675                 680                 685

Ala Ala Gln His Leu Met Ser Arg Lys Glu Leu Thr Asp Thr Asp Ile
    690                 695                 700

Arg Tyr Ser Ile Ile Ile Glu Ser Asn Arg Phe Ala Phe Ser Ala Ser
705                 710                 715                 720

Thr Ala Glu Leu Lys Lys Asn Thr Leu Ala Lys Lys Asn Ala Glu Lys
                725                 730                 735

Gly Leu Asn Phe Glu Leu Lys Arg Trp Gln Asp Lys Asp Ser Arg Ile
            740                 745                 750

Arg Glu Ala Ser Arg Gly Ile Cys Ala Tyr Thr Gly Ala Lys Leu Gly
        755                 760                 765

Asp Val Val Glu Tyr Asp His Ile Ile Pro Arg Ala Phe Thr Thr Ser
    770                 775                 780
```

```
Ala Met Gly Ser Val Phe Asn Ser Glu Ala Asn Leu Ile Cys Val Ser
785                 790                 795                 800


Arg Pro Gly Asn Gln Thr Lys Ala Asp Lys Arg Tyr Gly Leu Asn Lys
                805                 810                 815


Leu His Lys Thr Tyr Leu Thr Ala Val Phe Gly Thr Ala Asp Val Thr
            820                 825                 830


Thr Ile Ala Ala Ser Ile Glu Asp Ile Val Gly Lys Leu Ala Ser Ala
        835                 840                 845


Asn Arg Leu Arg His Phe Glu Leu Leu Asn Glu Lys Glu Gln Asp Ala
    850                 855                 860


Val Arg His Ala Leu Phe Leu Asp Asp Glu Ser Asp Ala Arg Arg Ile
865                 870                 875                 880


Val Leu Arg Glu Leu Ala Ala Gln Asn Lys Ser Arg Val Asn Gly Thr
                885                 890                 895


Gln Ala Trp Phe Val Arg Ala Phe Met Thr Lys Leu Leu Glu Ile Thr
            900                 905                 910


Lys Asp Trp Arg Glu Arg Thr Gly Asn Thr Leu Asp Ile Arg Ser Trp
        915                 920                 925


Lys Thr Asp Ala Glu Val Ala Ser Arg Leu Arg Ser Ala Leu Asn Phe
    930                 935                 940


His Ala Glu Ile Thr Leu Thr
945                 950
```

<210> 792
<211> 406
<212> PRT
<213> Sutterella parvirubra

<400> 792

```
Ser Asn Leu Phe Arg Glu Glu Val Pro Tyr Gly Asp His Phe Leu Pro
1               5                  10                  15

Ile Ile Gln Met Lys Asn Arg Ile Tyr Ile Gly Tyr Gln Leu Pro Lys
            20                  25                  30

Ala Asp Gly Thr Gly Gly Asn Ala Val Ala Val Leu Gly Lys Asp Pro
        35                  40                  45

Leu Glu Leu Leu Glu Thr Leu Lys Pro Phe Leu Asp Arg Glu Pro Gln
    50                  55                  60

Ala Phe Ser Asp His Pro Val Thr Tyr Lys Met Ile Asn Glu Arg Ala
65                  70                  75                  80

Tyr Glu Leu Leu Thr Lys Cys Ala Leu Thr Pro Asp Gln Thr Thr Glu
                85                  90                  95

Leu Glu Arg Thr Gln Ala Glu Val Leu Arg Ser Leu Asn Tyr Gln Thr
            100                 105                 110

Ser Arg Ala Ala Val Leu Gly Arg Leu Val Asp Asp Lys Asn Lys Phe
        115                 120                 125

Val Ala Lys Asp Ala Val Trp Lys Glu Lys Asp Phe Val Ile Ser Phe
    130                 135                 140

Lys Leu Ser Pro Lys Lys Ser Ala Phe Lys Ala Ser Gly Gln Leu Glu
145                 150                 155                 160

Leu Pro Ala Lys Ser Asp Trp Lys Ala Leu Val Asp Ser Pro Glu Leu
                165                 170                 175

Ala Ile Asn Trp Gly Gln Pro Ala Asp Asp Thr Phe Ser Gln Arg Ile
            180                 185                 190
```

```
Glu Arg Lys Val Arg Met Asn Ser Ser His Leu Glu His Thr Pro Lys
        195                 200                 205

Lys Arg Val Val Ser Leu Pro Val Val Asp Lys Pro Ser Gly Gly Phe
    210                 215                 220

Arg Ile Arg Arg His Asn Leu Asp Gly Ser Ala Val Phe Gln Val His
225                 230                 235                 240

Thr Val Ala Asn Asn Lys Tyr Gly Gly Phe Ser Ala Asp Ser Ala Gly
                245                 250                 255

Lys Val Asp Trp Ser Thr Pro Val Leu Cys Gly His Leu Gln His Ala
            260                 265                 270

Asn Leu Val Pro Leu Asp Pro Glu Thr Ala Ser Ala Glu Gln Leu Val
        275                 280                 285

Arg Met Ser Glu Trp Arg Val Val Glu Thr Thr Ser Asp Ile Arg Leu
    290                 295                 300

Glu Val Cys Pro Gly Thr Ser Gly Arg Arg Tyr Val Arg Val Glu Leu
305                 310                 315                 320

Pro Phe Thr Leu Leu Gln Glu Trp Leu Thr Ala Gly Lys Val Ala Asp
                325                 330                 335

Val Pro Val Ser Pro Leu His Leu Pro Gly Ser Ile Lys Leu Thr Asp
            340                 345                 350

Pro Lys Thr Phe Cys Ala Glu Ala Gln Lys Thr Leu Ser Ile Phe Ala
        355                 360                 365

Gln Pro Arg Ala Thr Ile Phe Phe Glu Gln Leu Gly Asp Arg Val Arg
    370                 375                 380

Phe Arg Phe Glu Ala Ser Gly Gly Pro Ala Thr Met Asn Ala Ala Tyr
```

385 390 395 400

Asn Ala Ala Gly Arg Ser
405

<210> 793
<211> 389
<212> PRT
<213> Sutterella wadsworthensis

<400> 793

Met Lys Ala Cys Asp Leu Glu Glu Lys Thr Asn His Leu Gln Ala Cys
1 5 10 15

Val Ala Ile Asp Leu Gly Ala Arg Tyr Thr Gly Thr Phe Ser Ile Leu
20 25 30

His Lys Ser Ser His Leu Pro Ser Lys Asp Asp Cys Arg Ala Ala Thr
35 40 45

Tyr Val Leu Pro Glu Asp Gly Gly Lys Met Thr Tyr Ser Gln Arg Asn
50 55 60

Arg Thr Ala Val Arg His Arg Ile Arg Gly Lys Lys Arg Phe Ala Leu
65 70 75 80

Ala Arg Arg Met Ala Met Leu Ile Ile Arg Glu Lys Leu Ala Ala Lys
85 90 95

Ser Val Thr Leu Thr Ser Ser Glu Thr Arg Arg Leu Ala Glu Ala Val
100 105 110

Gly Ser Leu Leu Arg Arg Arg Gly Tyr Asn Arg Leu Glu Thr Glu Thr
115 120 125

Asp Asn Asp Leu Thr Val Leu Glu Asn Ile Glu Pro Glu Val Phe Ser
130 135 140

```
Glu His Glu Ile Leu Gly Lys Tyr Phe Tyr Ala Gly Thr Asp Leu Ala
145                 150                 155                 160

Ile Gln Trp Glu Thr Leu Ser Gln Asp Leu Ser Lys Ile Ser Ser Leu
                165                 170                 175

Leu Ala Glu Arg Leu Ser Glu Lys Asp Phe Lys Lys Tyr Leu Thr Gly
            180                 185                 190

Leu Ile Pro Asp Asp Lys Asn Lys Ile Lys His Ile Ile Ser Val Phe
        195                 200                 205

Lys Met Leu Ile Asp Glu Ala Glu Ser Ile Asn Met Gln Cys Val Leu
    210                 215                 220

Gly His Lys His Arg Thr Gln Tyr Leu Ser Asp Ile His Ala Asp Met
225                 230                 235                 240

His Arg Asp Thr Arg Leu Ser Lys Ala Ala Glu Ala Phe Gly Gly Val
                245                 250                 255

Asp Arg Leu Trp Arg Leu Leu Gly Asn Leu Ser Asn Leu Gln Leu Arg
            260                 265                 270

Ala His Arg Trp Tyr Phe Asn Ala Pro His Leu Phe Asp Asp Gln Ala
        275                 280                 285

Leu Glu Pro Ala Arg Leu Gln Lys Thr Leu Val Arg Ala Phe Lys Tyr
    290                 295                 300

Leu His Cys Pro Gln Gly Val Glu Ser Arg Ala Gln Ala Glu Leu Val
305                 310                 315                 320

Lys Glu Leu Glu Glu Ala Asp Asp Ile Ile Asp Ala Leu Cys Thr Ile
                325                 330                 335

Asp Pro Val Arg Thr Ile Pro Pro Tyr Glu Asn Gln Gln Asn Arg Arg
            340                 345                 350
```

```
Pro Pro Phe Asp Gln Thr Leu Tyr Leu Ser Pro Asp Leu Gly Val Ser
        355                 360                 365


Gly Phe Leu Cys Leu Gly Arg Leu Phe Gln Gly Gln Pro Asn Glu Ala
    370                 375                 380


Ala Leu Cys Phe Leu
385
```

<210> 794
<211> 976
<212> PRT
<213> Tannerella sp.

<400> 794

```
Met Lys Lys Ile Leu Gly Leu Asp Leu Gly Ser Asn Ser Ile Gly Trp
1               5                   10                  15


Ala Leu Val Asn Glu Ala Glu Asn Arg Asp Glu Ala Ser Ser Ile Ile
            20                  25                  30


Lys Leu Gly Val Arg Val Asn Pro Leu Thr Val Asp Glu Met Gln Asn
        35                  40                  45


Phe Glu Lys Gly Lys Ser Ile Thr Thr Asn Ala Asp Arg Thr Leu Lys
    50                  55                  60


Arg Ser Met Arg Arg Asn Leu Gln Arg Tyr Lys Leu Arg Arg Asp Ala
65                  70                  75                  80


Leu Ile Lys Leu Leu Lys Lys Val Gly Phe Ile Thr Asp Gly Thr Ile
                85                  90                  95


Leu Ser Glu Gln Gly Asn Arg Thr Thr Phe Glu Thr Tyr Arg Leu Arg
            100                 105                 110


Ala Lys Ala Pro Asp Glu Glu Ile Ser Leu Gln Glu Leu Ala Arg Val
```

```
        115                 120                 125

Leu Leu Met Ile Asn Lys Lys Arg Gly Tyr Lys Ser Ser Arg Lys Ile
    130                 135                 140

Lys Glu Lys Glu Ala Gly Thr Leu Ile Asp Gly Met Glu Val Ala Lys
145                 150                 155                 160

Lys Leu Tyr Asp Glu Asp Leu Thr Pro Gly Gln Leu Cys Leu Gln Leu
                165                 170                 175

Leu Glu Ser Gly Lys Lys Ser Leu Pro Asp Phe Tyr Ser Ser Asp Leu
            180                 185                 190

Gln Glu Glu Phe Asp Arg Ile Trp Asn Phe Gln Lys Gln Phe Asn Pro
        195                 200                 205

Lys Ala Phe Cys Asp Thr Ala Lys Glu Glu Ile Lys Gly Lys Asn Lys
    210                 215                 220

Ser Gln Thr Trp Ala Ile Leu Ala Lys Tyr Phe Ile Trp Met Glu Glu
225                 230                 235                 240

Met Asp Val Trp Asn Glu Lys Glu Ser Lys Thr Glu Arg Val Glu Lys
                245                 250                 255

Glu Cys Lys Leu Val Gly Leu Lys Arg Thr Val Lys Lys Glu Glu Gln
            260                 265                 270

Arg Lys Glu Asn Tyr Cys Trp Arg Val Gln Ala Leu Thr Glu Gln Leu
        275                 280                 285

Asp Leu Glu Lys Val Ala Val Val Leu Gln Glu Ile Asn Gly Gln Ile
    290                 295                 300

Ser Thr Ser Ser Gly Tyr Leu Gly Ala Ile Ser Asp Arg Ser Lys Val
305                 310                 315                 320
```

```
Leu Tyr Phe Asn Arg Gln Thr Val Gly Gln Tyr Gln Met Ala Glu Leu
                325                 330                 335

Glu Lys Asn Pro Asn Thr Ser Leu Arg Asn Met Val Phe Tyr Arg Gln
            340                 345                 350

Asp Tyr Leu Asp Glu Phe Asp Lys Ile Trp Glu Lys Gln Ala Glu Phe
        355                 360                 365

His Lys Glu Leu Thr Val Glu Leu Lys Lys Glu Ile Arg Asp Ile Ile
    370                 375                 380

Ile Phe Tyr Gln Arg Arg Leu Lys Ser Gln Lys Gly Leu Ile Gly Phe
385                 390                 395                 400

Cys Glu Phe Glu Asn Arg Glu Ile Met Val Glu Lys Asn Gly Lys Met
                405                 410                 415

Gln Ala Lys Val Val Gly Cys Lys Val Ile Pro Arg Ser His Pro Leu
            420                 425                 430

Phe Gln Glu Phe Lys Ile Trp Gln Thr Leu Asn Asn Val Glu Val Phe
        435                 440                 445

Ala Gly Glu Lys Lys Cys Lys Arg Lys Arg Thr Asp Ala Phe Pro Gly
    450                 455                 460

Leu Phe Asp Gly Thr Glu Asp Thr Leu Met Val Glu Gly Trp Arg Tyr
465                 470                 475                 480

Leu Tyr Gln Glu Glu Lys Glu Ile Leu Ala Lys Glu Leu Ser Val Lys
                485                 490                 495

Lys Ser Leu Lys Lys Glu Tyr Ile Leu Lys Leu Leu Phe Asp Asn Pro
            500                 505                 510

Gln Asp Leu Asp Met Asn Phe Glu Gln Ile Glu Gly Asn Asp Thr Gly
```

```
        515                 520                 525

Asn Val Leu Phe Ser Ala Tyr Ser Lys Met Ile Glu Lys Tyr Gly Tyr
    530                 535                 540

Glu Pro Leu Asp Phe Gly Lys Pro Thr Asp Lys Ile Ile Glu Gln Leu
545                 550                 555                 560

Gln Val Ile Phe Ala Asp Leu Gly Trp Asn Thr Asp Leu Leu Phe Val
                565                 570                 575

Asp Leu Asn Lys Glu Gly Lys Asp Leu Glu Lys Gln Pro Tyr Phe Lys
            580                 585                 590

Leu Trp His Leu Leu Tyr Ser Phe Glu Gly Asp Asn Thr Pro Thr Gly
        595                 600                 605

Asn Gly Lys Leu Val Glu Lys Leu Met Glu Leu Cys His Val Gly Lys
    610                 615                 620

Glu Cys Ala Leu Glu Leu Val Asn Ile Ser Phe Gln Asn Asp Tyr Gly
625                 630                 635                 640

Ser Leu Ser Ala Lys Ala Ile Lys Lys Ile Leu Pro Tyr Leu Lys Glu
                645                 650                 655

Gly Asn Arg Tyr Asp Val Ala Cys Gly Tyr Ala Gly Tyr Arg His Ser
            660                 665                 670

Lys Ser Ser Leu Thr Lys Glu Glu Ile Glu Asn Lys Val Leu Lys Asp
        675                 680                 685

Lys Leu Asp Ile Leu Pro Lys Asn Ser Leu Arg Asn Pro Val Val Glu
    690                 695                 700

Lys Ile Leu Asn Gln Met Val Asn Val Ile Asn Ala Ile Ile Asp Thr
705                 710                 715                 720
```

```
Tyr Gly Lys Pro Asp Glu Ile Arg Val Glu Leu Ala Arg Glu Leu Lys
                725                 730                 735

Lys Ser Ala Lys Glu Arg Glu Glu Leu Thr Lys Ala Ile Ala Lys Ser
            740                 745                 750

Thr Arg Glu His Glu Glu Ile Arg Lys Val Leu Gln Glu Glu Phe Gly
        755                 760                 765

Met Ile Asn Val Ser Arg Asn Asp Ile Ile Arg Tyr Lys Leu Tyr Lys
    770                 775                 780

Glu Leu Lys Asp Asn Gly Tyr Lys Thr Leu Tyr Ser Asn Gln Asp Ile
785                 790                 795                 800

Pro Lys Glu Lys Val Phe Ser Lys Glu Ile Asp Ile Glu His Ile Ile
                805                 810                 815

Pro Gln Ala Arg Leu Phe Asp Asp Ser Leu Ser Asn Lys Thr Leu Glu
            820                 825                 830

Tyr Lys Ala Ile Asn Ile Glu Lys Gly Asn Lys Thr Ala Tyr Asp Phe
        835                 840                 845

Val Lys Glu Lys Tyr Gly Glu Lys Gly Leu Gln Gln Tyr Leu Asn Arg
    850                 855                 860

Cys Glu Ser Leu Phe Lys Gly His Arg Thr Lys Leu Arg Lys Leu Lys
865                 870                 875                 880

Met Gly Gln Glu Asn Ile Pro Glu Gly Phe Ile Asp Arg Asp Leu Arg
                885                 890                 895

Asn Thr Gln Tyr Ile Ala Lys Lys Ala Leu Ala Met Leu Asn Glu Ile
            900                 905                 910

Cys Arg Arg Val Val Ala Thr Thr Gly Ser Ile Thr Asp Arg Leu Arg
```

915 920 925

Glu Asp Trp Gln Leu Val Asp Val Leu Lys Glu Leu Arg Cys Phe Arg
930 935 940

Tyr Phe Lys Asp Thr Lys Met Lys Ala Asn His Asn Lys Asn Ile Phe
945 950 955 960

Tyr Thr Ser Ile Lys Val Asp Val Ser Asp Thr Ser Lys Ile Leu Lys
965 970 975

<210> 795
<211> 1049
<212> PRT
<213> Tistrella mobilis

<400> 795

Met Ile Asn Glu Arg Leu Thr Phe Gly Ile Asp Leu Gly Ile Gly Ser
1 5 10 15

Cys Gly Trp Ala Val Leu Arg His Ala Asp Ala Ala Gly Glu Pro Gly
20 25 30

Val Ile Glu Gly Leu Gly Ser Trp Cys Phe Asp Val Pro Glu Thr Ser
35 40 45

Lys Glu Arg Ile Pro Thr Asn Gln Val Arg Arg Ser Asn Arg Leu Leu
50 55 60

Arg Arg Val Ile Arg Arg Arg Arg Asn Arg Met Ala Glu Ile Arg Arg
65 70 75 80

Leu Phe His Ala Gln Gly Leu Leu Pro Ser Ala Asp Glu Asp Ala Leu
85 90 95

Lys Arg Pro Arg Leu Asp Pro Trp Glu Leu Arg Ala Arg Gly Leu Asp
100 105 110

```
Gln Cys Leu Ser Ala Glu Glu Phe Ala Val Ala Leu Gly His Ile Ala
        115                 120                 125

Arg His Arg Gly Phe Arg Ser Ser Ala Lys Arg Lys Ala Ala Asn Thr
    130                 135                 140

Ser Gly Glu Asp Ser Lys Met Leu Ser Ala Leu Leu Val Thr Arg Glu
145                 150                 155                 160

Arg Thr Ala Arg Tyr Arg Thr Val Gly Glu Met Phe Ala Arg Asp Pro
                165                 170                 175

Glu Tyr Ser Ala Arg Arg Arg Asn Arg Asp Gly Ile Phe Asp Arg Thr
            180                 185                 190

Val Ala Arg Asp Asp Leu Ile His Glu Val Gly Lys Leu Phe Glu Ala
        195                 200                 205

Gln Arg Ala Arg Gly Ser Ala Phe Ala Ser Pro Asp Leu Glu Ala Asp
    210                 215                 220

Phe Asn Ala Ile Ala Phe Arg Gln Ala Glu Met Gln Asp Ser Glu Arg
225                 230                 235                 240

Leu Val Gly Asn Cys Pro Phe Glu Arg Asp Glu Lys Arg Ala Ala Arg
                245                 250                 255

Trp Ala Pro Ser Phe Glu Arg Phe Arg Leu Leu Thr Arg Leu Ile Asn
            260                 265                 270

Leu Arg Ile Ala Thr Ala Glu Gly Glu Arg Arg Phe Thr Pro Glu Asp
        275                 280                 285

Leu Ala Arg Val Ser Ala Glu Leu Gly Ala Thr Ala Lys Leu Pro Val
    290                 295                 300

Ser Arg Val Arg Ala Leu Ile Gly Leu Leu Pro Asp Glu Arg Phe Thr
305                 310                 315                 320
```

```
Thr Ile Arg Val Glu Asp Glu Asp Arg Asp Ile Val Ala Arg Thr Gly
                325                 330                 335

Glu Ala Ala Pro Gly Thr Trp Arg Leu Arg Lys Thr Leu Gly Glu Ala
            340                 345                 350

Leu Trp Ala Glu Met Gln Ala Arg Pro Asp Gln Leu Asp Ala Ile Ala
        355                 360                 365

His Val Leu Ser Phe Phe Glu Ala Thr Ala Lys Ile Arg Ser Glu Leu
    370                 375                 380

Asp Arg Leu Gly Leu Pro Ala Ala Val Ile Glu Ala Leu Asp Arg Gly
385                 390                 395                 400

Leu Glu Asp Gly Ala Phe Ala Lys Phe Lys Gly Ala Gly His Ile Ser
                405                 410                 415

Ala Lys Ala Cys Arg Asn Leu Leu Pro His Leu Gln Gln Gly His Arg
            420                 425                 430

Tyr Asp Gln Ala Cys Arg Leu Ala Gly Tyr Asp His Ala Ala Ser Thr
        435                 440                 445

Leu Ser His Thr Ala Gln Val Val Ser Lys Ala Gly Phe Asn Ala Leu
    450                 455                 460

Val Thr Glu Leu Gly Glu Ser Ile Ala Asn Pro Ile Ala Arg Lys Ala
465                 470                 475                 480

Leu Thr Glu Gly Leu Lys Gln Ile Arg Ala Met Cys Ala Arg Trp Gly
                485                 490                 495

Leu Pro Gly Ala Ile His Ile Glu Leu Ala Arg Glu Val Gly Asn Ser
            500                 505                 510
```

```
Ile Glu Lys Arg Arg Glu Leu Glu Ser Gln Arg Glu Thr Thr Thr Lys
        515                 520                 525

Arg Arg Gln Thr Glu Arg Asp Glu Ile Arg Gly Leu Leu Ala Leu Glu
    530                 535                 540

Asp Val Asp Asp Asp Thr Leu Leu Arg Tyr Arg Leu Trp Lys Glu Gln
545                 550                 555                 560

Gly Gly Lys Cys Leu Tyr Thr Gly Lys Asp Ile His Val Arg Gln Leu
                565                 570                 575

Ile Ala Thr Asp Asn Ser Val Gln Val Asp His Ile Leu Pro Trp Ser
            580                 585                 590

Arg Phe Gly Asp Asp Ser Phe Asn Asn Lys Thr Leu Cys Leu Ala Ser
        595                 600                 605

Ala Asn Gln Arg Lys Arg Gly Gln Thr Pro Trp Glu Trp Phe Ser Leu
    610                 615                 620

Thr Gly Thr Pro Glu Ala Trp Glu Val Phe Ala Ser Arg Val Glu Thr
625                 630                 635                 640

Ser Lys Asp Leu Arg Gly Phe Lys Lys Arg Asn Leu Leu Leu Lys Asn
                645                 650                 655

Ala Asp Glu Val Ala Gln Arg Phe Arg Ser Arg Asn Leu Asn Asp Thr
            660                 665                 670

Arg Tyr Ala Ala Arg Leu Leu Ala Glu Ala Ala Lys Leu Phe Tyr Pro
        675                 680                 685

Ala Gly Asp Arg Gln Glu Lys Asp Gly Arg Arg Arg Val Leu Thr Arg
    690                 695                 700

Pro Gly Pro Leu Thr Ala Ala Leu Arg His Ala Trp Gly Leu Glu Ser
705                 710                 715                 720
```

```
Leu Lys Lys Ala Asp Gly Lys Arg Val Ser Asp Asp Arg His His Ala
               725                 730                 735

Leu Asp Ala Leu Ala Val Ala Ala Ile Ser Glu Arg Glu Val Gln Arg
            740                 745                 750

Leu Thr Arg Ser Phe Gln Glu Trp Glu Gln Gln Gly Leu Ala Arg Pro
        755                 760                 765

Leu Arg His Val Ala Pro Pro Trp Pro Gly Phe Arg Gly Asp Val Leu
    770                 775                 780

Ala Ala Tyr Ala Gln Ala Phe Val Ala Arg Pro Glu Arg Arg Arg Ala
785                 790                 795                 800

Arg Gly Lys Gly His Asp Ala Ser Ile Arg Gln Val Val Gly Glu Gly
               805                 810                 815

Pro Glu Ala Gln Val Phe Glu Arg Arg Gly Leu Ala Asp Leu Lys Glu
            820                 825                 830

Ala Asp Leu Asp Arg Val Lys Asp Pro Glu Arg Asn Gln Ala Ile Ile
        835                 840                 845

Glu Ala Val Arg Ala Trp Ile Leu Ala Gly Arg Pro Ala Asp Ala Pro
    850                 855                 860

Pro Arg Ser Pro Arg Gly Asp Val Ile Val Lys Leu Arg Thr Ala Pro
865                 870                 875                 880

Ala Lys Lys Ile Lys Pro Ala Val Pro Val Arg Gly Gly Thr Ala Asp
               885                 890                 895

Arg Gly Asp Met Val Arg Ile Asp Val Phe Thr Arg Pro Asn Arg Lys
            900                 905                 910
```

```
Gly Arg Asp Glu Trp Tyr Leu Val Pro Ile Tyr Pro His Gln Val Met
        915                 920                 925


Asn Arg Lys Ala Trp Pro His Pro Pro Met Arg Ser Val Val Ala Tyr
    930                 935                 940


Lys Asp Glu Ala Gly Trp Thr Glu Ile Gly Ala Glu His Ser Phe Arg
945                 950                 955                 960


Phe Ser Leu Tyr Pro Arg Ser Tyr Val Gln Leu Val Lys Ser Asn Gly
                965                 970                 975


Asp Val Ile Glu Gly Tyr Leu Val Ser Met Asp Arg Ser Thr Gly Ala
            980                 985                 990


Phe Arg Val Phe Val His Asn Asn  Pro Ala Glu Met Ala  Lys Gly Ile
        995                 1000                1005


Gly Ala  Lys Thr Leu Leu Asn  Leu Arg Lys Phe Asn  Val Asp Arg
    1010                1015                1020


Phe Gly  Val Arg Thr Glu Val  Lys Ser Glu Val Arg  Thr Trp His
    1025                1030                1035


Gly Glu  Val Cys Thr Ser Pro  Val Pro Pro Asp
    1040                1045


<210>  796
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<212>  PRT
<213>  Treponema denticola

<400>  796

Met Lys Lys Glu Ile Lys Asp Tyr Phe Leu Gly Leu Asp Val Gly Thr
1               5                   10                  15


Gly Ser Val Gly Trp Ala Val Thr Asp Thr Asp Tyr Lys Leu Leu Lys
            20                  25                  30
```

```
Ala Asn Arg Lys Asp Leu Trp Gly Met Arg Cys Phe Glu Thr Ala Glu
        35                  40                  45

Thr Ala Glu Val Arg Arg Leu His Arg Gly Ala Arg Arg Arg Ile Glu
    50                  55                  60

Arg Arg Lys Lys Arg Ile Lys Leu Leu Gln Glu Leu Phe Ser Gln Glu
65                  70                  75                  80

Ile Ala Lys Ile Asp Glu Gly Phe Phe Gln Arg Met Lys Glu Ser Pro
                85                  90                  95

Phe Tyr Ala Glu Asp Lys Thr Ile Leu Gln Glu Asn Ala Leu Phe Asn
            100                 105                 110

Asp Lys Asp Phe Thr Asp Lys Thr Tyr His Lys Ala Tyr Pro Thr Ile
        115                 120                 125

Asn His Leu Ile Lys Ala Trp Ile Glu Asn Lys Val Lys Pro Asp Pro
    130                 135                 140

Arg Leu Leu Tyr Leu Ala Cys His Asn Ile Ile Lys Lys Arg Gly His
145                 150                 155                 160

Phe Leu Phe Glu Gly Asp Phe Asp Ser Glu Asn Gln Phe Asp Thr Ser
                165                 170                 175

Ile Gln Ala Leu Phe Glu Tyr Leu Arg Glu Asp Met Glu Val Asp Ile
            180                 185                 190

Asp Ala Asp Ser Gln Lys Val Lys Glu Ile Leu Lys Asp Ser Ser Leu
        195                 200                 205

Lys Asn Ser Glu Lys Gln Ser Arg Leu Asn Lys Ile Leu Gly Leu Lys
    210                 215                 220

Pro Ser Asp Lys Gln Lys Lys Ala Ile Thr Asn Leu Ile Ser Gly Asn
```

```
225                 230                 235                 240

Lys Ile Asn Phe Ala Asp Leu Tyr Asp Asn Pro Asp Leu Lys Asp Ala
                245                 250                 255

Glu Lys Asn Ser Ile Ser Phe Ser Lys Asp Asp Phe Asp Ala Leu Ser
            260                 265                 270

Asp Asp Leu Ala Ser Ile Leu Gly Asp Ser Phe Glu Leu Leu Leu Lys
        275                 280                 285

Ala Lys Ala Val Tyr Asn Cys Ser Val Leu Ser Lys Val Ile Gly Asp
    290                 295                 300

Glu Gln Tyr Leu Ser Phe Ala Lys Val Lys Ile Tyr Glu Lys His Lys
305                 310                 315                 320

Thr Asp Leu Thr Lys Leu Lys Ala Val Ile Lys Lys His Phe Pro Asn
                325                 330                 335

Asn Tyr Lys Lys Val Phe Gly Tyr Asn Gln Asp Asn Glu Ser Lys Asn
            340                 345                 350

Asn Tyr Ser Gly Tyr Val Gly Val Cys Lys Thr Lys Asn Lys Lys Leu
        355                 360                 365

Val Ile Asn Asn Ser Val Asn Gln Glu Asp Phe Tyr Lys Phe Leu Lys
    370                 375                 380

Pro Ile Leu Ser Ala Lys Ser Glu Ile Lys Glu Val Asn Asp Ile Leu
385                 390                 395                 400

Ala Glu Ile Glu Thr Gly Asn Phe Leu Pro Lys Gln Ile Ser Lys Ser
                405                 410                 415

Asn Ala Glu Ile Pro Tyr Gln Leu Arg Lys Met Glu Leu Glu Lys Ile
            420                 425                 430
```

```
Leu Ser Asn Ala Glu Lys His Phe Ser Phe Leu Lys Gln Lys Asp Glu
        435                 440                 445

Lys Gly Leu Ser His Ser Glu Lys Ile Ile Met Leu Leu Thr Phe Lys
    450                 455                 460

Ile Pro Tyr Tyr Ile Gly Pro Ile Asn Asp Asn His Lys Lys Ser Phe
465                 470                 475                 480

Pro Asp Arg Cys Trp Val Val Lys Lys Glu Lys Ser Pro Ser Gly Lys
                485                 490                 495

Thr Thr Pro Trp Asn Phe Phe Asp His Ile Asp Lys Glu Lys Thr Ala
            500                 505                 510

Glu Glu Phe Ile Thr Ser Arg Thr Asn Phe Cys Thr Tyr Leu Ile Gly
        515                 520                 525

Glu Ser Val Leu Pro Lys Asn Ser Leu Leu Tyr Ser Glu Tyr Thr Val
    530                 535                 540

Leu Asn Glu Ile Asn Asn Leu Gln Ile Ile Ile Asp Gly Lys Asn Ile
545                 550                 555                 560

Cys Asp Thr Lys Leu Lys Gln Lys Ile Tyr Glu Asp Leu Phe Lys Lys
                565                 570                 575

Tyr Lys Lys Ile Thr Gln Lys Gln Ile Ser Thr Phe Ile Lys His Glu
            580                 585                 590

Gly Ile Cys Asn Lys Thr Asp Glu Val Ile Ile Leu Gly Ile Asp Lys
        595                 600                 605

Glu Cys Thr Ser Ser Leu Lys Ser Tyr Ile Glu Leu Lys Asn Ile Phe
    610                 615                 620

Gly Lys Gln Val Asp Glu Ile Ser Thr Lys Asn Met Leu Glu Glu Ile
```

625 630 635 640

Ile Arg Trp Ala Thr Ile Tyr Asp Glu Gly Glu Gly Lys Thr Ile Leu
645 650 655

Lys Thr Lys Ile Lys Ala Glu Tyr Gly Lys Tyr Cys Ser Asp Glu Gln
660 665 670

Ile Lys Lys Ile Leu Asn Leu Lys Phe Ser Gly Trp Gly Arg Leu Ser
675 680 685

Arg Lys Phe Leu Glu Thr Val Thr Ser Glu Met Pro Gly Phe Ser Glu
690 695 700

Pro Val Asn Ile Ile Thr Ala Met Arg Glu Thr Gln Asn Asn Leu Met
705 710 715 720

Glu Leu Leu Ser Ser Glu Phe Lys Phe Thr Glu Asn Ile Lys Lys Ile
725 730 735

Asn Ser Gly Phe Glu Asp Ala Glu Lys Gln Phe Ser Tyr Asp Gly Leu
740 745 750

Val Lys Pro Leu Phe Leu Ser Pro Ser Val Lys Lys Met Leu Trp Gln
755 760 765

Thr Leu Lys Leu Val Lys Glu Ile Ser His Ile Thr Gln Ala Pro Pro
770 775 780

Lys Lys Ile Phe Ile Glu Met Ala Lys Gly Ala Glu Leu Glu Pro Ala
785 790 795 800

Arg Thr Lys Thr Arg Leu Lys Ile Leu Gln Asp Leu Tyr Ser Ser Cys
805 810 815

Lys Asn Asp Ala Asp Ala Phe Ser Ser Glu Ile Gln Tyr Leu Ser Gly
820 825 830

```
Lys Ile Glu Asn Glu Asp Asn Leu Arg Leu Arg Ser Asp Lys Leu Tyr
        835                 840                 845

Leu Tyr Tyr Thr Gln Leu Gly Lys Cys Met Tyr Cys Gly Lys Pro Ile
    850                 855                 860

Glu Ile Gly His Val Phe Asp Thr Ser Asn Tyr Asp Ile Asp His Ile
865                 870                 875                 880

Tyr Pro Gln Ser Lys Ile Lys Asp Asp Ser Ile Ser Asn Arg Val Leu
                885                 890                 895

Val Cys Ser Ser Cys Asn Lys Asn Lys Glu Asp Lys Tyr Pro Leu Lys
            900                 905                 910

Ser Glu Ile Gln Ser Lys Gln Arg Gly Phe Trp Asn Phe Leu Gln Arg
        915                 920                 925

Asn Asn Phe Ile Ser Leu Glu Lys Leu Asn Arg Leu Thr Arg Thr Thr
    930                 935                 940

Pro Ile Ser Asp Asp Glu Thr Ala Lys Phe Ile Ala Arg Gln Leu Val
945                 950                 955                 960

Glu Thr Arg Gln Ala Thr Lys Val Ala Ala Lys Val Leu Glu Lys Met
                965                 970                 975

Phe Pro Glu Thr Lys Ile Val Tyr Ser Lys Ala Glu Thr Val Ser Met
            980                 985                 990

Phe Arg Asn Lys Phe Asp Ile Ile  Lys Cys Arg Glu Ile  Asn Asp Phe
        995                 1000                1005

His His  Ala His Asp Ala Tyr  Leu Asn Ile Val Val  Gly Asn Val
    1010                1015                1020

Tyr Asn  Thr Lys Phe Thr Asn  Asn Pro Trp Asn Phe  Ile Lys Glu
```

```
    1025                1030                1035

Lys Arg  Asp Asn Pro Lys Ile  Ala Asp Thr Tyr Asn  Tyr Tyr Lys
    1040                1045                1050

Val Phe  Asp Tyr Asp Val Lys  Arg Asn Asn Ile Thr  Ala Trp Glu
    1055                1060                1065

Lys Gly  Lys Thr Ile Ile Thr  Val Lys Asp Met Leu  Lys Arg Asn
    1070                1075                1080

Thr Pro  Ile Tyr Thr Arg Gln  Ala Ala Cys Lys Lys  Gly Gly Leu
    1085                1090                1095

Phe Asp  Gln Thr Ile Met Lys  Lys Gly Leu Gly Gln  His Pro Leu
    1100                1105                1110

Lys Lys  Glu Gly Pro Phe Ser  Asn Ile Ser Lys Tyr  Gly Gly Tyr
    1115                1120                1125

Asn Lys  Val Ser Ala Ala Tyr  Tyr Thr Leu Ile Glu  Tyr Glu Glu
    1130                1135                1140

Lys Gly  Asn Lys Ile Arg Ser  Leu Glu Thr Ile Pro  Leu Tyr Leu
    1145                1150                1155

Val Lys  Asp Ile Gln Lys Asp  Gln Asp Val Leu Lys  Ser Tyr Leu
    1160                1165                1170

Thr Asp  Leu Leu Gly Lys Lys  Glu Phe Lys Ile Leu  Val Pro Lys
    1175                1180                1185

Ile Lys  Ile Asn Ser Leu Leu  Lys Ile Asn Gly Phe  Pro Cys His
    1190                1195                1200

Ile Thr  Gly Lys Thr Asn Asp  Ser Phe Leu Leu Arg  Pro Ala Val
    1205                1210                1215
```

```
Gln Phe  Cys Cys Ser Asn Asp  Glu Val Leu Tyr Phe  Lys Lys Ile
    1220                1225                1230

Ile Arg  Phe Ser Glu Ile Arg  Ser Gln Arg Glu Lys  Ile Gly Lys
    1235                1240                1245

Thr Ile  Ser Pro Tyr Glu Asp  Leu Ser Phe Arg Ser  Tyr Ile Lys
    1250                1255                1260

Glu Asn  Leu Cys Lys Lys Thr  Lys Asn Asp Glu Ile  Gly Glu Lys
    1265                1270                1275

Glu Phe  Tyr Asp Leu Leu Gln  Lys Lys Asn Leu Glu  Ile Tyr Asp
    1280                1285                1290

Met Leu  Leu Thr Lys His Lys  Asp Thr Ile Tyr Lys  Lys Arg Pro
    1295                1300                1305

Asn Ser  Ala Thr Ile Asp Ile  Leu Val Lys Gly Lys  Glu Lys Phe
    1310                1315                1320

Lys Ser  Leu Ile Ile Glu Asn  Gln Phe Glu Val Ile  Leu Glu Ile
    1325                1330                1335

Leu Lys  Leu Phe Ser Ala Thr  Arg Asn Val Ser Glu  Leu Gln His
    1340                1345                1350

Ile Gly  Gly Ser Lys Tyr Ser  Gly Val Ala Lys Ile  Gly Asn Lys
    1355                1360                1365

Ile Ser  Ser Leu Asp Asn Cys  Ile Leu Ile Tyr Gln  Ser Ile Thr
    1370                1375                1380

Gly Ile  Phe Glu Lys Arg Ile  Asp Leu Leu Lys Val
    1385                1390                1395
```

<210> 797

<211> 769
<212> PRT
<213> Treponema denticola

<400> 797

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Met Lys Lys Glu Ile Lys Asp Tyr Phe Leu Gly Leu Asp Val Gly Thr
1               5                  10                  15


Gly Ser Val Gly Trp Ala Val Thr Asp Thr Asp Tyr Lys Leu Leu Lys
            20                  25                  30


Ala Asn Arg Lys Asp Leu Trp Gly Met Arg Cys Phe Glu Thr Ala Glu
        35                  40                  45


Thr Ala Glu Val Arg Arg Leu His Arg Gly Ala Arg Arg Arg Ile Glu
    50                  55                  60


Arg Arg Lys Lys Arg Ile Lys Leu Leu Gln Glu Leu Phe Ser Gln Glu
65                  70                  75                  80


Ile Ala Lys Ile Asp Glu Gly Phe Phe Gln Arg Met Lys Glu Ser Pro
                85                  90                  95


Phe Tyr Ala Glu Asp Lys Thr Ile Leu Gln Glu Asn Ala Leu Phe Asn
            100                 105                 110


Asp Lys Asp Phe Thr Asp Lys Thr Tyr His Lys Ala Tyr Pro Thr Ile
        115                 120                 125


Asn His Leu Ile Lys Ala Trp Ile Glu Asn Lys Val Lys Pro Asp Pro
    130                 135                 140


Arg Leu Leu Tyr Leu Ala Cys His Asn Ile Ile Lys Lys Arg Gly His
145                 150                 155                 160


Phe Leu Phe Glu Gly Asp Phe Asp Ser Glu Asn Gln Phe Asp Thr Ser
                165                 170                 175
```

```
Ile Gln Ala Leu Phe Glu Tyr Leu Arg Glu Asp Met Glu Val Asp Ile
            180                 185                 190

Asp Ala Asp Ser Gln Lys Val Lys Glu Ile Leu Lys Asp Ser Ser Leu
        195                 200                 205

Lys Asn Ser Glu Lys Gln Ser Arg Leu Asn Lys Ile Leu Gly Leu Lys
    210                 215                 220

Pro Ser Asp Lys Gln Lys Lys Ala Ile Thr Asn Leu Ile Ser Gly Asn
225                 230                 235                 240

Lys Ile Asn Phe Ala Asp Leu Tyr Asp Asn Pro Asp Leu Lys Asp Ala
                245                 250                 255

Glu Lys Asn Ser Ile Ser Phe Ser Lys Asp Asp Phe Asp Ala Leu Ser
            260                 265                 270

Asp Asp Leu Ala Ser Ile Leu Gly Asp Ser Phe Glu Leu Leu Leu Lys
        275                 280                 285

Ala Lys Ala Val Tyr Asn Cys Ser Val Leu Ser Lys Val Ile Gly Asp
    290                 295                 300

Glu Gln Tyr Leu Ser Phe Ala Lys Val Lys Ile Tyr Glu Lys His Lys
305                 310                 315                 320

Thr Asp Leu Thr Lys Leu Lys Ala Val Ile Lys Lys His Phe Pro Asn
                325                 330                 335

Asn Tyr Lys Lys Val Phe Gly Tyr Asn Gln Asp Asn Glu Ser Lys Asn
            340                 345                 350

Asn Tyr Ser Gly Tyr Val Gly Val Cys Lys Thr Lys Asn Lys Lys Leu
        355                 360                 365

Val Ile Asn Asn Ser Val Asn Gln Glu Asp Phe Tyr Lys Phe Leu Lys
    370                 375                 380
```

```
Pro Ile Leu Ser Ala Lys Ser Glu Ile Lys Glu Val Asn Asp Ile Leu
385                 390                 395                 400

Ala Glu Ile Glu Thr Gly Asn Phe Leu Pro Lys Gln Ile Ser Lys Ser
                405                 410                 415

Asn Ala Glu Ile Pro Tyr Gln Leu Arg Lys Met Glu Leu Glu Lys Ile
            420                 425                 430

Leu Ser Asn Ala Glu Lys His Phe Ser Phe Leu Lys Gln Lys Asp Glu
        435                 440                 445

Lys Gly Leu Ser His Ser Glu Lys Ile Ile Met Leu Leu Thr Phe Lys
    450                 455                 460

Ile Pro Tyr Tyr Ile Gly Pro Ile Asn Asp Asn His Lys Lys Ser Phe
465                 470                 475                 480

Pro Asp Arg Cys Trp Val Val Lys Lys Glu Lys Ser Pro Ser Gly Lys
                485                 490                 495

Thr Thr Pro Trp Asn Phe Phe Asp His Ile Asp Lys Glu Lys Thr Ala
            500                 505                 510

Glu Glu Phe Ile Thr Ser Arg Thr Asn Phe Cys Thr Tyr Leu Ile Gly
        515                 520                 525

Glu Ser Val Leu Pro Lys Asn Ser Leu Leu Tyr Ser Glu Tyr Thr Val
    530                 535                 540

Leu Asn Glu Ile Asn Asn Leu Gln Ile Ile Ile Asp Gly Lys Asn Ile
545                 550                 555                 560

Cys Asp Thr Lys Leu Lys Gln Lys Ile Tyr Glu Asp Leu Phe Lys Lys
                565                 570                 575
```

```
Tyr Lys Lys Ile Thr Gln Lys Gln Ile Ser Thr Phe Ile Lys His Glu
            580                 585                 590

Gly Ile Cys Asn Lys Thr Asp Glu Val Ile Ile Leu Gly Ile Asp Lys
        595                 600                 605

Glu Cys Thr Ser Ser Leu Lys Ser Tyr Ile Glu Leu Lys Asn Ile Phe
    610                 615                 620

Gly Lys Gln Val Asp Glu Ile Ser Thr Lys Asn Met Leu Glu Glu Ile
625                 630                 635                 640

Ile Arg Trp Ala Thr Ile Tyr Asp Glu Gly Glu Gly Lys Thr Ile Leu
                645                 650                 655

Lys Thr Lys Ile Lys Ala Glu Tyr Gly Lys Tyr Cys Ser Asp Glu Gln
            660                 665                 670

Ile Lys Lys Ile Leu Asn Leu Lys Phe Ser Gly Trp Gly Arg Leu Ser
        675                 680                 685

Arg Lys Phe Leu Glu Thr Val Thr Ser Glu Met Pro Gly Phe Ser Glu
    690                 695                 700

Pro Val Asn Ile Ile Thr Ala Met Arg Glu Thr Gln Asn Asn Leu Met
705                 710                 715                 720

Glu Leu Leu Ser Ser Glu Phe Lys Phe Thr Glu Asn Ile Lys Lys Ile
                725                 730                 735

Asn Ser Gly Phe Glu Asp Ala Glu Lys Gln Phe Ser Tyr Asp Gly Leu
            740                 745                 750

Val Lys Pro Leu Phe Leu Ser Pro Ser Val Lys Lys Cys Cys Gly Arg
        755                 760                 765

Leu
```

<210> 798
<211> 1395
<212> PRT
<213> Treponema denticola

<400> 798

```
Met Lys Lys Glu Ile Lys Asp Tyr Phe Leu Gly Leu Asp Val Gly Thr
1               5                  10                  15


Gly Ser Val Gly Trp Ala Val Thr Asp Thr Asp Tyr Lys Leu Leu Lys
            20                  25                  30


Ala Asn Arg Lys Asp Leu Trp Gly Met Arg Cys Phe Glu Thr Ala Glu
        35                  40                  45


Thr Ala Glu Val Arg Arg Leu His Arg Gly Ala Arg Arg Arg Ile Glu
    50                  55                  60


Arg Arg Lys Lys Arg Ile Lys Leu Leu Gln Glu Leu Phe Ser Gln Glu
65                  70                  75                  80


Ile Ala Lys Ile Asp Glu Gly Phe Phe Gln Arg Met Lys Glu Ser Pro
                85                  90                  95


Phe Tyr Ala Glu Asp Lys Thr Ile Leu Gln Glu Asn Ala Leu Phe Asn
            100                 105                 110


Asp Lys Asp Phe Thr Asp Lys Thr Tyr His Lys Ala Tyr Pro Thr Ile
        115                 120                 125


Asn His Leu Ile Lys Ala Trp Ile Glu Asn Lys Val Lys Pro Asp Pro
    130                 135                 140


Arg Leu Leu Tyr Leu Ala Cys His Asn Ile Ile Lys Lys Arg Gly His
145                 150                 155                 160


Phe Leu Phe Glu Gly Asp Phe Asp Ser Glu Asn Gln Phe Asp Thr Ser
```

```
                165                 170                 175

Ile Gln Ala Leu Phe Glu Tyr Leu Arg Glu Asp Met Glu Val Asp Ile
            180                 185                 190

Asp Ala Asp Ser Gln Lys Val Lys Glu Ile Leu Lys Asp Ser Ser Leu
        195                 200                 205

Lys Asn Ser Glu Lys Gln Ser Arg Leu Asn Lys Ile Leu Gly Leu Lys
    210                 215                 220

Pro Ser Asp Lys Gln Lys Lys Ala Ile Thr Asn Leu Ile Ser Gly Asn
225                 230                 235                 240

Lys Ile Asn Phe Ala Asp Leu Tyr Asp Asn Pro Asp Leu Lys Asp Ala
                245                 250                 255

Glu Lys Asn Ser Ile Ser Phe Ser Lys Asp Asp Phe Asp Ala Leu Ser
            260                 265                 270

Asp Asp Leu Ala Ser Ile Leu Gly Asp Ser Phe Glu Leu Leu Leu Lys
        275                 280                 285

Ala Lys Ala Val Tyr Asn Cys Ser Val Leu Ser Lys Val Ile Gly Asp
    290                 295                 300

Glu Gln Tyr Leu Ser Phe Ala Lys Val Lys Ile Tyr Glu Lys His Lys
305                 310                 315                 320

Thr Asp Leu Thr Lys Leu Lys Ala Val Ile Lys Lys His Phe Pro Asn
                325                 330                 335

Asn Tyr Lys Lys Val Phe Gly Tyr Asn Gln Asp Asn Glu Ser Lys Asn
            340                 345                 350

Asn Tyr Ser Gly Tyr Val Gly Val Cys Lys Thr Lys Asn Lys Lys Leu
        355                 360                 365
```

```
Val Ile Asn Asn Ser Val Asn Gln Glu Asp Phe Tyr Lys Phe Leu Lys
    370                 375                 380

Pro Ile Leu Ser Ala Lys Ser Glu Ile Lys Glu Val Asn Asp Ile Leu
385                 390                 395                 400

Ala Glu Ile Glu Thr Gly Asn Phe Leu Pro Lys Gln Ile Ser Lys Ser
                405                 410                 415

Asn Ala Glu Ile Pro Tyr Gln Leu Arg Lys Met Glu Leu Glu Lys Ile
            420                 425                 430

Leu Ser Asn Ala Glu Lys His Phe Ser Phe Leu Lys Gln Lys Asp Glu
        435                 440                 445

Lys Gly Leu Ser His Ser Glu Lys Ile Ile Met Leu Leu Thr Phe Lys
    450                 455                 460

Ile Pro Tyr Tyr Ile Gly Pro Ile Asn Asp Asn His Lys Lys Ser Phe
465                 470                 475                 480

Pro Asp Arg Cys Trp Val Val Lys Lys Glu Lys Ser Pro Ser Gly Lys
                485                 490                 495

Thr Thr Pro Trp Asn Phe Phe Asp His Ile Asp Lys Glu Lys Thr Ala
            500                 505                 510

Glu Glu Phe Ile Thr Ser Arg Thr Asn Phe Cys Thr Tyr Leu Ile Gly
        515                 520                 525

Glu Ser Val Leu Pro Lys Asn Ser Leu Leu Tyr Ser Glu Tyr Thr Val
    530                 535                 540

Leu Asn Glu Ile Asn Asn Leu Gln Ile Ile Ile Asp Gly Lys Asn Ile
545                 550                 555                 560

Cys Asp Thr Lys Leu Lys Gln Lys Ile Tyr Glu Asp Leu Phe Lys Lys
```

```
                565                 570                 575

Tyr Lys Lys Ile Thr Gln Lys Gln Ile Ser Thr Phe Ile Lys His Glu
            580                 585                 590

Gly Ile Cys Asn Lys Thr Asp Glu Val Ile Ile Leu Gly Ile Asp Lys
        595                 600                 605

Glu Cys Thr Ser Ser Leu Lys Ser Tyr Ile Glu Leu Lys Asn Ile Phe
    610                 615                 620

Gly Lys Gln Val Asp Glu Ile Ser Thr Lys Asn Met Leu Glu Glu Ile
625                 630                 635                 640

Ile Arg Trp Ala Thr Ile Tyr Asp Glu Gly Glu Gly Lys Thr Ile Leu
                645                 650                 655

Lys Thr Lys Ile Lys Ala Glu Tyr Gly Lys Tyr Cys Ser Asp Glu Gln
            660                 665                 670

Ile Lys Lys Ile Leu Asn Leu Lys Phe Ser Gly Trp Gly Arg Leu Ser
        675                 680                 685

Arg Lys Phe Leu Glu Thr Val Thr Ser Glu Met Pro Gly Phe Ser Glu
    690                 695                 700

Pro Val Asn Ile Ile Thr Ala Met Arg Glu Thr Gln Asn Asn Leu Met
705                 710                 715                 720

Glu Leu Leu Ser Ser Glu Phe Lys Phe Thr Glu Asn Ile Lys Lys Ile
                725                 730                 735

Asn Ser Gly Phe Glu Asp Ala Glu Lys Gln Phe Ser Tyr Asp Gly Leu
            740                 745                 750

Val Lys Pro Leu Phe Leu Ser Pro Ser Val Lys Lys Met Leu Trp Gln
        755                 760                 765
```

```
Thr Leu Lys Leu Val Lys Glu Ile Ser His Ile Thr Gln Ala Pro Pro
    770                 775                 780

Lys Lys Ile Phe Ile Glu Met Ala Lys Gly Ala Glu Leu Glu Pro Ala
785                 790                 795                 800

Arg Thr Lys Thr Arg Leu Lys Ile Leu Gln Asp Leu Tyr Ser Ser Cys
                805                 810                 815

Lys Asn Asp Ala Asp Ala Phe Ser Ser Glu Ile Gln Tyr Leu Ser Gly
            820                 825                 830

Lys Ile Glu Asn Glu Asp Asn Leu Arg Leu Arg Ser Asp Lys Leu Tyr
        835                 840                 845

Leu Tyr Tyr Thr Gln Leu Gly Lys Cys Met Tyr Cys Gly Lys Pro Ile
    850                 855                 860

Glu Ile Gly His Val Phe Asp Thr Ser Asn Tyr Asp Ile Asp His Ile
865                 870                 875                 880

Tyr Pro Gln Ser Lys Ile Lys Asp Asp Ser Ile Ser Asn Arg Val Leu
                885                 890                 895

Val Cys Ser Ser Cys Asn Lys Asn Lys Glu Asp Lys Tyr Pro Leu Lys
            900                 905                 910

Ser Glu Ile Gln Ser Lys Gln Arg Gly Phe Trp Asn Phe Leu Gln Arg
        915                 920                 925

Asn Asn Phe Ile Ser Leu Glu Lys Leu Asn Arg Leu Thr Arg Thr Thr
    930                 935                 940

Pro Ile Ser Asp Asp Glu Thr Ala Lys Phe Ile Ala Arg Gln Leu Val
945                 950                 955                 960

Glu Thr Arg Gln Ala Thr Lys Val Ala Ala Lys Val Leu Glu Lys Met
```

```
               965                 970                 975

Phe Pro Glu Thr Lys Ile Val Tyr Ser Lys Ala Glu Thr Val Ser Met
            980                 985                 990

Phe Arg Asn Lys Phe Asp Ile Ile  Lys Cys Arg Glu Ile  Asn Asp Phe
        995                 1000                1005

His His  Ala His Asp Ala Tyr  Leu Asn Ile Val Val  Gly Asn Val
    1010                1015                1020

Tyr Asn  Thr Lys Phe Thr Asn  Asn Pro Trp Asn Phe  Ile Lys Glu
    1025                1030                1035

Lys Arg  Asp Asn Pro Lys Ile  Ala Asp Thr Tyr Asn  Tyr Tyr Lys
    1040                1045                1050

Val Phe  Asp Tyr Asp Val Lys  Arg Asn Asn Ile Thr  Ala Trp Glu
    1055                1060                1065

Lys Gly  Lys Thr Ile Ile Thr  Val Lys Asp Met Leu  Lys Arg Asn
    1070                1075                1080

Thr Pro  Ile Tyr Thr Arg Gln  Ala Ala Cys Lys Lys  Gly Glu Leu
    1085                1090                1095

Phe Asn  Gln Thr Ile Met Lys  Lys Gly Leu Gly Gln  His Pro Leu
    1100                1105                1110

Lys Lys  Glu Gly Pro Phe Ser  Asn Ile Ser Lys Tyr  Gly Gly Tyr
    1115                1120                1125

Asn Lys  Val Ser Ala Ala Tyr  Tyr Thr Leu Ile Glu  Tyr Glu Glu
    1130                1135                1140

Lys Val  Asn Lys Ile Arg Ser  Leu Glu Thr Ile Pro  Leu Tyr Leu
    1145                1150                1155
```

```
Val Lys  Asp Ile Gln Lys Asp  Gln Asp Val Leu Lys  Ser Tyr Leu
    1160                1165                1170

Thr Asp  Leu Leu Gly Lys Lys  Glu Ile Lys Ile Leu  Val Pro Lys
    1175                1180                1185

Ile Lys  Ile Asn Ser Leu Leu  Lys Ile Asn Gly Phe  Pro Cys His
    1190                1195                1200

Ile Thr  Gly Lys Thr Gly Asp  Ser Phe Val Leu Arg  Pro Ala Val
    1205                1210                1215

Gln Phe  Cys Cys Ser Asn Asp  Glu Val Leu Tyr Phe  Lys Lys Ile
    1220                1225                1230

Ile Arg  Phe Asn Glu Ile Arg  Ser Gln Arg Glu Lys  Met Gly Lys
    1235                1240                1245

Thr Ile  Ser Pro Tyr Glu Asp  Leu Ser Phe Arg Ser  Tyr Ile Lys
    1250                1255                1260

Glu Asn  Leu Cys Lys Lys Thr  Lys Ala Asp Glu Ile  Gly Glu Lys
    1265                1270                1275

Glu Phe  Tyr Asp Leu Leu Gln  Lys Lys Asn Leu Glu  Ile Tyr Asp
    1280                1285                1290

Met Leu  Leu Thr Lys His Lys  Asp Thr Ile Tyr Asn  Lys Arg Pro
    1295                1300                1305

Asn Ser  Thr Thr Leu Gly Met  Leu Thr Lys Gly Arg  Tyr Glu Phe
    1310                1315                1320

Ile Asn  Leu Lys Pro Lys Asp  Gln Ile Ile Val Met  Leu Glu Ile
    1325                1330                1335

Leu Lys  Leu Phe Cys Thr Thr  Arg Glu Ala Ile Asp  Leu Gly Leu
```

```
    1340                1345                1350

Ile Lys  Gly Lys Pro Ala Ala  Gly Val Ala Thr Leu  Gly Lys Lys
    1355                1360                1365

Ile Ser  Asn Leu Asp Asn Cys  Ile Leu Ile Tyr Gln  Ser Ile Thr
    1370                1375                1380

Gly Ile  Phe Glu Lys Arg Ile  Asp Leu Leu Lys Val
    1385                1390                1395
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<212> PRT
<213> Treponema denticola

<400> 799

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Met Lys Lys Glu Ile Lys Asp Tyr Phe Leu Gly Leu Asp Val Gly Thr
1               5                   10                  15

Gly Ser Val Gly Trp Ala Val Thr Asp Thr Asp Tyr Lys Leu Leu Lys
            20                  25                  30

Ala Asn Arg Lys Asp Leu Trp Gly Met Arg Cys Phe Glu Thr Ala Glu
        35                  40                  45

Thr Ala Glu Val Arg Arg Leu His Arg Gly Ala Arg Arg Arg Ile Glu
    50                  55                  60

Arg Arg Lys Lys Arg Ile Lys Leu Leu Gln Glu Leu Phe Ser Gln Glu
65                  70                  75                  80

Ile Ala Lys Ile Asp Glu Gly Phe Phe Gln Arg Met Lys Glu Ser Pro
                85                  90                  95

Phe Tyr Ala Glu Asp Lys Thr Ile Leu Gln Glu Asn Thr Leu Phe Asn
            100                 105                 110
```

```
Asp Lys Asp Phe Thr Asp Lys Thr Tyr His Lys Ala Tyr Pro Thr Ile
        115                 120                 125

Asn His Leu Ile Lys Ala Trp Ile Glu Asn Lys Val Lys Pro Asp Pro
    130                 135                 140

Arg Leu Leu Tyr Leu Ala Cys His Asn Ile Ile Lys Lys Arg Gly His
145                 150                 155                 160

Phe Leu Phe Glu Gly Asp Phe Asp Ser Glu Asn Gln Phe Asp Thr Ser
                165                 170                 175

Ile Gln Ala Leu Phe Glu Tyr Leu Arg Glu Asp Met Glu Val Asp Ile
            180                 185                 190

Asp Ala Asp Ser Gln Lys Val Lys Glu Ile Leu Lys Asp Ser Ser Leu
        195                 200                 205

Lys Asn Ser Glu Lys Gln Ser Arg Leu Asn Lys Ile Leu Gly Leu Lys
    210                 215                 220

Pro Ser Asp Lys Gln Lys Lys Ala Ile Thr Asn Leu Ile Ser Gly Asn
225                 230                 235                 240

Lys Ile Asn Phe Ala Asp Leu Tyr Asp Asn Pro Asp Leu Lys Asp Ala
                245                 250                 255

Glu Lys Asn Ser Ile Ser Phe Ser Lys Asp Asp Phe Asp Ala Leu Ser
            260                 265                 270

Asp Asp Leu Ala Ser Ile Leu Gly Asp Ser Phe Glu Leu Leu Leu Lys
        275                 280                 285

Ala Lys Ala Val Tyr Asn Cys Ser Val Leu Ser Lys Val Ile Gly Asp
    290                 295                 300

Glu Gln Tyr Leu Ser Phe Ala Lys Val Lys Ile Tyr Glu Lys His Lys
305                 310                 315                 320
```

```
Thr Asp Leu Thr Lys Leu Lys Asn Val Ile Lys Lys His Phe Pro Lys
                325                 330                 335

Asp Tyr Lys Lys Val Phe Gly Tyr Asn Lys Asn Glu Lys Asn Asn Asn
            340                 345                 350

Asn Tyr Ser Gly Tyr Val Gly Val Cys Lys Thr Lys Ser Lys Lys Leu
        355                 360                 365

Ile Ile Asn Asn Ser Val Asn Gln Glu Asp Phe Tyr Lys Phe Leu Lys
    370                 375                 380

Thr Ile Leu Ser Ala Lys Ser Glu Ile Lys Glu Val Asn Asp Ile Leu
385                 390                 395                 400

Thr Glu Ile Glu Thr Gly Thr Phe Leu Pro Lys Gln Ile Ser Lys Ser
                405                 410                 415

Asn Ala Glu Ile Pro Tyr Gln Leu Arg Lys Met Glu Leu Glu Lys Ile
            420                 425                 430

Leu Ser Asn Ala Glu Lys His Phe Ser Phe Leu Lys Gln Lys Asp Glu
        435                 440                 445

Lys Gly Leu Ser His Ser Glu Lys Ile Ile Met Leu Leu Thr Phe Lys
    450                 455                 460

Ile Pro Tyr Tyr Ile Gly Pro Ile Asn Asp Asn His Lys Lys Ser Phe
465                 470                 475                 480

Pro Asp Arg Cys Trp Val Ile Lys Lys Glu Lys Ser Pro Ser Gly Lys
                485                 490                 495

Thr Thr Pro Trp Asn Phe Phe Asp His Ile Asp Lys Asp Lys Thr Ala
            500                 505                 510
```

```
Glu Ala Phe Ile Thr Ser Arg Thr Asn Phe Cys Thr Tyr Leu Val Gly
        515                 520                 525

Glu Ser Val Leu Pro Lys Ser Ser Leu Leu Tyr Ser Glu Tyr Thr Val
    530                 535                 540

Leu Asn Glu Ile Asn Asn Leu Gln Ile Ile Ile Asp Gly Lys Asn Ile
545                 550                 555                 560

Cys Asp Ile Lys Leu Lys Gln Lys Ile Tyr Glu Glu Leu Phe Lys Lys
                565                 570                 575

Tyr Lys Lys Ile Thr Gln Lys Gln Ile Ser Thr Phe Ile Lys His Glu
            580                 585                 590

Gly Ile Cys Asn Lys Thr Asp Glu Val Ile Ile Leu Gly Ile Asp Lys
        595                 600                 605

Glu Cys Thr Ser Ser Leu Lys Ser Tyr Ile Glu Leu Lys Asn Ile Phe
    610                 615                 620

Gly Lys Gln Val Asp Glu Ile Ser Thr Lys Asn Met Leu Glu Glu Ile
625                 630                 635                 640

Ile Arg Trp Ala Thr Ile Tyr Asp Glu Gly Glu Gly Lys Thr Ile Leu
                645                 650                 655

Lys Thr Lys Ile Lys Ala Glu Tyr Gly Lys Tyr Cys Ser Asp Glu Gln
            660                 665                 670

Ile Lys Lys Ile Leu Asn Leu Lys Phe Ser Gly Trp Gly Arg Leu Ser
        675                 680                 685

Arg Lys Phe Leu Glu Thr Val Thr Ser Glu Met Pro Gly Phe Ser Glu
    690                 695                 700

Pro Val Asn Ile Ile Thr Ala Met Arg Glu Thr Gln Asn Asn Leu Met
705                 710                 715                 720
```

```
Glu Leu Leu Ser Ser Glu Phe Lys Phe Thr Glu Asn Ile Lys Lys Ile
               725                 730                 735

Asn Ser Gly Phe Glu Asp Ala Glu Lys Gln Phe Ser Tyr Asn Gly Leu
            740                 745                 750

Val Lys Pro Leu Phe Leu Ser Pro Ser Val Lys Lys Met Leu Trp Gln
        755                 760                 765

Thr Leu Lys Leu Val Lys Glu Ile Ser His Ile Thr Gln Ala Pro Pro
    770                 775                 780

Lys Lys Ile Phe Ile Glu Met Ala Lys Gly Ala Glu Leu Glu Pro Ala
785                 790                 795                 800

Arg Thr Lys Thr Arg Leu Lys Ile Leu Gln Asp Leu Tyr Asn Asn Cys
               805                 810                 815

Lys Asn Asp Ala Asp Ala Phe Ser Ser Glu Ile Lys Asp Leu Ser Gly
            820                 825                 830

Lys Ile Glu Asn Glu Asp Asn Leu Arg Leu Arg Ser Asp Lys Leu Tyr
        835                 840                 845

Leu Tyr Tyr Thr Gln Leu Gly Lys Cys Met Tyr Cys Gly Lys Pro Ile
    850                 855                 860

Glu Ile Gly His Val Phe Asp Thr Ser Asn Tyr Asp Ile Asp His Ile
865                 870                 875                 880

Tyr Pro Gln Ser Lys Ile Lys Asp Asp Ser Ile Ser Asn Arg Val Leu
               885                 890                 895

Val Cys Ser Ser Cys Asn Lys Asn Lys Glu Asp Lys Tyr Pro Leu Lys
            900                 905                 910
```

```
Ser Glu Ile Gln Ser Lys Gln Arg Gly Phe Trp Asn Phe Leu Gln Arg
        915                 920                 925

Asn Asn Phe Ile Ser Leu Glu Lys Leu Asn Arg Leu Thr Arg Thr Thr
    930                 935                 940

Pro Ile Ser Asp Asp Glu Thr Ala Lys Phe Ile Ala Arg Gln Leu Val
945                 950                 955                 960

Glu Thr Arg Gln Ala Thr Lys Val Ala Ala Lys Val Leu Glu Lys Met
                965                 970                 975

Phe Pro Glu Thr Lys Ile Val Tyr Ser Lys Ala Glu Thr Val Ser Met
            980                 985                 990

Phe Arg Asn Lys Phe Asp Ile Ile  Lys Cys Arg Glu Ile  Asn Asp Phe
        995                 1000                1005

His His  Ala His Asp Ala Tyr  Leu Asn Ile Val Val  Gly Asn Val
    1010                1015                1020

Tyr Asn  Thr Lys Phe Thr Asn  Asn Pro Trp Asn Phe  Ile Lys Glu
    1025                1030                1035

Lys Arg  Asp Asn Pro Lys Ile  Ala Asp Thr Tyr Asn  Tyr Tyr Lys
    1040                1045                1050

Val Phe  Asp Tyr Asp Val Lys  Arg Asn Asn Ile Thr  Ala Trp Glu
    1055                1060                1065

Lys Gly  Lys Thr Ile Ile Thr  Val Lys Asp Met Leu  Lys Arg Asn
    1070                1075                1080

Thr Pro  Ile Tyr Thr Arg Gln  Ala Ala Cys Lys Lys  Gly Gly Leu
    1085                1090                1095

Phe Asp  Gln Thr Ile Met Lys  Lys Gly Leu Gly Gln  His Pro Leu
    1100                1105                1110
```

```
Lys Lys  Glu Gly Ala Phe Ser  Asn Ile Ser Lys Tyr  Gly Gly Tyr
    1115                1120                1125

Asn Lys  Val Ser Ala Ala Tyr  Tyr Thr Leu Ile Glu  Tyr Glu Glu
    1130                1135                1140

Lys Gly  Asn Lys Ile Arg Ser  Leu Glu Thr Ile Pro  Leu Tyr Leu
    1145                1150                1155

Val Lys  Asp Ile Gln Lys Asp  Gln Asp Val Leu Lys  Ser Tyr Leu
    1160                1165                1170

Thr Asp  Leu Leu Gly Lys Lys  Glu Ile Lys Ile Leu  Val Pro Lys
    1175                1180                1185

Ile Lys  Ile Asn Ser Leu Leu  Lys Ile Asn Gly Phe  Pro Cys His
    1190                1195                1200

Ile Thr  Gly Lys Thr Gly Asp  Ser Phe Val Leu Arg  Pro Ala Val
    1205                1210                1215

Gln Phe  Cys Cys Ser Asn Asp  Glu Val Leu Tyr Phe  Lys Lys Ile
    1220                1225                1230

Ile Arg  Phe Asn Glu Ile Arg  Ser Gln Arg Glu Lys  Met Gly Lys
    1235                1240                1245

Thr Ile  Ser Pro Tyr Glu Asp  Leu Ser Phe Arg Ser  Tyr Ile Lys
    1250                1255                1260

Glu Asn  Leu Cys Lys Lys Thr  Lys Ala Asp Glu Ile  Gly Glu Lys
    1265                1270                1275

Glu Phe  Tyr Asp Leu Leu Gln  Lys Lys Asn Leu Glu  Ile Tyr Asp
    1280                1285                1290
```

```
Met Leu  Leu Thr Lys His Lys  Asp Thr Ile Tyr Asn  Lys Arg Pro
    1295                1300                1305


Asn Ser  Thr Thr Leu Gly Met  Leu Thr Lys Gly Arg  Tyr Glu Phe
    1310                1315                1320


Ile Asn  Leu Lys Pro Lys Asp  Gln Ile Ile Val Met  Leu Glu Ile
    1325                1330                1335


Leu Lys  Leu Phe Cys Thr Thr  Arg Glu Ala Ile Asp  Leu Gly Leu
    1340                1345                1350


Ile Lys  Gly Lys Pro Ala Ala  Gly Val Ala Thr Leu  Gly Lys Lys
    1355                1360                1365


Ile Ser  Asn Pro Asp Asn Cys  Ile Leu Ile Tyr Gln  Ser Ile Thr
    1370                1375                1380


Gly Ile  Phe Glu Lys Arg Ile  Asp Leu Leu Lys Val
    1385                1390                1395


<210>  800
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<213>  Treponema denticola

<400>  800

Met Lys Lys Glu Ile Lys Asp Tyr Phe Leu Gly Leu Asp Val Gly Thr
1               5                   10                  15


Gly Ser Val Gly Trp Ala Val Thr Asp Thr Asp Tyr Lys Leu Leu Lys
            20                  25                  30


Ala Asn Arg Lys Asp Leu Trp Gly Met Arg Cys Phe Glu Thr Ala Glu
        35                  40                  45


Thr Ala Glu Val Arg Arg Leu His Arg Gly Ala Arg Arg Arg Ile Glu
    50                  55                  60
```

```
Arg Arg Lys Lys Arg Ile Lys Leu Leu Gln Glu Leu Phe Ser Gln Glu
65                  70                  75                  80

Ile Ala Lys Ile Asp Glu Gly Phe Phe Gln Arg Met Lys Glu Ser Pro
                85                  90                  95

Leu Tyr Ala Glu Asp Lys Thr Ile Leu Gln Glu Asn Thr Leu Phe Asn
            100                 105                 110

Asp Lys Asp Phe Thr Asp Lys Thr Tyr His Lys Ala Tyr Pro Thr Ile
        115                 120                 125

Asn His Leu Ile Lys Ala Trp Ile Glu Asn Lys Val Lys Pro Asp Pro
    130                 135                 140

Arg Leu Leu Tyr Leu Ala Cys His Asn Ile Ile Lys Lys Arg Gly His
145                 150                 155                 160

Phe Leu Phe Glu Gly Asp Phe Asp Ser Glu Asn Gln Phe Asp Thr Ser
                165                 170                 175

Ile Gln Ala Leu Phe Glu Tyr Leu Arg Glu Asp Met Glu Leu Asp Ile
            180                 185                 190

Asp Ala Asp Ser Gln Lys Val Lys Glu Ile Leu Lys Asp Ser Ser Leu
        195                 200                 205

Lys Asn Ser Glu Lys Gln Ser Arg Leu Asn Lys Met Leu Gly Leu Lys
    210                 215                 220

Pro Ser Asp Lys Gln Lys Lys Ala Ile Thr Asn Leu Ile Ser Gly Asn
225                 230                 235                 240

Lys Ile Asn Phe Ala Asp Leu Tyr Asp Asn Pro Asp Leu Lys Asp Ala
                245                 250                 255

Glu Lys Asn Ser Ile Ser Phe Ser Lys Asp Asp Phe Asp Ala Leu Ser
```

```
            260                 265                 270

Asp Asp Leu Ala Ser Ile Leu Gly Asp Ser Phe Glu Leu Leu Leu Lys
        275                 280                 285

Ala Lys Ala Val Tyr Asn Cys Ser Val Leu Ser Lys Val Ile Gly Asp
    290                 295                 300

Glu Gln Tyr Leu Ser Phe Ala Lys Val Lys Ile Tyr Glu Lys His Lys
305                 310                 315                 320

Thr Asp Leu Thr Lys Leu Lys Asn Val Ile Lys Lys His Phe Pro Lys
                325                 330                 335

Asp Tyr Lys Lys Val Phe Gly Tyr Asn Lys Asn Glu Lys Asn Asn Asn
            340                 345                 350

Asn Tyr Ser Ala Tyr Val Gly Val Cys Lys Ile Thr His Lys Lys Leu
        355                 360                 365

Val Ile Lys Asn Ser Ala Ser Gln Glu Asp Phe Tyr Lys Phe Leu Lys
    370                 375                 380

Thr Ile Leu Ser Ala Lys Ser Glu Ile Lys Glu Val Asn Asp Ile Leu
385                 390                 395                 400

Thr Glu Ile Glu Thr Gly Thr Phe Leu Pro Lys Gln Ile Ser Lys Ser
                405                 410                 415

Asn Ala Glu Ile Pro Tyr Gln Leu Arg Lys Met Glu Leu Glu Lys Ile
            420                 425                 430

Leu Ser Asn Ala Glu Lys His Phe Ser Phe Leu Lys Gln Lys Asp Glu
        435                 440                 445

Lys Gly Leu Ser His Ser Glu Lys Ile Ile Met Leu Leu Thr Phe Lys
    450                 455                 460
```

```
Ile Pro Tyr Tyr Ile Gly Pro Ile Asn Asp Asn His Lys Lys Ser Phe
465                 470                 475                 480

Pro Asp Arg Cys Trp Val Val Lys Lys Glu Lys Ser Pro Ser Gly Lys
                485                 490                 495

Thr Thr Pro Trp Asn Phe Phe Asp His Ile Asp Lys Glu Lys Thr Ala
            500                 505                 510

Glu Glu Phe Ile Thr Ser Arg Thr Asn Phe Cys Thr Tyr Leu Ile Gly
        515                 520                 525

Glu Ser Val Leu Pro Lys Ser Ser Leu Leu Tyr Ser Glu Tyr Thr Val
    530                 535                 540

Leu Asn Glu Ile Asn Asn Leu Gln Ile Ile Ile Asp Gly Lys Asn Ile
545                 550                 555                 560

Cys Asp Ile Lys Leu Lys Gln Lys Ile Tyr Glu Glu Leu Phe Lys Lys
                565                 570                 575

Tyr Lys Lys Ile Thr Gln Lys Gln Ile Ser Thr Phe Ile Lys His Glu
            580                 585                 590

Gly Ile Cys Asn Lys Thr Asp Glu Val Ile Ile Leu Gly Ile Asp Lys
        595                 600                 605

Glu Cys Thr Ser Ser Leu Lys Ser Tyr Ile Glu Leu Lys Asn Ile Phe
    610                 615                 620

Gly Lys Gln Val Asp Glu Ile Ser Thr Lys Asn Met Leu Glu Glu Ile
625                 630                 635                 640

Ile Arg Trp Ala Thr Ile Tyr Asp Glu Gly Glu Gly Lys Thr Ile Leu
                645                 650                 655

Lys Thr Lys Ile Lys Ala Glu Tyr Gly Lys Tyr Cys Ser Asp Glu Gln
```

```
            660                 665                 670

Ile Lys Lys Ile Leu Asn Leu Lys Phe Ser Gly Trp Gly Arg Leu Ser
        675                 680                 685

Arg Lys Phe Leu Glu Thr Val Thr Ser Glu Met Pro Gly Phe Ser Glu
    690                 695                 700

Pro Val Asn Ile Ile Thr Ala Met Arg Glu Thr Gln Asn Asn Leu Met
705                 710                 715                 720

Glu Leu Leu Ser Ser Glu Phe Lys Phe Thr Glu Asn Ile Lys Lys Ile
                725                 730                 735

Asn Ser Gly Phe Glu Asp Ala Glu Lys Gln Phe Ser Tyr Asn Gly Leu
            740                 745                 750

Val Lys Pro Leu Phe Leu Ser Pro Ser Val Lys Lys Met Leu Trp Gln
        755                 760                 765

Thr Leu Lys Leu Val Lys Glu Ile Ser His Ile Thr Gln Ala Pro Pro
    770                 775                 780

Lys Lys Ile Phe Ile Glu Met Ala Lys Gly Ala Glu Leu Glu Pro Ala
785                 790                 795                 800

Arg Thr Lys Thr Arg Leu Lys Ile Leu Gln Asp Leu Tyr Ser Ser Cys
                805                 810                 815

Lys Asn Asp Ala Asp Ala Phe Ser Ser Glu Ile Gln Tyr Leu Ser Gly
            820                 825                 830

Lys Ile Glu Asn Glu Asp Asn Leu Arg Leu Arg Ser Asp Lys Leu Tyr
        835                 840                 845

Leu Tyr Tyr Thr Gln Leu Gly Lys Cys Met Tyr Cys Gly Lys Pro Ile
    850                 855                 860
```

```
Glu Ile Gly His Val Phe Asp Thr Ser Asn Tyr Asp Ile Asp His Ile
865                 870                 875                 880


Tyr Pro Gln Ser Lys Ile Lys Asp Asp Ser Ile Ser Asn Arg Val Leu
                885                 890                 895


Val Cys Ser Ser Cys Asn Lys Asn Lys Glu Asp Lys Tyr Pro Leu Lys
            900                 905                 910


Ala Glu Ile Gln Ser Lys Gln Arg Gly Phe Trp Asn Phe Leu Gln Arg
        915                 920                 925


Asn Asn Phe Ile Ser Leu Glu Lys Leu Asn Arg Leu Thr Arg Thr Ser
    930                 935                 940


Pro Ile Ser Asp Asp Glu Thr Ala Lys Phe Ile Ala Arg Gln Leu Val
945                 950                 955                 960


Glu Thr Arg Gln Ala Thr Lys Val Ala Ala Lys Val Leu Glu Lys Met
                965                 970                 975


Phe Pro Glu Thr Lys Ile Val Tyr Ser Lys Ala Glu Thr Val Ser Met
            980                 985                 990


Phe Arg Asn Lys Phe Asp Ile Ile  Lys Cys Arg Glu Ile  Asn Asp Phe
        995                 1000                1005


His His  Ala His Asp Ala Tyr  Leu Asn Ile Val Val  Gly Asn Val
    1010                1015                1020


Tyr Asn  Thr Lys Phe Thr Asn  Asn Pro Trp Asn Phe  Ile Lys Glu
    1025                1030                1035


Lys Arg  Asp Asn Pro Lys Ile  Ala Asp Thr Tyr Asn  Tyr Tyr Lys
    1040                1045                1050


Val Phe  Asp Tyr Asp Val Lys  Arg Asn Asn Ile Thr  Ala Trp Glu
```

```
    1055                1060                1065

Lys Gly  Lys Thr Ile Ile Thr  Val Lys Asp Met Leu  Lys Arg Asn
    1070                1075                1080

Thr Pro  Ile Tyr Thr Arg Gln  Ala Ala Cys Lys Lys  Gly Glu Leu
    1085                1090                1095

Phe Asn  Gln Thr Ile Met Lys  Lys Gly Leu Gly Gln  His Pro Leu
    1100                1105                1110

Lys Lys  Glu Gly Pro Leu Ser  Asn Ile Ser Lys Tyr  Gly Gly Tyr
    1115                1120                1125

Asn Lys  Val Ser Ala Ala Tyr  Tyr Thr Leu Ile Glu  Tyr Glu Glu
    1130                1135                1140

Lys Gly  Ser Lys Ile Arg Ser  Leu Glu Thr Ile Pro  Leu Tyr Leu
    1145                1150                1155

Val Lys  Asp Ile Gln Lys Asn  Lys Asp Gly Leu Lys  Ser Tyr Leu
    1160                1165                1170

Thr Asp  Gln Ile Gly Lys Lys  Glu Ile Lys Ile Leu  Ile Pro Lys
    1175                1180                1185

Ile Lys  Ile Asn Ser Leu Leu  Lys Ile Asn Gly Phe  Pro Cys His
    1190                1195                1200

Ile Thr  Gly Lys Met Gly Glu  Ala Phe Val Leu Arg  Pro Ala Val
    1205                1210                1215

Gln Phe  Cys Cys Ser Asn Asp  Glu Ala Leu Tyr Phe  Lys Lys Ile
    1220                1225                1230

Ile Arg  Phe Asn Glu Ile Arg  Lys Gln Arg Glu Lys  Met Gly Lys
    1235                1240                1245
```

```
Thr Ile  Ser Pro Tyr Glu Asp  Leu Ser Phe Arg Ser  Tyr Ile Lys
    1250                1255                1260


Asp Asn  Leu Cys Lys Lys Thr  Lys Ala Asp Glu Ile  Glu Glu Lys
    1265                1270                1275


Glu Phe  Tyr Asp Leu Leu Gln  Lys Lys Asn Leu Glu  Ile Tyr Asp
    1280                1285                1290


Met Leu  Leu Thr Lys His Lys  Asp Thr Ile Tyr Lys  Lys Arg Pro
    1295                1300                1305


Asn Ser  Ala Thr Ile Asp Ile  Leu Val Lys Gly Lys  Glu Lys Phe
    1310                1315                1320


Lys Ser  Leu Ile Ile Glu Asn  Gln Phe Glu Val Ile  Leu Glu Ile
    1325                1330                1335


Leu Lys  Leu Phe Ser Ala Thr  Arg Asn Val Ser Asp  Leu Gln His
    1340                1345                1350


Ile Gly  Gly Ser Lys Asn Ala  Gly Asn Ala Arg Val  Gly Asn Lys
    1355                1360                1365


Ile Ser  Ser Leu Asp Asn Cys  Ile Leu Ile Tyr Gln  Ser Ile Thr
    1370                1375                1380


Gly Ile  Phe Glu Lys Arg Ile  Asp Leu Leu Lys Ile
    1385                1390                1395


<210>  801
<211>  1395
<212>  PRT
<213>  Treponema denticola

<400>  801

Met Lys Lys Glu Ile Lys Asp Tyr Phe Leu Gly Leu Asp Val Gly Thr
1               5                  10                  15
```

```
Gly Ser Val Gly Trp Ala Val Thr Asp Thr Asp Tyr Lys Leu Leu Lys
            20                  25                  30

Ala Asn Arg Lys Asp Leu Trp Gly Met Arg Cys Phe Glu Thr Ala Glu
        35                  40                  45

Thr Ala Glu Val Arg Arg Leu His Arg Gly Ala Arg Arg Arg Ile Glu
    50                  55                  60

Arg Arg Lys Lys Arg Ile Lys Leu Leu Gln Glu Leu Phe Ser Gln Glu
65                  70                  75                  80

Ile Ala Lys Ile Asp Glu Gly Phe Phe Gln Arg Met Lys Glu Ser Pro
                85                  90                  95

Leu Tyr Ala Glu Asp Lys Thr Ile Leu Gln Glu Asn Thr Leu Phe Asn
            100                 105                 110

Asp Lys Asp Phe Thr Asp Lys Thr Tyr His Lys Ala Tyr Pro Thr Ile
        115                 120                 125

Asn His Leu Ile Lys Ala Trp Ile Glu Asn Lys Val Lys Pro Asp Pro
    130                 135                 140

Arg Leu Leu Tyr Leu Ala Cys His Asn Ile Ile Lys Lys Arg Gly His
145                 150                 155                 160

Phe Leu Phe Glu Gly Asp Phe Asp Ser Glu Asn Gln Phe Asp Thr Ser
                165                 170                 175

Ile Gln Ala Leu Phe Glu Tyr Leu Arg Glu Asp Met Glu Val Asp Ile
            180                 185                 190

Asp Ala Asp Ser Gln Lys Val Lys Glu Ile Leu Lys Asp Ser Ser Leu
        195                 200                 205
```

```
Lys Asn Ser Glu Lys Gln Ser Arg Leu Asn Lys Met Leu Gly Leu Lys
    210                 215                 220

Pro Ser Asp Lys Gln Lys Lys Ala Ile Thr Asn Leu Ile Ser Gly Asn
225                 230                 235                 240

Lys Ile Asn Phe Ala Asp Leu Tyr Asp Asn Pro Asp Leu Lys Asp Ala
                245                 250                 255

Glu Lys Asn Ser Ile Ser Phe Ser Lys Asp Asp Phe Asp Ala Leu Ser
            260                 265                 270

Asp Asp Leu Ala Ser Ile Leu Gly Asp Ser Phe Glu Leu Leu Leu Lys
        275                 280                 285

Ala Lys Ala Val Tyr Asn Cys Ser Val Leu Ser Lys Val Ile Gly Asp
    290                 295                 300

Glu Gln Tyr Leu Ser Phe Ala Lys Val Lys Ile Tyr Glu Lys His Lys
305                 310                 315                 320

Thr Asp Leu Thr Lys Leu Lys Asn Val Ile Lys Lys His Phe Pro Lys
                325                 330                 335

Asp Tyr Lys Lys Val Phe Gly Tyr Asn Lys Asn Glu Lys Asn Asn Asn
            340                 345                 350

Asn Tyr Ser Gly Tyr Val Gly Val Cys Lys Thr Lys Ser Lys Lys Leu
        355                 360                 365

Ile Ile Asn Asn Ser Val Asn Gln Glu Asp Phe Tyr Lys Phe Leu Lys
    370                 375                 380

Thr Ile Leu Ser Ala Lys Ser Glu Ile Lys Glu Val Asn Asp Ile Leu
385                 390                 395                 400

Thr Glu Ile Glu Thr Gly Thr Phe Leu Pro Lys Gln Ile Ser Lys Ser
                405                 410                 415
```

```
Asn Ala Glu Ile Pro Tyr Gln Leu Arg Lys Met Glu Leu Glu Lys Ile
            420                 425                 430

Leu Ser Asn Ala Glu Lys His Phe Ser Phe Leu Lys Gln Lys Asp Glu
        435                 440                 445

Lys Gly Leu Ser His Ser Glu Lys Ile Ile Met Leu Leu Thr Phe Lys
    450                 455                 460

Ile Pro Tyr Tyr Ile Gly Pro Ile Asn Asp Asn His Lys Lys Ser Phe
465                 470                 475                 480

Pro Asp Arg Cys Trp Val Val Lys Lys Glu Lys Ser Pro Ser Gly Lys
                485                 490                 495

Thr Thr Pro Trp Asn Phe Phe Asp His Ile Asp Lys Glu Lys Thr Ala
            500                 505                 510

Glu Glu Phe Ile Thr Ser Arg Thr Asn Phe Cys Thr Tyr Leu Ile Gly
        515                 520                 525

Glu Ser Val Leu Pro Lys Asn Ser Leu Leu Tyr Ser Glu Tyr Thr Val
    530                 535                 540

Leu Asn Glu Ile Asn Asn Leu Gln Ile Ile Ile Asp Gly Lys Asn Ile
545                 550                 555                 560

Cys Asp Thr Lys Leu Lys Gln Lys Ile Tyr Glu Glu Leu Phe Lys Lys
                565                 570                 575

Tyr Lys Lys Ile Thr Gln Lys Gln Ile Ser Thr Phe Ile Lys His Glu
            580                 585                 590

Gly Ile Cys Asn Lys Thr Asp Glu Val Ile Ile Leu Gly Ile Asp Lys
        595                 600                 605
```

```
Glu Cys Thr Ser Ser Leu Lys Ser Tyr Ile Glu Leu Lys Asn Ile Phe
    610                 615                 620

Gly Lys Gln Val Asp Glu Ile Ser Thr Lys Asn Met Leu Glu Glu Ile
625                 630                 635                 640

Ile Arg Trp Ala Thr Ile Tyr Asp Glu Gly Glu Gly Lys Thr Ile Leu
                645                 650                 655

Lys Thr Lys Ile Lys Ala Glu Tyr Gly Lys Tyr Cys Ser Asp Glu Gln
            660                 665                 670

Ile Lys Lys Ile Leu Asn Leu Lys Phe Ser Gly Trp Gly Arg Leu Ser
        675                 680                 685

Arg Lys Phe Leu Glu Thr Val Thr Ser Glu Met Pro Gly Phe Ser Glu
    690                 695                 700

Pro Val Asn Ile Ile Thr Ala Met Arg Glu Thr Gln Asn Asn Leu Met
705                 710                 715                 720

Glu Leu Leu Ser Ser Glu Phe Lys Phe Thr Glu Asn Ile Lys Lys Ile
                725                 730                 735

Asn Ser Gly Phe Glu Asp Val Glu Lys Gln Phe Ser Tyr Asp Gly Leu
            740                 745                 750

Val Lys Pro Leu Phe Leu Ser Pro Ser Val Lys Lys Met Leu Trp Gln
        755                 760                 765

Thr Leu Lys Leu Val Lys Glu Ile Ser His Ile Thr Gln Ala Pro Pro
    770                 775                 780

Lys Lys Ile Phe Ile Glu Met Ala Lys Gly Ala Glu Leu Asp Pro Val
785                 790                 795                 800

Arg Thr Lys Thr Arg Leu Lys Ile Leu Gln Asp Leu Tyr Asn Asn Cys
                805                 810                 815
```

```
Lys Asn Asp Ala Asp Ala Phe Ser Ser Glu Ile Lys Asp Leu Ser Gly
            820                 825                 830

Lys Ile Glu Asn Glu Asp Asn Leu Arg Leu Arg Ser Asp Lys Leu Tyr
        835                 840                 845

Leu Tyr Tyr Thr Gln Leu Gly Lys Cys Met Tyr Cys Gly Lys Pro Ile
    850                 855                 860

Glu Ile Gly His Val Phe Asp Thr Ser Asn Tyr Asp Ile Asp His Ile
865                 870                 875                 880

Tyr Pro Gln Ser Lys Ile Lys Asp Asp Ser Ile Ser Asn Arg Val Leu
                885                 890                 895

Val Cys Ser Ser Cys Asn Lys Asn Lys Glu Asp Lys Tyr Pro Leu Lys
            900                 905                 910

Ala Glu Ile Gln Ser Lys Gln Arg Gly Phe Trp Asn Phe Leu Gln Arg
        915                 920                 925

Asn Asn Phe Ile Ser Leu Glu Lys Phe Asn Arg Leu Thr Arg Ala Thr
    930                 935                 940

Pro Ile Ser Asp Asp Glu Thr Ala Lys Phe Ile Ala Arg Gln Leu Val
945                 950                 955                 960

Glu Thr Arg Gln Ala Thr Lys Val Ala Ala Arg Val Leu Glu Lys Met
                965                 970                 975

Phe Pro Glu Thr Lys Ile Val Tyr Ser Lys Ala Glu Thr Val Ser Met
            980                 985                 990

Phe Arg Asn Lys Phe Asp Ile Val  Lys Cys Arg Glu Ile  Asn Asp Phe
        995                 1000                1005
```

```
His His  Ala His Asp Ala Tyr  Leu Asn Ile Val Val  Gly Asn Val
    1010                1015                1020

Tyr Asn  Thr Lys Phe Thr Asn  Asn Leu Trp Asn Phe  Ile Lys Glu
    1025                1030                1035

Lys Arg  Asp Asn Pro Lys Ile  Ala Asp Thr Tyr Asn  Tyr Tyr Lys
    1040                1045                1050

Val Phe  Asp Tyr Asp Val Lys  Arg Asn Asn Ile Thr  Ala Trp Glu
    1055                1060                1065

Lys Gly  Lys Thr Ile Ile Thr  Val Lys Asp Met Leu  Lys Arg Asn
    1070                1075                1080

Thr Pro  Ile Tyr Thr Arg Gln  Ala Ala Cys Lys Lys  Gly Gly Leu
    1085                1090                1095

Phe Asp  Gln Thr Ile Met Lys  Lys Gly Leu Gly Gln  His Pro Leu
    1100                1105                1110

Lys Lys  Glu Gly Pro Phe Ser  Asn Ile Ser Lys Tyr  Gly Gly Tyr
    1115                1120                1125

Asn Lys  Val Ser Ala Ala Tyr  Tyr Thr Leu Ile Glu  Tyr Glu Glu
    1130                1135                1140

Lys Gly  Asn Lys Ile Arg Ser  Leu Glu Thr Ile Pro  Leu Tyr Leu
    1145                1150                1155

Val Lys  Asp Ile Gln Lys Asp  Gln Asp Val Leu Lys  Ser Tyr Leu
    1160                1165                1170

Thr Asp  Leu Leu Gly Lys Lys  Glu Phe Lys Ile Leu  Val Pro Lys
    1175                1180                1185

Ile Lys  Ile Asn Ser Leu Leu  Lys Ile Asn Gly Phe  Pro Cys His
    1190                1195                1200
```

```
Ile Thr  Gly Lys Thr Asn Asp  Ser Phe Leu Leu Arg  Pro Ala Val
    1205                1210                1215

Gln Phe  Cys Cys Ser Asn Asp  Glu Val Leu Tyr Phe  Lys Lys Ile
    1220                1225                1230

Ile Arg  Phe Ser Glu Ile Arg  Ser Gln Arg Glu Lys  Ile Gly Lys
    1235                1240                1245

Thr Ile  Ser Pro Tyr Glu Asp  Leu Ser Phe Arg Ser  Tyr Ile Lys
    1250                1255                1260

Glu Asn  Leu Cys Lys Lys Thr  Lys Asn Asp Glu Ile  Gly Glu Lys
    1265                1270                1275

Glu Phe  Tyr Asp Leu Leu Gln  Lys Lys Asn Leu Glu  Ile Tyr Asp
    1280                1285                1290

Met Leu  Leu Thr Lys His Lys  Asp Thr Ile Tyr Lys  Lys Arg Pro
    1295                1300                1305

Asn Ser  Ala Thr Ile Asp Ile  Leu Val Lys Gly Lys  Glu Lys Phe
    1310                1315                1320

Lys Ser  Leu Ile Ile Glu Asn  Gln Phe Glu Val Ile  Leu Glu Ile
    1325                1330                1335

Leu Lys  Leu Phe Ser Ala Thr  Arg Asn Val Ser Asp  Leu Gln His
    1340                1345                1350

Ile Gly  Gly Ser Lys Tyr Ser  Gly Val Ala Lys Ile  Gly Asn Lys
    1355                1360                1365

Ile Ser  Ser Leu Asp Asn Cys  Ile Leu Ile Tyr Gln  Ser Ile Thr
    1370                1375                1380
```

```
Gly Ile  Phe Glu Lys Arg Ile  Asp Leu Leu Lys Val
    1385                1390                1395


<210>  802
<211>  357
<212>  PRT
<213>  Treponema denticola

<400>  802

Met Lys Lys Glu Ile Lys Asp Tyr Phe Leu Gly Leu Asp Val Gly Thr
1               5                   10                  15


Gly Ser Val Gly Trp Ala Val Thr Asp Thr Asp Tyr Lys Leu Leu Lys
            20                  25                  30


Ala Asn Arg Lys Asp Leu Trp Gly Met Arg Cys Phe Glu Thr Ala Glu
        35                  40                  45


Thr Ala Glu Val Arg Arg Leu His Arg Gly Ala Arg Arg Arg Ile Glu
    50                  55                  60


Arg Arg Lys Lys Arg Ile Lys Leu Leu Gln Glu Leu Phe Ser Gln Glu
65                  70                  75                  80


Ile Ala Lys Thr Asp Glu Gly Phe Phe Gln Arg Met Lys Glu Ser Pro
                85                  90                  95


Phe Tyr Ala Glu Asp Lys Thr Ile Leu Gln Glu Asn Ala Leu Phe Asn
            100                 105                 110


Asp Arg Asp Phe Thr Asp Lys Thr Tyr His Lys Ala Tyr Pro Thr Ile
        115                 120                 125


Asn His Leu Ile Lys Ala Trp Ile Glu Asn Lys Val Lys Pro Asp Pro
    130                 135                 140


Arg Leu Leu Tyr Leu Ala Cys His Asn Ile Ile Lys Lys Arg Gly His
145                 150                 155                 160
```

```
Phe Leu Phe Glu Gly Asp Phe Asp Ser Glu Asn Gln Phe Asp Thr Ser
                165                 170                 175

Ile Gln Ala Phe Phe Glu Tyr Leu Arg Glu Asp Met Glu Val Asp Ile
            180                 185                 190

Asp Ala Asp Ser Gln Lys Ile Lys Glu Ile Leu Lys Asp Ser Ser Leu
        195                 200                 205

Lys Asn Ser Glu Lys Gln Ser Arg Leu Asn Lys Ile Leu Gly Leu Lys
    210                 215                 220

Ser Ser Asp Lys Gln Lys Lys Ala Ile Thr Asn Leu Ile Ser Gly Asn
225                 230                 235                 240

Lys Ile Asn Phe Ala Asp Leu Tyr Asp Asn Pro Asp Leu Lys Asp Ala
                245                 250                 255

Glu Lys Asn Ser Ile Ser Phe Ser Lys Asp Asp Phe Asp Ala Leu Ser
            260                 265                 270

Asp Asp Leu Ala Ser Ile Leu Gly Asp Ser Phe Glu Leu Leu Leu Lys
        275                 280                 285

Ala Lys Ala Val Tyr Asn Cys Ser Val Leu Ser Lys Val Ile Gly Asp
    290                 295                 300

Glu Gln Tyr Leu Ser Phe Ala Lys Val Lys Ile Tyr Glu Lys His Lys
305                 310                 315                 320

Thr Asp Leu Thr Lys Leu Lys Asn Val Ile Lys Lys His Phe Pro Lys
                325                 330                 335

Asp Tyr Lys Lys Val Phe Gly Tyr Asn Lys Asn Glu Lys Ile Thr Thr
            340                 345                 350

Ile Thr Pro Asp Met
```

355

<210> 803
<211> 1395
<212> PRT
<213> Treponema denticola

<400> 803

Met Lys Lys Glu Ile Lys Asp Tyr Phe Leu Gly Leu Asp Val Gly Thr
1 5 10 15

Gly Ser Val Gly Trp Ala Val Thr Asp Thr Asp Tyr Lys Leu Leu Lys
20 25 30

Ala Asn Arg Lys Asp Leu Trp Gly Met Arg Cys Phe Glu Thr Ala Glu
35 40 45

Thr Ala Glu Val Arg Arg Leu His Arg Gly Ala Arg Arg Arg Ile Glu
50 55 60

Arg Arg Lys Lys Arg Ile Lys Leu Leu Gln Glu Leu Phe Ser Gln Glu
65 70 75 80

Ile Ala Lys Thr Asp Glu Gly Phe Phe Gln Arg Met Lys Glu Ser Pro
85 90 95

Phe Tyr Ala Glu Asp Lys Thr Ile Leu Gln Glu Asn Ala Leu Phe Asn
100 105 110

Asp Arg Asp Phe Thr Asp Lys Thr Tyr His Lys Ala Tyr Pro Thr Ile
115 120 125

Asn His Leu Ile Lys Ala Trp Ile Glu Asn Lys Val Lys Pro Asp Pro
130 135 140

Arg Leu Leu Tyr Leu Ala Cys His Asn Ile Ile Lys Lys Arg Gly His
145 150 155 160

```
Phe Leu Phe Glu Gly Asp Phe Asp Ser Glu Asn Gln Phe Asp Thr Ser
                165                 170                 175

Ile Gln Ala Leu Phe Glu Tyr Leu Arg Glu Asp Met Glu Val Asp Ile
            180                 185                 190

Asp Ala Asp Ser Gln Lys Val Lys Glu Ile Leu Lys Asp Ser Ser Leu
        195                 200                 205

Lys Asn Ser Glu Lys Gln Ser Arg Leu Asn Lys Met Leu Gly Leu Lys
    210                 215                 220

Pro Ser Asp Lys Gln Lys Lys Ala Ile Thr Asn Leu Ile Ser Gly Asn
225                 230                 235                 240

Lys Ile Asn Phe Ala Asp Leu Tyr Asp Asn Pro Asp Leu Lys Asp Ala
                245                 250                 255

Glu Lys Asn Ser Ile Ser Phe Ser Lys Asp Asp Phe Asp Ala Leu Ser
            260                 265                 270

Asp Asp Leu Ala Ser Ile Leu Gly Asp Ser Phe Glu Leu Leu Leu Lys
        275                 280                 285

Ala Lys Ala Val Tyr Asn Cys Ser Val Leu Ser Lys Val Ile Gly Asp
    290                 295                 300

Glu Gln Tyr Leu Ser Phe Ala Lys Val Lys Ile Tyr Glu Lys His Lys
305                 310                 315                 320

Thr Asp Leu Thr Lys Leu Lys Asn Val Ile Lys Lys His Phe Pro Asn
                325                 330                 335

Asp Tyr Lys Lys Val Phe Gly Tyr Asn Lys Asn Glu Lys Asn Asn Asn
            340                 345                 350

Asn Tyr Ser Ala Tyr Val Gly Val Cys Lys Thr Lys Ser Lys Lys Leu
        355                 360                 365
```

```
Val Ile Asn Asn Thr Val Asn Gln Glu Asp Phe Tyr Lys Phe Leu Lys
    370                 375                 380

Pro Ile Leu Leu Ala Lys Ser Glu Ile Lys Glu Val Asn Asp Ile Leu
385                 390                 395                 400

Thr Glu Ile Glu Thr Gly Thr Phe Leu Pro Lys Gln Ile Ser Lys Ser
                405                 410                 415

Asn Ala Glu Ile Pro Tyr Gln Leu Arg Lys Met Glu Leu Glu Lys Ile
            420                 425                 430

Leu Ser Asn Ala Glu Lys His Phe Ser Phe Leu Lys Gln Lys Asp Glu
        435                 440                 445

Lys Gly Leu Ser His Ser Glu Lys Ile Ile Met Leu Leu Thr Phe Lys
    450                 455                 460

Ile Pro Tyr Tyr Ile Gly Pro Ile Asn Asp Asn His Lys Lys Ser Phe
465                 470                 475                 480

Pro Asp Arg Cys Trp Val Ile Lys Lys Glu Lys Ser Pro Ser Gly Lys
                485                 490                 495

Thr Thr Pro Trp Asn Phe Phe Asp His Ile Asp Lys Asp Lys Thr Ala
            500                 505                 510

Glu Ala Phe Ile Thr Ser Arg Thr Asn Phe Cys Thr Tyr Leu Val Gly
        515                 520                 525

Glu Ser Val Leu Pro Lys Asn Ser Leu Leu Tyr Ser Glu Tyr Thr Val
    530                 535                 540

Leu Asn Glu Ile Asn Asn Leu Gln Ile Ile Ile Asp Gly Lys Asn Ile
545                 550                 555                 560
```

```
Cys Asp Ile Lys Leu Lys Gln Lys Ile Tyr Glu Glu Leu Phe Lys Lys
                565                 570                 575

Tyr Lys Lys Ile Thr Gln Lys Gln Ile Ser Thr Phe Ile Lys His Glu
            580                 585                 590

Gly Ile Cys Asn Lys Thr Asp Glu Val Ile Ile Leu Gly Ile Asp Lys
        595                 600                 605

Glu Cys Thr Ser Ser Leu Lys Ser Tyr Ile Glu Leu Lys Asn Ile Phe
    610                 615                 620

Gly Lys Gln Val Asp Glu Ile Ser Thr Lys Asn Met Leu Glu Glu Ile
625                 630                 635                 640

Ile Arg Trp Ala Thr Ile Tyr Asp Glu Gly Glu Gly Lys Thr Ile Leu
                645                 650                 655

Lys Thr Lys Ile Lys Ala Glu Tyr Gly Lys Tyr Cys Ser Asp Glu Gln
            660                 665                 670

Ile Lys Lys Ile Leu Asn Leu Lys Phe Ser Gly Trp Gly Arg Leu Ser
        675                 680                 685

Arg Lys Phe Leu Glu Thr Val Thr Ser Glu Met Pro Gly Phe Ser Glu
    690                 695                 700

Pro Val Asn Ile Ile Thr Ala Met Arg Glu Thr Gln Asn Asn Leu Met
705                 710                 715                 720

Glu Leu Leu Ser Ser Glu Phe Lys Phe Thr Glu Asn Ile Lys Lys Ile
                725                 730                 735

Asn Ser Gly Phe Glu Asp Val Glu Lys Gln Phe Ser Tyr Asp Ser Leu
            740                 745                 750

Val Lys Pro Leu Phe Leu Ser Pro Ser Val Lys Lys Met Leu Trp Gln
        755                 760                 765
```

```
Thr Leu Lys Leu Val Lys Glu Ile Ser His Ile Thr Gln Ala Pro Pro
    770                 775                 780

Lys Lys Ile Phe Ile Glu Met Ala Lys Gly Ala Glu Leu Asp Pro Val
785                 790                 795                 800

Arg Thr Lys Thr Arg Leu Lys Ile Leu Gln Asp Leu Tyr Asn Asn Cys
                805                 810                 815

Lys Asn Asp Ala Asp Ala Phe Ser Ser Glu Ile Lys Asp Leu Ser Gly
            820                 825                 830

Lys Ile Glu Asn Glu Asp Asn Leu Arg Leu Arg Ser Asp Lys Leu Tyr
        835                 840                 845

Leu Tyr Tyr Thr Gln Leu Gly Lys Cys Met Tyr Cys Gly Lys Pro Ile
    850                 855                 860

Glu Ile Gly His Val Phe Asp Thr Ser Asn Tyr Asp Ile Asp His Ile
865                 870                 875                 880

Tyr Pro Gln Ser Lys Ile Lys Asp Asp Ser Ile Ser Asn Arg Val Leu
                885                 890                 895

Val Cys Ser Ser Cys Asn Lys Asn Lys Glu Asp Lys Tyr Pro Leu Lys
            900                 905                 910

Ala Glu Ile Gln Ser Lys Gln Arg Gly Phe Trp Asn Phe Leu Gln Arg
        915                 920                 925

Asn Asn Phe Ile Ser Leu Glu Lys Leu Asn Arg Leu Thr Arg Thr Ser
    930                 935                 940

Pro Ile Ser Asp Asp Glu Thr Ala Lys Phe Ile Ala Arg Gln Leu Val
945                 950                 955                 960
```

```
Glu Thr Arg Gln Ala Thr Lys Val Ala Ala Lys Val Leu Glu Lys Met
                965                 970                 975

Phe Pro Glu Thr Lys Ile Val Tyr Ser Lys Ala Glu Thr Val Ser Met
            980                 985                 990

Phe Arg Asn Lys Phe Asp Ile Ile  Lys Cys Arg Glu Ile  Asn Asp Phe
        995                 1000                1005

His His  Ala His Asp Ala Tyr  Leu Asn Ile Val Val  Gly Asn Val
    1010                1015                1020

Tyr Asn  Thr Lys Phe Thr Asn  Asn Pro Trp Asn Phe  Ile Lys Glu
    1025                1030                1035

Lys Arg  Asp Asn Pro Lys Ile  Ala Asp Thr Tyr Asn  Tyr Tyr Lys
    1040                1045                1050

Val Phe  Asp Tyr Asp Val Lys  Arg Asn Asn Ile Thr  Ala Trp Glu
    1055                1060                1065

Lys Gly  Lys Thr Ile Ile Thr  Val Lys Asp Met Leu  Lys Arg Asn
    1070                1075                1080

Thr Pro  Ile Tyr Thr Arg Gln  Ala Ala Cys Lys Lys  Gly Glu Leu
    1085                1090                1095

Phe Asn  Gln Thr Ile Met Lys  Lys Gly Leu Gly Gln  His Pro Leu
    1100                1105                1110

Lys Lys  Glu Gly Pro Leu Ser  Asn Ile Ser Lys Tyr  Gly Gly Tyr
    1115                1120                1125

Asn Lys  Val Ser Ala Ala Tyr  Tyr Thr Leu Ile Glu  Tyr Glu Glu
    1130                1135                1140

Lys Gly  Ser Lys Ile Arg Ser  Leu Glu Thr Ile Pro  Leu Tyr Leu
    1145                1150                1155
```

```
Val Lys  Asp Ile Gln Lys Asn  Lys Asp Gly Leu Lys  Ser Tyr Leu
    1160                1165                1170

Thr Asp  Gln Ile Gly Lys Lys  Glu Ile Lys Ile Leu  Ile Pro Lys
    1175                1180                1185

Ile Lys  Ile Asn Ser Leu Leu  Lys Ile Asn Gly Phe  Pro Cys His
    1190                1195                1200

Ile Thr  Gly Lys Met Gly Glu  Ala Phe Val Leu Arg  Pro Ala Val
    1205                1210                1215

Gln Phe  Cys Cys Ser Asn Asp  Glu Ala Leu Tyr Phe  Lys Lys Ile
    1220                1225                1230

Ile Arg  Phe Asn Glu Ile Arg  Lys Gln Arg Glu Lys  Met Gly Lys
    1235                1240                1245

Thr Ile  Ser Pro Tyr Glu Asp  Leu Ser Phe Arg Ser  Tyr Ile Lys
    1250                1255                1260

Asp Asn  Leu Cys Lys Lys Thr  Lys Ala Asp Glu Ile  Glu Glu Lys
    1265                1270                1275

Glu Phe  Tyr Asp Leu Leu Gln  Lys Lys Asn Leu Glu  Ile Tyr Asp
    1280                1285                1290

Met Leu  Leu Thr Lys His Lys  Asp Thr Ile Tyr Lys  Lys Arg Pro
    1295                1300                1305

Asn Ser  Ala Thr Ile Asp Ile  Leu Val Lys Gly Lys  Glu Lys Phe
    1310                1315                1320

Lys Ser  Leu Ile Ile Glu Asn  Gln Phe Glu Val Ile  Leu Glu Ile
    1325                1330                1335
```

```
Leu Lys  Leu Phe Ser Ala Thr  Arg Asn Val Ser Asp  Leu Gln His
    1340                1345                1350


Ile Gly  Gly Ser Lys Asn Ala  Gly Asn Ala Arg Val  Gly Asn Lys
    1355                1360                1365


Ile Ser  Ser Leu Asp Asn Cys  Ile Leu Ile Tyr Gln  Ser Ile Thr
    1370                1375                1380


Gly Ile  Phe Glu Lys Arg Ile  Asp Leu Leu Lys Ile
    1385                1390                1395
```

<210> 804
<211> 631
<212> PRT
<213> Treponema denticola

<400> 804

```
Met Leu Trp Gln Thr Leu Lys Leu Val Lys Glu Ile Ser His Ile Thr
1               5                   10                  15


Gln Ala Pro Pro Lys Lys Ile Phe Ile Glu Met Ala Lys Gly Ala Glu
            20                  25                  30


Leu Glu Pro Ala Arg Thr Lys Thr Arg Leu Lys Ile Leu Gln Asp Leu
        35                  40                  45


Tyr Asn Asn Cys Lys Asn Asp Ala Asp Ala Phe Ser Ser Glu Ile Lys
    50                  55                  60


Asp Leu Ser Gly Lys Ile Glu Asn Glu Asp Asn Leu Arg Leu Arg Ser
65                  70                  75                  80


Asp Lys Leu Tyr Leu Tyr Tyr Thr Gln Leu Gly Lys Cys Met Tyr Cys
                85                  90                  95


Gly Lys Pro Ile Glu Ile Gly His Val Phe Asp Thr Ser Asn Tyr Asp
            100                 105                 110
```

```
Ile Asp His Ile Tyr Pro Gln Ser Lys Ile Lys Asp Asp Ser Ile Ser
        115                 120                 125

Asn Arg Val Leu Val Cys Ser Ser Cys Asn Lys Asn Lys Glu Asp Lys
    130                 135                 140

Tyr Pro Leu Arg Ser Glu Ile Gln Ser Lys Gln Arg Gly Phe Trp Asn
145                 150                 155                 160

Phe Leu Gln Arg Asn Asn Phe Ile Ser Leu Glu Lys Leu Asn Arg Leu
                165                 170                 175

Thr Arg Thr Thr Pro Ile Ser Asp Asp Glu Thr Ala Lys Phe Ile Ala
            180                 185                 190

Arg Gln Leu Val Glu Thr Arg Gln Ala Thr Lys Val Ala Ala Lys Val
        195                 200                 205

Leu Glu Lys Met Phe Pro Glu Thr Lys Ile Val Tyr Ser Lys Ala Glu
    210                 215                 220

Thr Val Ser Met Phe Arg Asn Lys Phe Asp Ile Val Lys Cys Arg Glu
225                 230                 235                 240

Ile Asn Asp Phe His His Ala His Asp Ala Tyr Leu Asn Ile Val Val
                245                 250                 255

Gly Asn Ile Tyr Asn Thr Lys Phe Thr Asn Asn Pro Trp Asn Phe Ile
            260                 265                 270

Lys Glu Lys Arg Asp Asn Pro Lys Ile Ala Asp Thr Tyr Asn Tyr Tyr
        275                 280                 285

Lys Val Phe Asp Tyr Asp Val Lys Arg Asn Asn Ile Thr Ala Trp Glu
    290                 295                 300

Lys Gly Lys Thr Ile Ile Thr Val Lys Asp Met Leu Lys Arg Asn Thr
```

```
305                 310                 315                 320

Pro Ile Tyr Thr Arg Gln Ala Ala Cys Lys Lys Gly Gly Leu Phe Asp
                325                 330                 335

Gln Thr Ile Met Lys Lys Gly Leu Gly Gln His Pro Leu Lys Lys Glu
            340                 345                 350

Gly Pro Phe Ser Asn Ile Ser Lys Tyr Gly Gly Tyr Asn Lys Val Ser
        355                 360                 365

Ala Ala Tyr Tyr Thr Leu Ile Glu Tyr Glu Glu Lys Glu Asn Lys Ile
    370                 375                 380

Arg Ser Leu Glu Thr Ile Pro Leu Tyr Leu Val Lys Asp Ile Gln Lys
385                 390                 395                 400

Ser Gln Glu Lys Leu Lys Ser Tyr Leu Thr Asp Leu Leu Gly Lys Lys
                405                 410                 415

Glu Ile Lys Ile Leu Val Pro Lys Ile Lys Ile Asn Ser Leu Leu Lys
            420                 425                 430

Ile Asn Gly Phe Pro Cys His Ile Thr Gly Lys Thr Asn Asp Ser Phe
        435                 440                 445

Leu Leu Arg Pro Ala Val Gln Phe Cys Cys Ser Asn Asp Glu Val Leu
    450                 455                 460

Tyr Phe Lys Lys Ile Ile Arg Phe Asn Glu Ile Arg Ser Gln Arg Glu
465                 470                 475                 480

Lys Met Gly Lys Thr Ile Ser Pro Tyr Glu Asp Leu Ser Phe Arg Ser
                485                 490                 495

Tyr Ile Lys Glu Asn Leu Cys Lys Lys Thr Lys Asn Asp Glu Ile Gly
            500                 505                 510
```

```
Glu Lys Glu Phe Tyr Asp Leu Leu Gln Lys Lys Asn Leu Glu Ile Tyr
        515                 520                 525

Asp Met Leu Leu Thr Lys His Lys Asp Thr Ile Tyr Asn Lys Arg Pro
    530                 535                 540

Asn Ser Thr Thr Leu Gly Met Leu Thr Lys Gly Arg Tyr Glu Phe Ile
545                 550                 555                 560

Asn Leu Lys Pro Lys Asp Gln Ile Ile Val Met Leu Glu Ile Leu Lys
                565                 570                 575

Leu Phe Cys Thr Thr Arg Glu Ala Ile Asp Leu Gly Leu Ile Lys Gly
            580                 585                 590

Lys Pro Ala Ala Gly Val Ala Thr Leu Gly Lys Lys Ile Ser Asn Leu
        595                 600                 605

Asp Asn Cys Ile Leu Ile Tyr Gln Ser Ile Thr Gly Ile Phe Glu Lys
    610                 615                 620

Arg Ile Asp Leu Leu Lys Val
625                 630
```

<210> 805
<211> 631
<212> PRT
<213> Treponema denticola

<400> 805

```
Met Leu Trp Gln Thr Leu Lys Leu Val Lys Glu Ile Ser His Ile Thr
1               5                   10                  15

Gln Ala Pro Pro Lys Lys Ile Phe Ile Glu Met Ala Lys Gly Ala Glu
            20                  25                  30

Leu Glu Pro Ala Arg Thr Lys Thr Arg Leu Lys Ile Leu Gln Asp Leu
        35                  40                  45
```

```
Tyr Ser Ser Cys Lys Asn Asp Ala Asp Ala Phe Ser Ser Glu Ile Gln
    50                  55                  60

Tyr Leu Ser Gly Lys Ile Glu Asn Glu Asp Asn Leu Arg Leu Arg Ser
65                  70                  75                  80

Asp Lys Leu Tyr Leu Tyr Tyr Thr Gln Leu Gly Lys Cys Met Tyr Cys
                85                  90                  95

Gly Lys Pro Ile Glu Ile Gly His Val Phe Asp Thr Ser Asn Tyr Asp
            100                 105                 110

Ile Asp His Ile Tyr Pro Gln Ser Lys Ile Lys Asp Asp Ser Ile Ser
        115                 120                 125

Asn Arg Val Leu Val Cys Ser Ser Cys Asn Lys Asn Lys Glu Asp Lys
    130                 135                 140

Tyr Pro Leu Lys Ser Glu Ile Gln Ser Lys Gln Arg Gly Phe Trp Asn
145                 150                 155                 160

Phe Leu Gln Arg Asn Asn Phe Ile Ser Leu Glu Lys Leu Asn Arg Leu
                165                 170                 175

Thr Arg Thr Thr Pro Ile Ser Asp Asp Glu Thr Ala Lys Phe Ile Ala
            180                 185                 190

Arg Gln Leu Val Glu Thr Arg Gln Ala Thr Lys Val Ala Ala Lys Val
        195                 200                 205

Leu Glu Lys Met Phe Pro Glu Thr Lys Ile Val Tyr Ser Lys Ala Glu
    210                 215                 220

Thr Val Ser Met Phe Arg Asn Lys Phe Asp Ile Ile Lys Cys Arg Glu
225                 230                 235                 240
```

```
Ile Asn Asp Phe His His Ala His Asp Ala Tyr Leu Asn Ile Val Val
                245                 250                 255

Gly Asn Val Tyr Asn Thr Lys Phe Thr Asn Asn Pro Trp Asn Phe Ile
            260                 265                 270

Lys Glu Lys Arg Asp Asn Pro Lys Ile Ala Asp Thr Tyr Asn Tyr Tyr
        275                 280                 285

Lys Val Phe Asp Tyr Asp Val Lys Arg Asn Asn Ile Thr Ala Trp Glu
    290                 295                 300

Lys Gly Lys Thr Ile Ile Thr Val Lys Asp Met Leu Lys Arg Asn Thr
305                 310                 315                 320

Pro Ile Tyr Thr Arg Gln Ala Ala Cys Lys Lys Gly Glu Leu Phe Asn
                325                 330                 335

Gln Thr Ile Met Lys Lys Gly Leu Gly Gln His Pro Leu Lys Lys Glu
            340                 345                 350

Gly Pro Phe Ser Asn Ile Ser Lys Tyr Gly Gly Tyr Asn Lys Val Ser
        355                 360                 365

Ala Ala Tyr Tyr Thr Leu Ile Glu Tyr Glu Glu Lys Val Asn Lys Ile
    370                 375                 380

Arg Ser Leu Glu Thr Ile Pro Leu Tyr Leu Val Lys Asp Ile Gln Lys
385                 390                 395                 400

Asp Gln Asp Val Leu Lys Ser Tyr Leu Thr Asp Leu Leu Gly Lys Lys
                405                 410                 415

Glu Ile Lys Ile Leu Val Pro Lys Ile Lys Ile Asn Ser Leu Leu Lys
            420                 425                 430

Ile Asn Gly Phe Pro Cys His Ile Thr Gly Lys Thr Gly Asp Ser Phe
        435                 440                 445
```

```
Val Leu Arg Pro Ala Val Gln Phe Cys Cys Ser Asn Asp Glu Val Leu
    450                 455                 460

Tyr Phe Lys Lys Ile Ile Arg Phe Asn Glu Ile Arg Ser Gln Arg Glu
465                 470                 475                 480

Lys Met Gly Lys Thr Ile Ser Pro Tyr Glu Asp Leu Ser Phe Arg Ser
                485                 490                 495

Tyr Ile Lys Glu Asn Leu Cys Lys Lys Thr Lys Ala Asp Glu Ile Gly
            500                 505                 510

Glu Lys Glu Phe Tyr Asp Leu Leu Gln Lys Lys Asn Leu Glu Ile Tyr
        515                 520                 525

Asp Met Leu Leu Thr Lys His Lys Asp Thr Ile Tyr Asn Lys Arg Pro
    530                 535                 540

Asn Ser Thr Thr Leu Gly Met Leu Thr Lys Gly Arg Tyr Glu Phe Ile
545                 550                 555                 560

Asn Leu Lys Pro Lys Asp Gln Ile Ile Val Met Leu Glu Ile Leu Lys
                565                 570                 575

Leu Phe Cys Thr Thr Arg Glu Ala Ile Asp Leu Gly Leu Ile Lys Gly
            580                 585                 590

Lys Pro Ala Ala Gly Val Ala Thr Leu Gly Lys Lys Ile Ser Asn Leu
        595                 600                 605

Asp Asn Cys Ile Leu Ile Tyr Gln Ser Ile Thr Gly Ile Phe Glu Lys
    610                 615                 620

Arg Ile Asp Leu Leu Lys Val
625                 630
```

<210> 806
<211> 370
<212> PRT
<213> Treponema denticola

<400> 806

Met Thr Glu Ile Glu Thr Gly Thr Phe Leu Pro Lys Gln Ile Ser Lys
1 5 10 15

Ser Asn Ala Glu Ile Pro Tyr Gln Leu Arg Lys Met Glu Leu Glu Lys
20 25 30

Ile Leu Ser Asn Ala Glu Lys His Phe Ser Phe Leu Lys Gln Lys Asp
35 40 45

Glu Lys Gly Leu Ser His Ser Glu Lys Ile Ile Met Leu Leu Thr Phe
50 55 60

Lys Ile Pro Tyr Tyr Ile Gly Pro Ile Asn Asp Asn His Lys Lys Ser
65 70 75 80

Phe Pro Asp Arg Cys Trp Val Val Lys Lys Glu Lys Ser Pro Ser Gly
85 90 95

Lys Thr Thr Pro Trp Asn Phe Phe Asp His Ile Asp Lys Glu Lys Thr
100 105 110

Ala Glu Glu Phe Ile Thr Ser Arg Thr Asn Phe Cys Thr Tyr Leu Val
115 120 125

Gly Glu Ser Val Leu Pro Lys Ser Ser Leu Leu Tyr Ser Glu Tyr Thr
130 135 140

Val Leu Asn Glu Ile Asn Asn Leu Gln Ile Ile Ile Asp Gly Lys Asn
145 150 155 160

Ile Cys Asp Ile Lys Leu Lys Gln Lys Ile Tyr Glu Glu Leu Phe Lys
165 170 175

```
Lys Tyr Lys Lys Ile Thr Gln Lys Gln Ile Ser Thr Phe Ile Lys His
            180                 185                 190

Glu Gly Ile Cys Asn Lys Thr Asp Glu Val Ile Ile Leu Gly Ile Asp
        195                 200                 205

Lys Glu Cys Thr Ser Ser Leu Lys Ser Tyr Ile Glu Leu Lys Asn Ile
    210                 215                 220

Phe Gly Lys Gln Val Asp Glu Ile Ser Thr Lys Asn Met Leu Glu Asp
225                 230                 235                 240

Ile Ile Arg Trp Ala Ala Ile Tyr Asp Glu Gly Glu Gly Lys Thr Ile
                245                 250                 255

Leu Lys Thr Lys Ile Lys Ala Glu Tyr Gly Lys Tyr Cys Ser Asp Glu
            260                 265                 270

Gln Ile Lys Lys Ile Leu Asn Leu Lys Phe Ser Gly Trp Gly Arg Leu
        275                 280                 285

Ser Arg Lys Phe Leu Glu Thr Val Thr Ser Glu Met Pro Gly Phe Ser
    290                 295                 300

Glu Pro Val Asn Ile Ile Thr Ala Met Arg Glu Thr Gln Asn Asn Leu
305                 310                 315                 320

Met Glu Leu Leu Ser Ser Glu Phe Lys Phe Thr Glu Asn Ile Lys Lys
                325                 330                 335

Ile Asn Ser Gly Phe Glu Asp Val Glu Lys Gln Phe Ser Tyr Asp Gly
            340                 345                 350

Leu Val Lys Pro Leu Phe Leu Ser Pro Ser Val Lys Lys Cys Cys Gly
        355                 360                 365

Arg Leu
```

370

<210> 807
<211> 591
<212> PRT
<213> Treponema phagedenis

<400> 807

Met Ala Arg Gly Lys Glu Ala Glu Lys Gly Arg Thr Ser Ser Arg Tyr
1 5 10 15

Ala Ser Ile Lys Ala Leu Tyr Glu Asn Cys Lys Gln Asp Leu Ala Asp
20 25 30

Tyr Asp Ala Val Leu Glu Gln Phe Lys Ser Glu Glu Pro Leu Arg Leu
35 40 45

Arg Ser Asp Lys Leu Tyr Leu Tyr Tyr Thr Gln Leu Gly Arg Cys Met
50 55 60

Tyr Thr Gly Arg Val Ile Asp Ile Asp Arg Leu Met Ser Asp Asn Ser
65 70 75 80

Ala Tyr Asp Ile Asp His Ile Tyr Pro Arg Ser Lys Ile Lys Asp Asp
85 90 95

Ser Leu Thr Asn Arg Val Leu Val Val Lys Asp Ala Asn Gln Asp Lys
100 105 110

Arg Asp Glu Pro Leu Ser Pro Gln Ile Gln Asp Lys Gln Lys Gly Phe
115 120 125

Trp Asp Phe Leu Lys His Asn Asn Phe Ile Ser Ile Glu Lys Tyr Glu
130 135 140

Arg Leu Thr Tyr Arg Gly Tyr Phe Thr Glu Glu Met Leu Ser Gly Phe
145 150 155 160

```
Ile Ala Arg Gln Leu Val Glu Thr Arg Gln Gly Thr Lys Thr Ala Gly
                165                 170                 175

Gln Ile Leu Glu Gln Leu Tyr Pro Asp Ser Thr Val Val Tyr Cys Lys
            180                 185                 190

Ala Ala Asn Thr Ser Glu Phe Arg Gln Lys Phe Asn Leu Ile Lys Cys
        195                 200                 205

Arg Glu Ile Asn Asp Leu His His Ala His Asp Ala Tyr Leu Asn Ile
    210                 215                 220

Ala Val Gly Asn Val Tyr Tyr Thr Lys Phe Thr Ser Asn Pro Arg Asn
225                 230                 235                 240

Phe Met Lys Leu Lys Glu Pro Tyr Asn Leu Arg Glu Leu Phe Asp Arg
                245                 250                 255

Asp Val Glu Arg Asn Asn Thr Ile Ala Trp Val Lys Asn Lys Thr Ile
            260                 265                 270

Thr Thr Ile Lys Asp Met Leu Lys Arg Asn Thr Pro Leu Tyr Thr Arg
        275                 280                 285

Tyr Ala Tyr Cys Lys Thr Gly Gly Phe Phe Asp Gln Asn Ile Met Lys
    290                 295                 300

Lys Gly Lys Gly Gln Phe Pro Leu Lys Glu Asn Ser Pro Leu Ser Asp
305                 310                 315                 320

Ile Ser Lys Tyr Gly Gly Tyr Asn Lys Val Ser Gly Ala Tyr Phe Ile
                325                 330                 335

Leu Val Gln Lys Lys Glu Lys Asp Ala Val Val Arg Ile Leu Glu Thr
            340                 345                 350

Val Pro Leu Tyr Leu Leu Asn Lys Pro Gly Lys Glu Ser Glu Asn Val
        355                 360                 365
```

```
Arg Glu Tyr Leu Ser Thr Ala Leu Gly Thr Lys Asp Phe Lys Ile Leu
    370                 375                 380

Ile Pro Lys Ile Lys Ile Asn Ser Leu Phe Lys Ile Asn Gly Phe Leu
385                 390                 395                 400

Val His Ile Thr Gly Lys Thr Asn Asp Arg Phe Leu Val Arg Ser Ala
                405                 410                 415

Val Gln Phe Phe Cys Asp Asp Asn Leu Thr Leu Phe Phe Lys Arg Ile
            420                 425                 430

Ile Ala Phe Asn Gly Leu Arg Asn Leu Asn Lys Asp Lys Ser Met Thr
        435                 440                 445

Ala Tyr Asp Asp Asn Thr Met Arg Val Tyr Val Arg Gly Asn Leu Phe
    450                 455                 460

Lys Asp Lys Asn Gln Leu Phe Asp Lys Asn Lys Phe Asn Glu Ile Val
465                 470                 475                 480

Lys Gly Lys Asn Ile Ser Val Tyr Lys Asp Met Val Lys Arg Tyr Glu
                485                 490                 495

Thr Ser Ile Tyr Lys Phe Arg Pro Asn Thr Ala Val Ile Pro Ile Leu
            500                 505                 510

Lys Ser Gly Glu Asp Lys Phe Ile Asn Leu Pro Ile Glu Glu Gln Phe
        515                 520                 525

Lys Ile Leu Gln Glu Ile Leu Lys Leu Phe Gly Ala Ile Asn Gly Thr
    530                 535                 540

Ala Asn Leu Thr Leu Ile Gly Gly Arg Pro Ser Thr Gly Glu Met Lys
545                 550                 555                 560
```

```
Ile Ser Asn Asn Ile Ser Asn Leu Lys Gln Cys Ile Leu Ile His Gln
                565                 570                 575


Ser Pro Thr Gly Val Phe Glu Gln Gln Ile Asp Leu Leu Lys Ile
            580                 585                 590
```

<210> 808
<211> 1062
<212> PRT
<213> Treponema sp.

<400> 808

```
Met Ile Met Lys Leu Glu Lys Trp Arg Leu Gly Leu Asp Leu Gly Thr
1               5                   10                  15


Asn Ser Ile Gly Trp Ser Val Phe Ser Leu Asp Lys Asp Asn Ser Val
            20                  25                  30


Gln Asp Leu Ile Asp Met Gly Val Arg Ile Phe Ser Asp Gly Arg Asp
        35                  40                  45


Pro Lys Thr Lys Glu Pro Leu Ala Val Ala Arg Arg Thr Ala Arg Ser
    50                  55                  60


Gln Arg Lys Leu Ile Tyr Arg Arg Lys Leu Arg Arg Lys Gln Val Phe
65                  70                  75                  80


Lys Phe Leu Gln Glu Gln Gly Leu Phe Pro Lys Thr Lys Glu Glu Cys
                85                  90                  95


Met Thr Leu Lys Ser Leu Asn Pro Tyr Glu Leu Arg Ile Lys Ala Leu
            100                 105                 110


Asp Glu Lys Leu Glu Pro Tyr Glu Leu Gly Arg Ala Leu Phe Asn Leu
        115                 120                 125


Ala Val Arg Arg Gly Phe Lys Ser Asn Arg Lys Asp Gly Ser Arg Glu
    130                 135                 140
```

```
Glu Val Ser Glu Lys Lys Ser Pro Asp Glu Ile Lys Thr Gln Ala Asp
145                 150                 155                 160

Met Gln Thr His Leu Glu Lys Ala Ile Lys Glu Asn Gly Cys Arg Thr
                165                 170                 175

Ile Thr Glu Phe Leu Tyr Lys Asn Gln Gly Glu Asn Gly Gly Ile Arg
            180                 185                 190

Phe Ala Pro Gly Arg Met Thr Tyr Tyr Pro Thr Arg Lys Met Tyr Glu
        195                 200                 205

Glu Glu Phe Asn Leu Ile Arg Ser Lys Gln Glu Lys Tyr Tyr Pro Gln
    210                 215                 220

Val Asp Trp Asp Asp Ile Tyr Lys Ala Ile Phe Tyr Gln Arg Pro Leu
225                 230                 235                 240

Lys Pro Gln Gln Arg Gly Tyr Cys Ile Tyr Glu Asn Asp Lys Glu Arg
                245                 250                 255

Thr Phe Lys Ala Met Pro Cys Ser Gln Lys Leu Arg Ile Leu Gln Asp
            260                 265                 270

Ile Gly Asn Leu Ala Tyr Tyr Glu Gly Gly Ser Lys Lys Arg Val Glu
        275                 280                 285

Leu Asn Asp Asn Gln Asp Lys Val Leu Tyr Glu Leu Leu Asn Ser Lys
    290                 295                 300

Asp Lys Val Thr Phe Asp Gln Met Arg Lys Ala Leu Cys Leu Ala Asp
305                 310                 315                 320

Ser Asn Ser Phe Asn Leu Glu Glu Asn Arg Asp Phe Leu Ile Gly Asn
                325                 330                 335

Pro Thr Ala Val Lys Met Arg Ser Lys Asn Arg Phe Gly Lys Leu Trp
```

```
            340                 345                 350

Asp Glu Ile Pro Leu Glu Glu Gln Asp Leu Ile Ile Glu Thr Ile Ile
        355                 360                 365

Thr Ala Asp Glu Asp Asp Ala Val Tyr Glu Val Ile Lys Lys Tyr Asp
    370                 375                 380

Leu Thr Gln Glu Gln Arg Asp Phe Ile Val Lys Asn Thr Ile Leu Gln
385                 390                 395                 400

Ser Gly Thr Ser Met Leu Cys Lys Glu Val Ser Glu Lys Leu Val Lys
                405                 410                 415

Arg Leu Glu Glu Ile Ala Asp Leu Lys Tyr His Glu Ala Val Glu Ser
            420                 425                 430

Leu Gly Tyr Lys Phe Ala Asp Gln Thr Val Glu Lys Tyr Asp Leu Leu
        435                 440                 445

Pro Tyr Tyr Gly Lys Val Leu Pro Gly Ser Thr Met Glu Ile Asp Leu
    450                 455                 460

Ser Ala Pro Glu Thr Asn Pro Glu Lys His Tyr Gly Lys Ile Ser Asn
465                 470                 475                 480

Pro Thr Val His Val Ala Leu Asn Gln Thr Arg Val Val Val Asn Ala
                485                 490                 495

Leu Ile Lys Glu Tyr Gly Lys Pro Ser Gln Ile Ala Ile Glu Leu Ser
            500                 505                 510

Arg Asp Leu Lys Asn Asn Val Glu Lys Lys Ala Glu Ile Ala Arg Lys
        515                 520                 525

Gln Asn Gln Arg Ala Lys Glu Asn Ile Ala Ile Asn Asp Thr Ile Ser
    530                 535                 540
```

```
Ala Leu Tyr His Thr Ala Phe Pro Gly Lys Ser Phe Tyr Pro Asn Arg
545                 550                 555                 560

Asn Asp Arg Met Lys Tyr Arg Leu Trp Ser Glu Leu Gly Leu Gly Asn
                565                 570                 575

Lys Cys Ile Tyr Cys Gly Lys Gly Ile Ser Gly Ala Glu Leu Phe Thr
            580                 585                 590

Lys Glu Ile Glu Ile Glu His Ile Leu Pro Phe Ser Arg Thr Leu Leu
        595                 600                 605

Asp Ala Glu Ser Asn Leu Thr Val Ala His Ser Ser Cys Asn Ala Phe
    610                 615                 620

Lys Ala Glu Arg Ser Pro Phe Glu Ala Phe Gly Thr Asn Pro Ser Gly
625                 630                 635                 640

Tyr Ser Trp Gln Glu Ile Ile Gln Arg Ala Asn Gln Leu Lys Asn Thr
                645                 650                 655

Ser Lys Lys Asn Lys Phe Ser Pro Asn Ala Met Asp Ser Phe Glu Lys
            660                 665                 670

Asp Ser Ser Phe Ile Ala Arg Gln Leu Ser Asp Asn Gln Tyr Ile Ala
        675                 680                 685

Lys Ala Ala Leu Arg Tyr Leu Lys Cys Leu Val Glu Asn Pro Ser Asp
    690                 695                 700

Val Trp Thr Thr Asn Gly Ser Met Thr Lys Leu Leu Arg Asp Lys Trp
705                 710                 715                 720

Glu Met Asp Ser Ile Leu Cys Arg Lys Phe Thr Glu Lys Glu Val Ala
                725                 730                 735

Leu Leu Gly Leu Lys Pro Glu Gln Ile Gly Asn Tyr Lys Lys Asn Arg
```

```
            740                 745                 750

Phe Asp His Arg His His Ala Ile Asp Ala Val Val Ile Gly Leu Thr
        755                 760                 765

Asp Arg Ser Met Val Gln Lys Leu Ala Thr Lys Asn Ser His Lys Gly
    770                 775                 780

Asn Arg Ile Glu Ile Pro Glu Phe Pro Ile Leu Arg Ser Asp Leu Ile
785                 790                 795                 800

Glu Lys Val Lys Asn Ile Val Val Ser Phe Lys Pro Asp His Gly Ala
                805                 810                 815

Glu Gly Lys Leu Ser Lys Glu Thr Leu Leu Gly Lys Ile Lys Leu His
            820                 825                 830

Gly Lys Glu Thr Phe Val Cys Arg Glu Asn Ile Val Ser Leu Ser Glu
        835                 840                 845

Lys Asn Leu Asp Asp Ile Val Asp Glu Lys Ile Lys Ser Lys Val Lys
    850                 855                 860

Asp Tyr Val Ala Lys His Lys Gly Gln Lys Ile Glu Ala Val Leu Ser
865                 870                 875                 880

Asp Phe Ser Lys Glu Asn Gly Ile Lys Lys Val Arg Cys Val Asn Arg
                885                 890                 895

Val Gln Thr Pro Ile Glu Ile Thr Ser Gly Lys Ile Ser Arg Tyr Leu
            900                 905                 910

Ser Pro Glu Asp Tyr Phe Ala Ala Val Ile Trp Glu Ile Pro Gly Glu
        915                 920                 925

Lys Lys Thr Phe Lys Ala Gln Tyr Ile Arg Arg Asn Glu Val Glu Lys
    930                 935                 940
```

```
Asn Ser Lys Gly Leu Asn Val Val Lys Pro Ala Val Leu Glu Asn Gly
945                 950                 955                 960


Lys Pro His Pro Ala Ala Lys Gln Val Cys Leu Leu His Lys Asp Asp
                965                 970                 975


Tyr Leu Glu Phe Ser Asp Lys Gly Lys Met Tyr Phe Cys Arg Ile Ala
            980                 985                 990


Gly Tyr Ala Ala Thr Asn Asn Lys  Leu Asp Ile Arg Pro  Val Tyr Ala
        995                 1000                1005


Val Ser  Tyr Cys Ala Asp Trp  Ile Asn Ser Thr Asn  Glu Thr Met
    1010                1015                1020


Leu Thr  Gly Tyr Trp Lys Pro  Thr Pro Thr Gln Asn  Trp Val Ser
    1025                1030                1035


Val Asn  Val Leu Phe Asp Lys  Gln Lys Ala Arg Leu  Val Thr Val
    1040                1045                1050


Ser Pro  Ile Gly Arg Val Phe  Arg Lys
    1055                1060


<210>  809
<211>  281
<212>  PRT
<213>  Treponema vincentii

<400>  809

Met Lys Thr Leu Gly Leu Asp Ile Gly Thr Asn Ser Ile Gly Trp Gly
1               5                   10                  15


Ile Val Asp Glu Thr Ala Asn Lys Ile Glu Asp Cys Gly Val Tyr Ile
            20                  25                  30


Phe Pro Glu Gly Val Lys Lys Glu Lys Gly Asn Glu Ser Ser Lys Ala
        35                  40                  45
```

```
Ala Glu Arg Thr Ser Phe Arg Leu Ala Arg Arg Leu Lys Phe Arg Arg
    50                  55                  60

Lys Leu Arg Lys Cys Glu Thr Leu Lys Val Leu Ile Lys Asn Lys Met
65                  70                  75                  80

Cys Pro Leu Thr Met Glu Glu Leu Glu Lys Trp Arg Lys Gln Lys Ile
                85                  90                  95

Tyr Pro Val Ser Gln Asp Phe Leu Asn Trp Tyr Arg Thr Asp Glu Leu
            100                 105                 110

Lys Asn Trp Glu Pro Tyr Phe Leu Arg Lys Lys Cys Ala Glu Gln Lys
        115                 120                 125

Ala Gly Pro Tyr Glu Ile Gly Arg Ala Leu Tyr His Leu Ala Gln Arg
    130                 135                 140

Arg Gly Phe Leu Ser Asn Arg Lys Glu Ser Thr Lys Ala Ser Asp Gly
145                 150                 155                 160

Lys Val Ser Lys Ser Ile Asp Glu Leu Ser Ser Leu Met Asp Gly Arg
                165                 170                 175

Thr Leu Gly Gln Tyr Phe Tyr Glu Leu Lys Gln Ser Gly Glu Lys Val
            180                 185                 190

Arg Gly Lys Tyr Thr Ser Arg Lys Glu His Tyr Glu Lys Glu Phe Asn
        195                 200                 205

Lys Ile Cys Glu Val Gln Glu Ile Ser Pro Glu Leu Lys Asp Asp Leu
    210                 215                 220

Tyr Arg Ala Ile Phe Phe Gln Arg Lys Leu Lys Ser Gln Lys Phe Leu
225                 230                 235                 240
```

```
Val Gly Lys Cys Thr Phe Glu Arg Asn Lys Pro Arg Ala Pro Ile Ser
                245                 250                 255


His Phe Glu Phe Glu Glu Phe Arg Met Leu Ser Phe Ile Asn Ser Ile
            260                 265                 270


Lys Ile Ala Lys Lys Leu Arg Arg Arg
        275                 280


<210>  810
<211>  675
<212>  PRT
<213>  uncultured bacterium

<400>  810

Met Thr Ala Glu Asn Tyr Ser Asn Val Arg Phe Ala Phe Asp Ile Gly
1               5                   10                  15


Thr Asn Ser Ile Gly Trp Ala Val Phe Gln Leu Asn Asp Lys Gln Glu
            20                  25                  30


Ala Thr Ser Ile Leu Asn Ala Gly Ala Arg Ile Phe Ser Asp Gly Arg
        35                  40                  45


Asp Pro Lys Thr Phe Glu Pro Leu Ala Val Arg Arg Arg Asn Val Arg
    50                  55                  60


Ser Ala Ser Arg Met Arg Asp Arg Tyr Leu Arg Arg Arg Lys Arg Thr
65                  70                  75                  80


Leu Asp Lys Leu Ile Gly Tyr Gly Leu Leu Pro Glu Asp Lys Ala Glu
                85                  90                  95


Arg Asp Lys Ile Leu Leu Glu Thr Asn Asp Lys Pro Ser Gly Ser Thr
            100                 105                 110


Asp Lys Lys Thr Asp Pro Tyr Ser Leu Arg Ala Arg Ala Leu Glu Glu
        115                 120                 125
```

```
Lys Leu Pro Leu Ala Tyr Val Ala Arg Ala Leu Phe His Ile Gly Gln
    130                 135                 140

Arg Arg Gly Phe Lys Ser Asn Arg Lys Ala Asp Arg Lys Ser Asn Glu
145                 150                 155                 160

Lys Gly Lys Ile Ala Ala Gly Ile Glu Glu Leu Ser Gly Leu Met His
                165                 170                 175

Gln Ser His Ala Pro Thr Leu Gly Ala Tyr Leu Ala Lys Arg Arg Glu
            180                 185                 190

Glu Gly His Val Val Arg Leu Arg Ala Ser Ser Glu Ala Leu Thr Asn
        195                 200                 205

Lys Ala Tyr Ala Phe Tyr Pro Glu Arg Ala Met Leu Glu Asp Glu Phe
    210                 215                 220

His Lys Ile Trp Gln Ala Gln Ala Glu Tyr Tyr Pro Asp Val Leu Thr
225                 230                 235                 240

Lys Glu Arg Glu Glu Glu Leu Phe His Val Met Phe Phe Gln Arg Pro
                245                 250                 255

Leu Lys Glu Gln Lys Val Gly Leu Cys Thr Leu Val Glu Gly Glu Leu
            260                 265                 270

Arg Leu Pro Lys Ser Asp Pro Leu Phe Gln Gln Phe Arg Leu Tyr Lys
        275                 280                 285

Glu Ile Asn Glu Leu Ala Ile Ile Leu Pro Asp Leu Ser Gln Arg Lys
    290                 295                 300

Leu Thr Met Glu Glu Arg Asp Thr Leu Ile Thr Leu Met Arg Pro Ala
305                 310                 315                 320

Lys Thr Lys Thr Phe Ala Ala Leu Arg Lys Ala Leu Lys Ile Pro Ala
```

```
                325                 330                 335

Gly Gly Arg Phe Asn Lys Glu Thr Glu Asn Arg Lys Gln Leu Thr Gly
            340                 345                 350

Asp Glu Val Tyr Ser Val Phe Ser Lys Pro Glu Leu Phe Gly Gly Asp
        355                 360                 365

Trp Ala Lys Phe Ser Ile Glu Gln Gln Arg Glu Ile Ile Asp Gln Leu
    370                 375                 380

Asn Asn Glu Glu Asn Pro Asp Lys Leu Glu Glu Trp Leu Lys Asn Lys
385                 390                 395                 400

Phe Pro Lys Leu Ser Asp Glu Gln Arg Ser Glu Ile Ile Asn Ala Asn
                405                 410                 415

Leu Pro Asp Gly Tyr Gly Arg Phe Gly Ile Thr Ala Thr Ser Lys Ile
            420                 425                 430

Leu Glu Gln Leu Lys Lys Asp Val Ile Ser Glu Ala Glu Ala Ala His
        435                 440                 445

Arg Cys Gly Phe Asp His Ser Leu Ala Asn Arg Asn Trp Lys Gly Leu
    450                 455                 460

Asp Glu Leu Pro Arg Tyr Gln Glu Val Leu Glu Arg His Ile Val Pro
465                 470                 475                 480

Gly Thr Gly Asp Lys Asn Asp Ile Tyr Asp Ile Tyr Lys Gly Arg Leu
                485                 490                 495

Thr Asn Pro Thr Val His Ile Gly Leu Asn Gln Val Arg Arg Leu Thr
            500                 505                 510

Asn Arg Leu Ile Lys Ala Tyr Gly Lys Pro Trp Gln Ile Val Val Glu
        515                 520                 525
```

```
Leu Ala Arg Asp Leu Pro Met Ser Ser Glu Glu Arg Lys Glu His Asn
    530                 535                 540

Lys Thr Leu Asn Asp Asn Ile Lys Ala Gly Phe Glu Arg Thr Gln Lys
545                 550                 555                 560

Leu Glu Arg Leu Gly Gln Lys Asp Asn Ala Asn Asn Arg Leu Leu Leu
                565                 570                 575

Lys Leu Trp Glu Glu Leu Gly Lys Asp Pro Asp Asp Arg Lys Ser Ile
            580                 585                 590

Tyr Ser Gly Thr Arg Ile Thr Glu Pro Met Leu Phe Ser Gly Glu Val
        595                 600                 605

Glu Ile Asp His Ile Leu Pro Phe Ser Leu Thr Tyr Asp Asp Ser Tyr
    610                 615                 620

Ala Asn Lys Ile Leu Cys Leu Arg Glu Glu Asn Arg Ile Lys Arg Asn
625                 630                 635                 640

Arg Ala Pro Ala Asp Val Thr Glu Trp Lys Asp Arg Tyr Asp Glu Ile
                645                 650                 655

Ile Gly Arg Ser Lys Asn Cys Gln Arg Thr Asn Lys Asn Val Leu Gly
            660                 665                 670

Pro Met Gln
        675


<210>  811
<211>  1017
<212>  PRT
<213>  uncultured bacterium]

<400>  811

Met Arg Val Asp Ser Leu Gly Arg Cys Leu Ser Asp Glu Glu Trp Ala
1               5                   10                  15
```

```
Arg Val Ile Tyr His Leu Cys Lys His Arg Gly Phe His Trp Ile Ser
            20                  25                  30

Arg Ala Glu Ala Lys Gln Thr Glu Gly Asp Ser Lys Ser Glu Gly Gly
        35                  40                  45

Lys Val Lys Gln Gly Leu Ala Gly Thr Ala Lys Leu Met Asp Glu Lys
    50                  55                  60

Gly Tyr Arg Ser Ala Ala Glu Met Val Leu Ala Glu Phe Pro Glu Ala
65                  70                  75                  80

Gln Arg Asn Lys Gln Gly Glu Tyr Arg Lys Ala Leu Ser Arg Glu Leu
                85                  90                  95

Leu Ala Lys Glu Leu Ala Leu Leu Phe Ala Arg Gln Arg Val Phe Gly
            100                 105                 110

Asn Arg His Ala Thr Asp Thr Leu Glu Thr Ala Ile Leu Gly Asn Ser
        115                 120                 125

Asp Lys Lys Ser Gly Leu Phe Trp Gln Gln Lys Pro Ala Leu Ala Gly
    130                 135                 140

Ala Asp Leu Leu Lys Met Leu Gly Thr Cys Thr Phe Glu Lys Asn Glu
145                 150                 155                 160

Tyr Arg Ala Pro Lys Ala Ser Phe Thr Ala Glu Arg His Val Trp Leu
                165                 170                 175

Thr Arg Leu Asn Asn Leu Arg Ile Val Thr Asp Gly Ile Thr Arg Gln
            180                 185                 190

Leu Thr Glu Gln Glu Arg Gln Leu Val Leu Pro Leu Pro Tyr Arg Gln
        195                 200                 205
```

```
Ala Gly Asp Leu Thr Tyr Lys Gln Leu Gly Met Ala Leu Thr Lys Ala
    210                 215                 220

Gly Leu Leu Glu Ala Gly Cys Phe Lys Phe Ile Gly Leu Ala Tyr Pro
225                 230                 235                 240

Thr Glu Ala Gln Lys Ala Glu Gly Lys Thr Lys Asp Pro Glu Ser Ala
                245                 250                 255

Thr Leu Val Lys Ile Pro Ala Trp Gln Glu Leu Arg Gln Thr Leu Asn
            260                 265                 270

Lys Ala Ser Leu Asn Asp Glu Trp Glu Lys Leu Ser Gly Asp Ala Leu
        275                 280                 285

Cys Gly Gln Pro Glu Ile Phe Asp Lys Ile Ala Trp Ile Leu Ser Val
    290                 295                 300

Tyr Lys Asp Asp Asp Glu Val Arg Thr Glu Leu Ala Lys Leu Val Leu
305                 310                 315                 320

Pro Asn Pro Glu Gly Leu Thr Glu Ala Leu Leu Asn Ile Arg Phe Asp
                325                 330                 335

Lys Phe His Ala Leu Ser Leu Lys Ala Leu Arg Ala Ile Val Pro His
            340                 345                 350

Met Glu Lys Gly Leu Arg Tyr Asp Glu Ala Cys Val Gln Ala Gly Tyr
        355                 360                 365

His His Ser Gln Leu His Lys Ile Gly Glu Gly Glu His Lys Tyr Leu
    370                 375                 380

Pro Pro Leu Tyr Asp Gly Arg Asp Gly Asp Gly Arg Met Ile Phe Ala
385                 390                 395                 400

Glu Asp Ala Asp Ile Pro Arg Asn Pro Val Val Leu Arg Ser Leu Asn
                405                 410                 415
```

```
Gln Ala Arg Lys Val Val Asn Ala Ile Ile Arg Arg Tyr Gly Ser Pro
            420                 425                 430

Ser Ala Val His Ile Glu Met Ala Arg Asp Leu Ser Arg Pro Phe Asp
        435                 440                 445

Glu Arg Asn Lys Ile Lys Lys Asp Gln Asp Glu Tyr Gln Ala Arg Asn
    450                 455                 460

Gln Arg Asp Arg Glu Gln Phe Ile Glu Leu Phe Gly His Pro Pro Lys
465                 470                 475                 480

Gly Leu Glu Phe Glu Lys Trp Arg Leu Tyr Arg Glu Gln Asn Gly Gln
                485                 490                 495

Cys Ala Tyr Ser Gln Lys Pro Leu Ala Ser Ser Gly Asp Val Ala Glu
            500                 505                 510

Ile Phe Leu Asp Gly Ser Thr Glu Ile Asp His Ala Leu Pro Tyr Ser
        515                 520                 525

Arg Ser Phe Asp Asp Ser Lys Asn Asn Lys Val Leu Val Leu Thr Arg
    530                 535                 540

Glu Asn Arg Asp Lys Gly Asn Arg Thr Pro Tyr Glu Tyr Leu Gly Gly
545                 550                 555                 560

Ala Glu Asn Ser Glu Arg Trp Gln Arg Phe Phe Ser Phe Val Glu Ser
                565                 570                 575

Asn Lys Ala Tyr Arg Leu Ala Lys Arg Thr Arg Leu Leu Arg Lys Asp
            580                 585                 590

Phe Gly Ala Lys Glu Ser Glu Glu Phe Arg Glu Arg Asn Leu Asn Asp
        595                 600                 605
```

```
Thr Arg Tyr Val Cys Arg Phe Phe Lys Asn Tyr Val Glu Gln His Leu
    610                 615                 620

Lys Leu Ala Glu Gly Ser Glu Ala Lys Arg Cys Val Val Val Ser Gly
625                 630                 635                 640

Gln Leu Thr Asn Phe Leu Arg Thr Arg Trp Gly Leu Leu Lys Ile Arg
                645                 650                 655

Ser Asp Ser Asp Arg His His Ala Leu Asp Ala Ala Val Val Ala Ala
            660                 665                 670

Cys Ser His Ser Met Val Gln Arg Leu Ser Asn Tyr Ser Arg Thr Arg
        675                 680                 685

Glu Leu Glu Gln Val Arg Asp Gly Phe Val Asn Ile Glu Thr Gly Glu
    690                 695                 700

Ile Val Asn Pro Ala Met His Gln Gln Leu Arg Glu His Phe Pro Asp
705                 710                 715                 720

Pro Trp Pro Tyr Phe Arg His Glu Leu Glu Ala Arg Leu Lys Ile Asp
                725                 730                 735

Ser Pro Ala Leu Leu Arg Glu Glu Met Ala Arg Leu Ser Ser Tyr Thr
            740                 745                 750

Glu Glu Glu Leu Ala Ala Leu Lys Pro Leu Phe Val Ser Arg Ala Pro
        755                 760                 765

Gln Arg Arg Asn Gly Gly Ala Ala His Lys Asp Thr Ile Tyr Gly Gln
    770                 775                 780

Pro Glu Lys Leu Lys Lys Asn Gly Ser Val Ser Gln Lys Val Ala Leu
785                 790                 795                 800

Ala Ser Leu Ala Leu Lys Asp Ile Asp Leu Leu Ala Asp Pro His Arg
                805                 810                 815
```

```
Asn Ala Lys Leu Tyr Gly Ala Ile Arg Glu Arg Leu Glu Ala His Gly
            820                 825                 830

Gly Lys Gly Asp Lys Ala Phe Pro Ala Thr Asn Pro Leu Arg Lys Pro
        835                 840                 845

Asp Lys Glu Gly Asn Pro Thr Gly Pro Ile Val Arg Thr Val Thr Lys
    850                 855                 860

Val Ile Asp Lys Leu Ser Gly Ile Pro Val Arg Gly Gly Ile Ala Lys
865                 870                 875                 880

Asn Asp Thr Met Leu Arg Val Asp Val Phe Thr Lys Ala Gly Arg Phe
                885                 890                 895

His Leu Val Pro Val Tyr Val His His Arg Val Thr Gly Leu Pro Asn
            900                 905                 910

Gln Ala Ile Thr Arg Gly Lys Asp Glu Asn Gln Trp Ala Ile Ile Asp
        915                 920                 925

Asp Thr Phe Glu Trp Arg Phe Ser Leu Tyr Pro Asn Asp Leu Val Gln
    930                 935                 940

Ile Arg Leu Lys Asp Glu Thr His Leu Gly Tyr Tyr Ala Ser Thr Asp
945                 950                 955                 960

Arg Ser Thr Ser Ser Ile Ser Ile Trp Ala His Asp Arg Asn Gln Ser
                965                 970                 975

Val Gly Lys Asp Gly Leu Ile Arg Ser Ile Gly Val Thr Thr Ala Lys
            980                 985                 990

Asp Ile Glu Lys Phe His Val Asp  Thr Leu Gly Asn Val  Tyr Pro Ala
        995                 1000                1005
```

```
Pro Pro  Glu Lys Arg Arg Gly  Leu Ala
    1010                1015


<210>  812
<211>  600
<212>  PRT
<213>  uncultured bacterium]

<400>  812

Val Asn Ala Ile Ile Lys Lys His Gly Ser Leu Ser Ala Val His Ile
1               5                   10                  15


Glu Met Ala Arg Asp Leu Ser Arg Pro Leu Asp Glu Arg Arg Glu Val
            20                  25                  30


Lys Lys Leu Gln Glu Glu Phe Lys Asp Arg Asn Asp Lys Ala Arg Glu
        35                  40                  45


Ser Phe Glu Ala Asp His Gly Tyr Arg Pro Lys Gly Ile Val Phe Glu
    50                  55                  60


Lys Trp Met Leu Tyr Arg Glu Gln His Gly Lys Cys Ala Tyr Ser Met
65                  70                  75                  80


Glu Gly Leu Asp Ile Asp Arg Val Leu Asn Asp Ala Asn Tyr Ala Gln
                85                  90                  95


Ile Asp His Ala Leu Pro Tyr Ser Arg Ser Tyr Asp Asp Ser Lys Asn
            100                 105                 110


Asn Lys Val Leu Val Leu Thr Arg Glu Asn Gln Asn Lys Gly Asn Arg
        115                 120                 125


Thr Ala Tyr Glu Tyr Leu Thr Ser Phe Ala Gly Gly Glu Asp Gly Asp
    130                 135                 140


Arg Trp Arg Asn Tyr Ala Ala Trp Val Asn Ser Asn Lys Ser Tyr Arg
145                 150                 155                 160
```

```
Met Ala Lys Arg Asn Arg Leu Leu Arg Lys Asn Tyr Gly Pro Asp Glu
                165                 170                 175

Ala Ser Gly Phe Lys Asp Arg Asn Leu Asn Asp Thr Arg Tyr Ile Cys
            180                 185                 190

Lys Phe Phe Lys Asn Tyr Val Glu Glu His Leu Gln Leu Ala Pro Arg
        195                 200                 205

Ala Asp Gly Asn Ala Asn Lys Arg Cys Val Val Val Asn Gly Gln Leu
    210                 215                 220

Thr Ala Phe Leu Arg Ala Arg Trp Gly Leu Ser Lys Val Arg Ser Glu
225                 230                 235                 240

Ser Asp Arg His His Ala Leu Asp Ala Ala Val Val Ala Ala Cys Ser
                245                 250                 255

His Gly Met Val Lys Ala Leu Ala Asp Tyr Ala Arg Asn Lys Glu Val
            260                 265                 270

Ala Tyr Leu Arg Glu Gly Phe Pro Asp Pro Glu Thr Gly Glu Ile Ile
        275                 280                 285

Asn Pro Glu Ala His Ala Arg Gly Val His His Phe Pro Glu Pro Trp
    290                 295                 300

Ala His Phe Arg His Glu Leu Gln Val Arg Leu Tyr Ser Asp Asp Leu
305                 310                 315                 320

Gln Ala Leu Arg Glu Asp Leu Gln Arg Leu Gly Thr Tyr Ser Glu Gln
                325                 330                 335

Asp Leu Leu Gly Val Arg Thr Leu Phe Val Ser Arg Ala Pro Gln Arg
            340                 345                 350

Arg Asn Asp Gly Ala Val His Lys Glu Thr Ile Tyr Ala Gln Pro Glu
```

```
        355                 360                 365

Ala Leu Arg Lys Gln Gly Gly Val Val Gln Lys Val Pro Leu Thr Ser
    370                 375                 380

Leu Ser Leu Lys Asp Leu Asp Asn Leu Ala Asp Pro His Arg Asn Ala
385                 390                 395                 400

Lys Leu Tyr Thr Ala Leu Arg Ala Arg Leu Glu Ala His Gly Gly Lys
                405                 410                 415

Ala Asp Lys Ala Phe Gly Pro Asp Gln Pro Phe Tyr Lys Pro Asp Lys
            420                 425                 430

Asn Gly Asn Pro Thr Gly Pro Ile Val Arg Thr Ile Lys Leu Val Ile
        435                 440                 445

Asp Lys Leu Ser Gly Ile Pro Ile Arg Gly Gly Val Ala Lys Asn Asp
    450                 455                 460

Thr Met Leu Arg Val Asp Val Phe Thr Lys Ala Gly Lys Phe His Leu
465                 470                 475                 480

Val Pro Val Tyr Val His His Arg Val Thr Gly Leu Pro Asp Arg Ala
                485                 490                 495

Ile Val Ala Phe Lys Asp Glu Val Glu Trp Thr Gln Val Asp Asp Ser
            500                 505                 510

Phe Lys Phe Leu Phe Ser Ile His Pro Asn Asp Leu Ile Arg Ile Gly
        515                 520                 525

Leu Lys Ala Lys Glu Pro Met Ile Gly Tyr Phe Ala Ser Cys His Arg
    530                 535                 540

Gly Thr Gly Ala Phe Asn Val Trp Ser His Asp Arg Asn Thr Ser Val
545                 550                 555                 560
```

```
Gly Lys Ser Gly Ser Val Glu Gly Ile Gly Ile Lys Thr Ala Leu Ser
                565                 570                 575


Leu Glu Lys Leu Asn Ile Asp Val Leu Gly Asn Val Tyr Pro Ala Arg
            580                 585                 590


Pro Glu Gln Arg His Gly Leu Ala
        595                 600


<210>  813
<211>  1011
<212>  PRT
<213>  uncultured delta

<400>  813

Met Ser Ser Lys Ala Ile Asp Ser Leu Glu Gln Leu Asp Leu Phe Lys
1               5                   10                  15


Pro Gln Glu Tyr Thr Leu Gly Leu Asp Leu Gly Ile Lys Ser Ile Gly
            20                  25                  30


Trp Ala Ile Leu Ser Gly Glu Arg Ile Ala Asn Ala Gly Val Tyr Leu
        35                  40                  45


Phe Glu Thr Ala Glu Glu Leu Asn Ser Thr Gly Asn Lys Leu Ile Ser
    50                  55                  60


Lys Ala Ala Glu Arg Gly Arg Lys Arg Arg Ile Arg Arg Met Leu Asp
65                  70                  75                  80


Arg Lys Ala Arg Arg Gly Arg His Ile Arg Tyr Leu Leu Glu Arg Glu
                85                  90                  95


Gly Leu Pro Thr Asp Glu Leu Glu Glu Val Val Val His Gln Ser Asn
            100                 105                 110


Arg Thr Leu Trp Asp Val Arg Ala Glu Ala Val Glu Arg Lys Leu Thr
        115                 120                 125
```

```
Lys Gln Glu Leu Ala Ala Val Leu Phe His Leu Val Arg His Arg Gly
    130                 135                 140

Tyr Phe Pro Asn Thr Lys Lys Leu Pro Pro Asp Asp Glu Ser Asp Ser
145                 150                 155                 160

Ala Asp Glu Glu Gln Gly Lys Ile Asn Arg Ala Thr Ser Arg Leu Arg
                165                 170                 175

Glu Glu Leu Lys Ala Ser Asp Cys Lys Thr Ile Gly Gln Phe Leu Ala
            180                 185                 190

Gln Asn Arg Asp Arg Gln Arg Asn Arg Glu Gly Asp Tyr Ser Asn Leu
        195                 200                 205

Met Ala Arg Lys Leu Val Phe Glu Glu Ala Leu Gln Ile Leu Ala Phe
    210                 215                 220

Gln Arg Lys Gln Gly His Glu Leu Ser Lys Asp Phe Glu Lys Thr Tyr
225                 230                 235                 240

Leu Asp Val Leu Met Gly Gln Arg Ser Gly Arg Ser Pro Lys Leu Gly
                245                 250                 255

Asn Cys Ser Leu Ile Pro Ser Glu Leu Arg Ala Pro Ser Ser Ala Pro
            260                 265                 270

Ser Thr Glu Trp Phe Lys Phe Leu Gln Asn Leu Gly Asn Leu Gln Ile
        275                 280                 285

Ser Asn Ala Tyr Arg Glu Glu Trp Ser Ile Asp Ala Pro Arg Arg Ala
    290                 295                 300

Gln Ile Ile Asp Ala Cys Ser Gln Arg Ser Thr Ser Ser Tyr Trp Gln
305                 310                 315                 320
```

```
Ile Arg Arg Asp Phe Gln Ile Pro Asp Glu Tyr Arg Phe Asn Leu Val
                325                 330                 335

Asn Tyr Glu Arg Arg Asp Pro Asp Val Asp Leu Gln Glu Tyr Leu Gln
            340                 345                 350

Gln Gln Glu Arg Lys Thr Leu Ala Asn Phe Arg Asn Trp Lys Gln Leu
        355                 360                 365

Glu Lys Ile Ile Gly Thr Gly His Pro Ile Gln Thr Leu Asp Glu Ala
    370                 375                 380

Ala Arg Leu Ile Thr Leu Ile Lys Asp Asp Glu Lys Leu Ser Asp Gln
385                 390                 395                 400

Leu Ala Asp Leu Leu Pro Glu Ala Ser Asp Lys Ala Ile Thr Gln Leu
                405                 410                 415

Cys Glu Leu Asp Phe Thr Thr Ala Ala Lys Ile Ser Leu Glu Ala Met
            420                 425                 430

Tyr Arg Ile Leu Pro His Met Asn Gln Gly Met Gly Phe Phe Asp Ala
        435                 440                 445

Cys Gln Gln Glu Ser Leu Pro Glu Ile Gly Val Pro Pro Ala Gly Asp
    450                 455                 460

Arg Val Pro Pro Phe Asp Glu Met Tyr Asn Pro Val Val Asn Arg Val
465                 470                 475                 480

Leu Ser Gln Ser Arg Lys Leu Ile Asn Ala Val Ile Asp Glu Tyr Gly
                485                 490                 495

Met Pro Ala Lys Ile Arg Val Glu Leu Ala Arg Asp Leu Gly Lys Gly
            500                 505                 510

Arg Glu Leu Arg Glu Arg Ile Lys Leu Asp Gln Leu Asp Lys Ser Lys
        515                 520                 525
```

```
Gln Asn Asp Gln Arg Ala Glu Asp Phe Arg Ala Glu Phe Gln Gln Ala
    530                 535                 540

Pro Arg Gly Asp Gln Ser Leu Arg Tyr Arg Leu Trp Lys Glu Gln Asn
545                 550                 555                 560

Cys Thr Cys Pro Tyr Ser Gly Arg Met Ile Pro Val Asn Ser Val Leu
                565                 570                 575

Ser Glu Asp Thr Gln Ile Asp His Ile Leu Pro Ile Ser Gln Ser Phe
            580                 585                 590

Asp Asn Ser Leu Ser Asn Lys Val Leu Cys Phe Thr Glu Glu Asn Ala
        595                 600                 605

Gln Lys Ser Asn Arg Thr Pro Phe Glu Tyr Leu Asp Ala Ala Asp Phe
    610                 615                 620

Gln Arg Leu Glu Ala Ile Ser Gly Asn Trp Pro Glu Ala Lys Arg Asn
625                 630                 635                 640

Lys Leu Leu His Lys Ser Phe Gly Lys Val Ala Glu Glu Trp Lys Ser
                645                 650                 655

Arg Ala Leu Asn Asp Thr Arg Tyr Leu Thr Ser Ala Leu Ala Asp His
            660                 665                 670

Leu Arg His His Leu Pro Asp Ser Lys Ile Gln Thr Val Asn Gly Arg
        675                 680                 685

Ile Thr Gly Tyr Leu Arg Lys Gln Trp Gly Leu Glu Lys Asp Arg Asp
    690                 695                 700

Lys His Thr His His Ala Val Asp Ala Ile Val Val Ala Cys Thr Thr
705                 710                 715                 720
```

```
Pro Ala Ile Val Gln Gln Val Thr Leu Tyr His Gln Asp Ile Arg Arg
                725                 730                 735

Tyr Lys Lys Leu Gly Glu Lys Arg Pro Thr Pro Trp Pro Glu Thr Phe
            740                 745                 750

Arg Gln Asp Val Leu Asp Val Glu Glu Glu Ile Phe Ile Thr Arg Gln
        755                 760                 765

Pro Lys Lys Val Ser Gly Gly Ile Gln Thr Lys Asp Thr Leu Arg Lys
    770                 775                 780

His Arg Ser Lys Pro Asp Arg Gln Arg Val Ala Leu Thr Lys Val Lys
785                 790                 795                 800

Leu Ala Asp Leu Glu Arg Leu Val Glu Lys Asp Ala Ser Asn Arg Asn
                805                 810                 815

Leu Tyr Glu His Leu Lys Gln Cys Leu Glu Glu Ser Gly Asp Gln Pro
            820                 825                 830

Thr Lys Ala Phe Lys Ala Pro Phe Tyr Met Pro Ser Gly Pro Glu Ala
        835                 840                 845

Lys Gln Arg Pro Ile Leu Ser Lys Val Thr Leu Leu Arg Glu Lys Pro
    850                 855                 860

Glu Pro Pro Lys Gln Leu Thr Glu Leu Ser Gly Gly Arg Arg Tyr Asp
865                 870                 875                 880

Ser Met Ala Gln Gly Arg Leu Asp Ile Tyr Arg Tyr Lys Pro Gly Gly
                885                 890                 895

Lys Arg Lys Asp Glu Tyr Arg Val Val Leu Gln Arg Met Ile Asp Leu
            900                 905                 910

Met Arg Gly Glu Glu Asn Val His Val Phe Gln Lys Gly Val Pro Tyr
        915                 920                 925
```

```
Asp Gln Gly Pro Glu Ile Glu Gln Asn Tyr Thr Phe Leu Phe Ser Leu
    930                 935                 940

Tyr Phe Asp Asp Leu Val Glu Phe Gln Arg Ser Ala Asp Ser Glu Val
945                 950                 955                 960

Ile Arg Gly Tyr Tyr Arg Thr Phe Asn Ile Ala Asn Gly Gln Leu Lys
                965                 970                 975

Ile Ser Thr Tyr Leu Glu Gly Arg Gln Asp Phe Asp Phe Phe Gly Ala
            980                 985                 990

Asn Arg Leu Ala His Phe Ala Lys  Val Gln Val Asn Leu  Leu Gly Lys
        995                 1000                1005

Val Ile  Lys
    1010
```

<210> 814
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<212> PRT
<213> uncultured delta proteobacterium HF0070_07E19

<400> 814

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Met Ser Ser Lys Ala Ile Asp Ser Leu Glu Gln Leu Asp Leu Phe Lys
1               5                   10                  15

Pro Gln Glu Tyr Thr Leu Gly Leu Asp Leu Gly Ile Lys Ser Ile Gly
            20                  25                  30

Trp Ala Ile Leu Ser Gly Glu Arg Ile Ala Asn Ala Gly Val Tyr Leu
        35                  40                  45

Phe Glu Thr Ala Glu Glu Leu Asn Ser Thr Gly Asn Lys Leu Ile Ser
    50                  55                  60

Lys Ala Ala Glu Arg Gly Arg Lys Arg Arg Ile Arg Arg Met Leu Asp
```

```
65                  70                  75                  80

Arg Lys Ala Arg Arg Gly Arg His Ile Arg Tyr Leu Leu Glu Arg Glu
                85                  90                  95

Gly Leu Pro Thr Asp Glu Leu Glu Glu Val Val Val His Gln Ser Asn
            100                 105                 110

Arg Thr Leu Trp Asp Val Arg Ala Glu Ala Val Glu Arg Lys Leu Thr
        115                 120                 125

Lys Gln Glu Leu Ala Ala Val Leu Phe His Leu Val Arg His Arg Gly
    130                 135                 140

Tyr Phe Pro Asn Thr Lys Lys Leu Pro Pro Asp Asp Glu Ser Asp Ser
145                 150                 155                 160

Ala Asp Glu Glu Gln Gly Lys Ile Asn Arg Ala Thr Ser Arg Leu Arg
                165                 170                 175

Glu Glu Leu Lys Ala Ser Asp Cys Lys Thr Ile Gly Gln Phe Leu Ala
            180                 185                 190

Gln Asn Arg Asp Arg Gln Arg Asn Arg Glu Gly Asp Tyr Ser Asn Leu
        195                 200                 205

Met Ala Arg Lys Leu Val Phe Glu Glu Ala Leu Gln Ile Leu Ala Phe
    210                 215                 220

Gln Arg Lys Gln Gly His Glu Leu Ser Lys Asp Phe Glu Lys Thr Tyr
225                 230                 235                 240

Leu Asp Val Leu Met Gly Gln Arg Ser Gly Arg Ser Pro Lys Leu Gly
                245                 250                 255

Asn Cys Ser Leu Ile Pro Ser Glu Leu Arg Ala Pro Ser Ser Ala Pro
            260                 265                 270
```

```
Ser Thr Glu Trp Phe Lys Phe Leu Gln Asn Leu Gly Asn Leu Gln Ile
        275                 280                 285

Ser Asn Ala Tyr Arg Glu Glu Trp Ser Ile Asp Ala Pro Arg Arg Ala
    290                 295                 300

Gln Ile Ile Asp Ala Cys Ser Gln Arg Ser Thr Ser Ser Tyr Trp Gln
305                 310                 315                 320

Ile Arg Arg Asp Phe Gln Ile Pro Asp Glu Tyr Arg Phe Asn Leu Val
                325                 330                 335

Asn Tyr Glu Arg Arg Asp Pro Asp Val Asp Leu Gln Glu Tyr Leu Gln
            340                 345                 350

Gln Gln Glu Arg Lys Thr Leu Ala Asn Phe Arg Asn Trp Lys Gln Leu
        355                 360                 365

Glu Lys Ile Ile Gly Thr Gly His Pro Ile Gln Thr Leu Asp Glu Ala
    370                 375                 380

Ala Arg Leu Ile Thr Leu Ile Lys Asp Asp Glu Lys Leu Ser Asp Gln
385                 390                 395                 400

Leu Ala Asp Leu Leu Pro Glu Ala Ser Asp Lys Ala Ile Thr Gln Leu
                405                 410                 415

Cys Glu Leu Asp Phe Thr Thr Ala Ala Lys Ile Ser Leu Glu Ala Met
            420                 425                 430

Tyr Arg Ile Leu Pro His Met Asn Gln Gly Met Gly Phe Phe Asp Ala
        435                 440                 445

Cys Gln Gln Glu Ser Leu Pro Glu Ile Gly Val Pro Pro Ala Gly Asp
    450                 455                 460

Arg Val Pro Pro Phe Asp Glu Met Tyr Asn Pro Val Val Asn Arg Val
```

```
465                 470                 475                 480

Leu Ser Gln Ser Arg Lys Leu Ile Asn Ala Val Ile Asp Glu Tyr Gly
                485                 490                 495

Met Pro Ala Lys Ile Arg Val Glu Leu Ala Arg Asp Leu Gly Lys Gly
            500                 505                 510

Arg Glu Leu Arg Glu Arg Ile Lys Leu Asp Gln Leu Asp Lys Ser Lys
        515                 520                 525

Gln Asn Asp Gln Arg Ala Glu Asp Phe Arg Ala Glu Phe Gln Gln Ala
    530                 535                 540

Pro Arg Gly Asp Gln Ser Leu Arg Tyr Arg Leu Trp Lys Glu Gln Asn
545                 550                 555                 560

Cys Thr Cys Pro Tyr Ser Gly Arg Met Ile Pro Val Asn Ser Val Leu
                565                 570                 575

Ser Glu Asp Thr Gln Ile Asp His Ile Leu Pro Ile Ser Gln Ser Phe
            580                 585                 590

Asp Asn Ser Leu Ser Asn Lys Val Leu Cys Phe Thr Glu Glu Asn Ala
        595                 600                 605

Gln Lys Ser Asn Arg Thr Pro Phe Glu Tyr Leu Asp Ala Ala Asp Phe
    610                 615                 620

Gln Arg Leu Glu Ala Ile Ser Gly Asn Trp Pro Glu Ala Lys Arg Asn
625                 630                 635                 640

Lys Leu Leu His Lys Ser Phe Gly Lys Val Ala Glu Glu Trp Lys Ser
                645                 650                 655

Arg Ala Leu Asn Asp Thr Arg Tyr Leu Thr Ser Ala Leu Ala Asp His
            660                 665                 670
```

```
Leu Arg His His Leu Pro Asp Ser Lys Ile Gln Thr Val Asn Gly Arg
        675                 680                 685

Ile Thr Gly Tyr Leu Arg Lys Gln Trp Gly Leu Glu Lys Asp Arg Asp
    690                 695                 700

Lys His Thr His His Ala Val Asp Ala Ile Val Val Ala Cys Thr Thr
705                 710                 715                 720

Pro Ala Ile Val Gln Gln Val Thr Leu Tyr His Gln Asp Ile Arg Arg
                725                 730                 735

Tyr Lys Lys Leu Gly Glu Lys Arg Pro Thr Pro Trp Pro Glu Thr Phe
            740                 745                 750

Arg Gln Asp Val Leu Asp Val Glu Glu Glu Ile Phe Ile Thr Arg Gln
        755                 760                 765

Pro Lys Lys Val Ser Gly Gly Ile Gln Thr Lys Asp Thr Leu Arg Lys
    770                 775                 780

His Arg Ser Lys Pro Asp Arg Gln Arg Val Ala Leu Thr Lys Val Lys
785                 790                 795                 800

Leu Ala Asp Leu Glu Arg Leu Val Glu Lys Asp Ala Ser Asn Arg Asn
                805                 810                 815

Leu Tyr Glu His Leu Lys Gln Cys Leu Glu Glu Ser Gly Asp Gln Pro
            820                 825                 830

Thr Lys Ala Phe Lys Ala Pro Phe Tyr Met Pro Ser Gly Pro Glu Ala
        835                 840                 845

Lys Gln Arg Pro Ile Leu Ser Lys Val Thr Leu Leu Arg Glu Lys Pro
    850                 855                 860

Glu Pro Pro Lys Gln Leu Thr Glu Leu Ser Gly Gly Arg Arg Tyr Asp
```

```
865                 870                 875                 880

Ser Met Ala Gln Gly Arg Leu Asp Ile Tyr Arg Tyr Lys Pro Gly Gly
                885                 890                 895

Lys Arg Lys Asp Glu Tyr Arg Val Val Leu Gln Arg Met Ile Asp Leu
            900                 905                 910

Met Arg Gly Glu Glu Asn Val His Val Phe Gln Lys Gly Val Pro Tyr
        915                 920                 925

Asp Gln Gly Pro Glu Ile Glu Gln Asn Tyr Thr Phe Leu Phe Ser Leu
    930                 935                 940

Tyr Phe Asp Asp Leu Val Glu Phe Gln Arg Ser Ala Asp Ser Glu Val
945                 950                 955                 960

Ile Arg Gly Tyr Tyr Arg Thr Phe Asn Ile Ala Asn Gly Gln Leu Lys
                965                 970                 975

Ile Ser Thr Tyr Leu Glu Gly Arg Gln Asp Phe Asp Phe Phe Gly Ala
            980                 985                 990

Asn Arg Leu Ala His Phe Ala Lys  Val Gln Val Asn Leu  Leu Gly Lys
        995                 1000                1005

Val Ile  Lys
    1010
```

<210> 815
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<213> Veillonella sp.

<400> 815

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Met Gly Phe Lys Ala Asn Leu Val Asn Leu Phe Thr Asp Glu Asp Ile
1               5                   10                  15
```

```
Glu Val Ile Leu Pro Glu Glu Lys Glu Phe Lys Ser Ile Asn Leu His
            20                  25                  30

Glu Gly Ile Tyr Glu Asp Val Arg Asp Ala Tyr Glu Asp Ala Trp Gly
        35                  40                  45

Asp Arg Phe Ala Ile Val Asp Gln Cys Lys Val Leu His Asp Ile Ile
    50                  55                  60

Val Ile Ser Ser Ile Ile Lys Pro Gly Gln Ser Leu Ser Glu Ala Lys
65                  70                  75                  80

Ile Glu Ser Tyr Asn Gln His Lys Glu Asp Leu Val Leu Leu Lys Ser
                85                  90                  95

Val Leu Lys Glu Asp Arg Lys Leu Tyr Asp Asp Met Phe Val Val Asp
            100                 105                 110

Thr Asp Lys Gly Thr Asn Tyr Val Lys Tyr Thr Lys Gln Gly Val Asn
        115                 120                 125

Gly Asn Thr Ser Ala Thr Gln Glu Glu Phe Tyr Lys Tyr Val Arg Lys
    130                 135                 140

Val Val Ser Val Leu Pro Glu Thr Glu His Thr Arg Arg Ile Val Gln
145                 150                 155                 160

Lys Leu Glu Glu Gly Thr Phe Leu Pro Leu Gln Arg Ile Ser Lys Asn
                165                 170                 175

Gly Val Val Pro Tyr Gln Leu His Lys Glu Glu Leu Val Arg Ile Leu
            180                 185                 190

Asp Lys Ala Thr Val Asn Phe Pro Phe Leu Asn Lys Val Glu Asn Gly
        195                 200                 205

Leu Thr Val Ala Asp Lys Ile Ile Ser Ile Leu Glu Phe Lys Ile Pro
    210                 215                 220
```

```
Tyr Tyr Val Gly Pro Leu Asn Pro Thr His Ser Ile Glu Asn Gly Gly
225                 230                 235                 240

Phe Ala Trp Val Val Arg Lys Glu Ala Gly Gln Val Leu Pro Trp Asn
                245                 250                 255

Phe Glu Gln Lys Val Asp Val Gln Ala Ser Ala Val Lys Phe Ile Glu
            260                 265                 270

Asn Leu Thr Asn Lys Cys Thr Tyr Leu Ile Asp Gln Asp Val Leu Pro
        275                 280                 285

Lys Tyr Ser Leu Leu Tyr Ala Glu Phe Ser Leu Leu Asn Glu Leu Asn
    290                 295                 300

Asn Ile Arg Val Asn Asp Lys Pro Leu Pro Ala Asp Val Lys Gln Ala
305                 310                 315                 320

Phe Ile Arg Asp His Phe Ile Ser Leu Gln Asp Ser Lys Thr Ala Thr
                325                 330                 335

Lys Lys Val Val Ala Lys Tyr Leu Val Asp Asn Asn Tyr Val Ser Gln
            340                 345                 350

Pro Pro Ile Ile Thr Gly Met Asp Gln Gln Ile Ala Thr Lys Leu Thr
        355                 360                 365

Ser His Arg Asp Met Thr Arg Ile Leu Gly Glu His Phe Asp His Ala
    370                 375                 380

Met Ala Glu Asp Ile Ile Arg Tyr Ile Thr Ile Phe Gly Glu Ser Lys
385                 390                 395                 400

Asp Met Leu Arg Gln Val Leu Lys Asn Tyr Tyr Gly Asp Arg Leu Thr
                405                 410                 415
```

```
Thr Glu Gln Ile Lys Lys Leu Gly Lys Leu Thr Tyr Thr Gly Trp Gly
            420                 425                 430

Arg Leu Ser Lys Lys Phe Leu Ser Asp Ile Trp Gly Met Lys Lys Asn
        435                 440                 445

Asp Asp Asp Ala Glu Ala Gly Thr Ile Ile Glu His Met Arg Glu Gly
    450                 455                 460

Gln Glu Asn Leu Met Gln Leu Leu Ser Ser Ser Tyr Ser Phe Ile Asp
465                 470                 475                 480

Val Val Gln Glu Tyr Val Thr Asn Val Leu Gly Glu Lys Glu Lys Thr
                485                 490                 495

Ala Phe Glu Met Leu Glu Asp Leu Ser Leu Ser Pro Met Val Lys Arg
            500                 505                 510

Ser Val Trp Gln Thr Leu Arg Ile Leu Asp Glu Ile Val Ser Ile Arg
        515                 520                 525

Lys Glu Leu Pro Lys Lys Ile Phe Val Glu Val Ala Arg Thr Asn Lys
    530                 535                 540

Ala Asp Lys Lys Arg Thr Gln Ser Arg Lys Ala Leu Leu Glu Glu Leu
545                 550                 555                 560

Tyr Lys Gln Ile Lys Asp Glu Asp Val His Val Leu Gln Gln Glu Leu
                565                 570                 575

Glu Ser Lys Glu Asp Ser Ala Leu Asn Ser Lys Lys Leu Tyr Leu Tyr
            580                 585                 590

Phe Thr Gln Met Gly Arg Cys Met Tyr Ser Gly Arg Arg Ile Asp Ile
        595                 600                 605

His Glu Leu Phe Thr Asp Lys Tyr Asp Ile Asp His Ile Tyr Pro Arg
    610                 615                 620
```

```
Ser Leu Thr Lys Asp Asp Ser Trp His Asn Ile Val Leu Val Glu Lys
625                 630                 635                 640

Gln Leu Asn Ala Glu Lys Thr Asp Arg Phe Pro Ile Leu Ser Ala Ile
                645                 650                 655

Gln Ser Lys Gln Lys Gly Phe Trp Lys Leu Leu Trp Asp Arg Gly Phe
            660                 665                 670

Ile Ser Glu Lys Lys Tyr Asp Arg Leu Val Arg Thr Thr Asp Leu Thr
        675                 680                 685

Asp Glu Glu Leu Asn Gln Phe Ile Asn Arg Gln Met Val Ser Thr Asn
    690                 695                 700

Gln Ser Val Lys Ala Val Thr Thr Leu Leu His Gln Leu Tyr Pro Glu
705                 710                 715                 720

Thr Glu Val Val Phe Ser Lys Ala Glu Asn Val Ser Asp Phe Arg His
                725                 730                 735

Asp Tyr Asp Phe Val Lys Val Arg Ser Ile Asn His His His His Ala
            740                 745                 750

Lys Asp Ala Tyr Leu Asn Ile Val Val Gly Asn Val Tyr His Glu Lys
        755                 760                 765

Phe Thr Lys Asn Phe Leu Ser Phe Ala Lys Gln Lys Gly Thr Arg Arg
    770                 775                 780

Thr Tyr Asn Leu Thr Lys Ile Phe Glu Tyr Glu Ile Lys Leu Thr Glu
785                 790                 795                 800

Glu Ser Lys Lys Val Ile Trp Asp Pro Asn Ile His Met Asp Ile Val
                805                 810                 815
```

```
Lys Lys Met Met Lys Ser Asn Asp Val Arg Val Thr Gln Arg Ala Val
            820                 825                 830

Pro Gln Lys Gly Gly Leu Ser Asp Glu Thr Ile Tyr Lys Lys Gly Ile
        835                 840                 845

Ala Lys Arg Gly Val Tyr Leu Pro Leu Lys Ser Ser Asp Glu Arg Val
    850                 855                 860

Arg Asp Val Glu Lys Tyr Gly Gly Arg Thr Ser Ile Thr Ile Ser Glu
865                 870                 875                 880

Tyr Ile Ile Leu Asn Ile Arg Asp Thr Ser Asp Gln Asp Arg Ile Glu
                885                 890                 895

Ile Phe Ser Leu Pro Leu Tyr Ile Ala Gly Lys Lys Asp Ile His Lys
            900                 905                 910

Ala Ile Glu Glu Ala Tyr Leu Ser Thr Cys Lys Lys Pro Ala Ser Val
        915                 920                 925

Val Asp Ile Gln Ile Leu Tyr Arg Gly Leu Tyr Ile Gly Ser Lys Val
    930                 935                 940

Asn Ile Asn Gly Phe Thr Tyr Tyr Met Gly Gly Lys Thr Gly Ser Asn
945                 950                 955                 960

Val Ser Ile Asp Ser Ala Val Asp Val Val Met Asp Ile Thr Ser Ser
                965                 970                 975

Val Tyr Ile Lys Leu Leu Glu Lys Val Ala Ile Lys Lys Ile Glu Asn
            980                 985                 990

Pro Lys Thr Phe Arg Ile Glu Asn  Ile Lys Thr Ser Tyr  Asn His Lys
        995                 1000                1005

Glu Val  Thr Val Ser Lys Glu  Gln Asn Ile Ala Leu  Tyr Gln Glu
    1010                1015                1020
```

```
Leu Leu  Lys Lys Leu Asp Thr  Pro Leu Phe Ser Lys  Met Lys Gly
    1025                1030                1035


Asn Lys  Leu Glu Glu Phe Arg  Thr Val Gly Phe Asp  Thr Phe Ile
    1040                1045                1050


Ala Leu  Ser Leu Glu Glu Gln  Ala Ser Val Leu Leu  Glu Val Leu
    1055                1060                1065


Asn Val  Leu Thr Asn Phe Lys  Thr Lys Arg Asp Ile  Thr Lys Ile
    1070                1075                1080


Gly Met  Thr Ser Ser Arg Ser  Thr Leu Gly Ile Asn  Ile Ser Asn
    1085                1090                1095


Thr Glu  Gln Phe Ser Val Ile  Thr Thr Ser Ile Thr  Gly Leu Tyr
    1100                1105                1110


Glu Gln  Glu Ile Lys Ile Lys
    1115                1120
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<210> 816
<211> 983
<212> PRT
<213> Verminephrobacter aporrectodeae

<400> 816

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Met Arg Arg Arg Arg Asp Arg Leu Leu Lys Arg Lys Ala Arg Met His
1               5                   10                  15


Asp Gln Leu Met Arg His Gly Phe Phe Pro Ala Asp Ala Ala Gly Arg
            20                  25                  30


Lys Val Leu Glu Arg Leu Asn Pro Tyr Gln Leu Arg Ala Lys Gly Leu
        35                  40                  45


His Gln Ala Leu Thr Pro Gly Glu Phe Ala Arg Ala Leu Phe His Ile
```

```
    50                  55                  60

Asn Gln Arg Arg Gly Phe Gln Ser Asn Arg Lys Thr Asp Arg Lys Asp
65                  70                  75                  80

Asn Glu Ser Gly Ala Leu Lys Gln Ala Ile Ser Glu Leu Arg Ala Gln
                85                  90                  95

Ile His Asp Ser Gly Cys Ala Thr Val Gly Glu Trp Phe Trp Lys Glu
            100                 105                 110

Arg Met Gln Gln Lys Pro Glu Gly Val His Arg Gln Gly Val Arg Ala
        115                 120                 125

Arg Tyr Arg Glu Thr Pro Tyr Thr Thr Asp Glu Gly Arg Gln Arg Ile
    130                 135                 140

Asp Lys Arg Tyr Asp Leu Tyr Val Asp Arg Ala Met Ile Glu Gln Glu
145                 150                 155                 160

Phe Asp Ala Leu Trp Ala Val Gln Ala Ala Leu Gln Pro Gly Leu Phe
                165                 170                 175

Thr Asp Ala Ala Cys Lys Glu Leu Arg Tyr Thr Leu Leu Phe Gln Arg
            180                 185                 190

Lys Leu Arg Pro Val Lys Pro Gly Arg Cys Thr Leu Leu Pro Glu Glu
        195                 200                 205

Glu Arg Ala Pro Leu Ala Leu Pro Ser Thr Gln Arg Phe Arg Ile Leu
    210                 215                 220

Gln Glu Val Asn His Leu Arg Leu Leu Asp Glu Ala Leu Arg Glu Val
225                 230                 235                 240

Pro Leu Thr Leu Ala Gln Arg Asp Ala Leu Val Ala Ala Leu Glu Ser
                245                 250                 255
```

```
Gln Gly Lys Leu Gly Phe Ala Pro Met Arg Lys Leu Leu Lys Leu Pro
            260                 265                 270

Gly Thr Val Lys Phe Asn Leu Glu Asp Glu Lys Arg Thr Glu Leu Lys
        275                 280                 285

Gly Asn Ala Thr Ser Ala Ile Leu Ala Arg Lys Asp Leu Phe Gly Pro
    290                 295                 300

Ala Trp Ala Gly Phe Asp Ala Ala Leu Gln Asp Glu Ile Val Trp Gln
305                 310                 315                 320

Leu Val Ser Glu Glu Gly Glu Gly Arg Leu Ile Ala Trp Leu Gln Gln
                325                 330                 335

His Thr Gly Val Asp Glu Ala Arg Ala Glu Ala Ile Ala Asp Thr Ser
            340                 345                 350

Leu Pro Glu Gly Tyr Gly Ser Leu Ser Arg Lys Ala Leu Glu Arg Ile
        355                 360                 365

Val Pro Ala Leu Gln Arg Glu Val Cys Ser Tyr Asp Lys Ala Val Gln
    370                 375                 380

Ala Ala Gly Phe Ala His His Ser Asp Leu Gly Phe Asp Phe Glu His
385                 390                 395                 400

Ser Gly Asp Glu Val Gln Gln Val Gly Glu Arg Ile Ile Ala Ser Thr
                405                 410                 415

Gly Glu Val Arg Pro Leu Phe Ala Phe Lys Gln Leu Pro Tyr Tyr Gly
            420                 425                 430

Lys Ala Leu Gln Arg His Val Ala Phe Gly Ser Gly Lys Pro Glu Asp
        435                 440                 445

Pro Glu Glu Lys Arg His Gly Lys Ile Ala Asn Pro Thr Val His Ile
```

```
    450                 455                 460

Gly Leu Asn Gln Val Arg Thr Val Val Asn Ala Leu Ile Arg Arg Tyr
465                 470                 475                 480

Gly Arg Pro Ser Glu Val Val Val Glu Leu Ala Arg Asp Leu Lys Gln
                485                 490                 495

Ser Arg Glu Gln Gln Gln Glu Thr Gln Arg Lys Gln Ala Glu Asn Gln
            500                 505                 510

Arg Arg Asn Thr Arg Ile Arg Glu Arg Ile Ala Glu Thr Leu Gly Ile
        515                 520                 525

Ser Pro Glu Arg Val Arg Ser Ser Asp Ile Gln Lys Trp Ile Leu Trp
    530                 535                 540

Glu Glu Leu Ser Phe Asp Val Val Asp Arg Arg Cys Pro Tyr Ser Gly
545                 550                 555                 560

Glu Gln Ile Ser Thr Thr Met Leu Leu Ser Pro Lys Val Glu Ile Glu
                565                 570                 575

His Ile Leu Pro Phe Ser Gln Thr Leu Asp Asp Ser Leu Asn Asn Arg
            580                 585                 590

Thr Val Ala Leu Arg Glu Ala Asn Arg Ile Lys Arg Asn Arg Thr Pro
        595                 600                 605

Trp Asp Ala Arg Ala Asp Phe Glu Ala Arg Gly Trp Ser Tyr Glu Gly
    610                 615                 620

Ile Leu His Arg Ala Glu Arg Met Pro Leu Arg Lys Arg Tyr Arg Phe
625                 630                 635                 640

Ala Pro Asp Gly Tyr Gln Arg Trp Leu Gly Glu Asp Lys Asp Phe Leu
                645                 650                 655
```

```
Ala Arg Ala Leu Asn Asp Thr Arg Tyr Leu Ser Arg Val Ala Ala Asn
            660                 665                 670

Tyr Leu Arg Leu Val Cys Pro Lys Pro Gln Gly Val Arg Val Ile Pro
        675                 680                 685

Gly Arg Met Thr Ala Met Leu Arg Ala Lys Phe Gly Leu Asn Asp Val
    690                 695                 700

Leu Gly Leu Asp Gly Glu Lys Asn Arg Asn Asp His Arg His His Ala
705                 710                 715                 720

Val Asp Ala Cys Val Ile Gly Val Thr Asp Gln Gly Leu Met Gln Arg
                725                 730                 735

Phe Ala Arg Ala Ser Ala Gln Ala Arg Glu Asp Gly Leu Thr Arg Leu
            740                 745                 750

Val Gln Asp Met Pro Leu Pro Trp Pro Ser Tyr Arg Asp His Val Glu
        755                 760                 765

Arg Ala Val Arg His Ile Trp Val Ser His Lys Pro Asp His Gly Phe
    770                 775                 780

Glu Gly Ala Met Met Glu Glu Thr Ala Tyr Gly Ile Arg Lys Asp Gly
785                 790                 795                 800

Ser Ile Lys Pro Arg Arg Lys Ala Asp Gly Ser Ala Gly Arg Glu Val
                805                 810                 815

Val Asn Leu Ile Arg Ile Thr Glu Ser Arg Gln Pro Val Arg His Gly
            820                 825                 830

Val Asp Ser Gln Gly Gln Pro Leu Pro Tyr Lys Gly Tyr Val Gly Gly
        835                 840                 845

Ser Asn Tyr Cys Ile Glu Ile Thr Ala Asn Asp Gln Gly Lys Trp Glu
```

```
    850                 855                 860

Gly Ala Val Ile Ser Thr Phe Glu Ala Tyr Arg Ile Val Arg Ala Ser
865                 870                 875                 880

Gly Trp Gly Arg Leu Arg His Cys Ser His Gly Gln Asn Gly Arg Pro
                885                 890                 895

Leu Met Met Arg Leu Met Ile Gly Asp Ala Val Arg Leu Ala Leu Asp
            900                 905                 910

Gly Ser Glu Lys Thr Met Arg Val Val Lys Ile Ser Ala Asn Gly Gln
        915                 920                 925

Val Phe Leu Val Ala Pro Asn Glu Ala Asn Val Asp Ala Arg Asn Arg
    930                 935                 940

Asp Lys Ala Asp Pro Phe Ala Tyr Val Ser Lys Lys Ala Gly Ser Phe
945                 950                 955                 960

Gln Ser Ala Lys Ala Arg Gln Val Ser Ile Ser Pro Ile Gly Glu Leu
                965                 970                 975

Arg Asp Pro Gly Phe Lys Gly
            980


<210>  817
<211>  1300
<212>  PRT
<213>  Francisella tularensis

<400>  817

Met Ser Ile Tyr Gln Glu Phe Val Asn Lys Tyr Ser Leu Ser Lys Thr
1               5                   10                  15

Leu Arg Phe Glu Leu Ile Pro Gln Gly Lys Thr Leu Glu Asn Ile Lys
            20                  25                  30
```

```
Ala Arg Gly Leu Ile Leu Asp Asp Glu Lys Arg Ala Lys Asp Tyr Lys
        35                  40                  45

Lys Ala Lys Gln Ile Ile Asp Lys Tyr His Gln Phe Phe Ile Glu Glu
    50                  55                  60

Ile Leu Ser Ser Val Cys Ile Ser Glu Asp Leu Leu Gln Asn Tyr Ser
65                  70                  75                  80

Asp Val Tyr Phe Lys Leu Lys Lys Ser Asp Asp Asp Asn Leu Gln Lys
                85                  90                  95

Asp Phe Lys Ser Ala Lys Asp Thr Ile Lys Lys Gln Ile Ser Glu Tyr
            100                 105                 110

Ile Lys Asp Ser Glu Lys Phe Lys Asn Leu Phe Asn Gln Asn Leu Ile
        115                 120                 125

Asp Ala Lys Lys Gly Gln Glu Ser Asp Leu Ile Leu Trp Leu Lys Gln
    130                 135                 140

Ser Lys Asp Asn Gly Ile Glu Leu Phe Lys Ala Asn Ser Asp Ile Thr
145                 150                 155                 160

Asp Ile Asp Glu Ala Leu Glu Ile Ile Lys Ser Phe Lys Gly Trp Thr
                165                 170                 175

Thr Tyr Phe Lys Gly Phe His Glu Asn Arg Lys Asn Val Tyr Ser Ser
            180                 185                 190

Asn Asp Ile Pro Thr Ser Ile Ile Tyr Arg Ile Val Asp Asp Asn Leu
        195                 200                 205

Pro Lys Phe Leu Glu Asn Lys Ala Lys Tyr Glu Ser Leu Lys Asp Lys
    210                 215                 220

Ala Pro Glu Ala Ile Asn Tyr Glu Gln Ile Lys Lys Asp Leu Ala Glu
225                 230                 235                 240
```

```
Glu Leu Thr Phe Asp Ile Asp Tyr Lys Thr Ser Glu Val Asn Gln Arg
                245                 250                 255

Val Phe Ser Leu Asp Glu Val Phe Glu Ile Ala Asn Phe Asn Asn Tyr
            260                 265                 270

Leu Asn Gln Ser Gly Ile Thr Lys Phe Asn Thr Ile Ile Gly Gly Lys
        275                 280                 285

Phe Val Asn Gly Glu Asn Thr Lys Arg Lys Gly Ile Asn Glu Tyr Ile
    290                 295                 300

Asn Leu Tyr Ser Gln Gln Ile Asn Asp Lys Thr Leu Lys Lys Tyr Lys
305                 310                 315                 320

Met Ser Val Leu Phe Lys Gln Ile Leu Ser Asp Thr Glu Ser Lys Ser
                325                 330                 335

Phe Val Ile Asp Lys Leu Glu Asp Asp Ser Asp Val Val Thr Thr Met
            340                 345                 350

Gln Ser Phe Tyr Glu Gln Ile Ala Ala Phe Lys Thr Val Glu Glu Lys
        355                 360                 365

Ser Ile Lys Glu Thr Leu Ser Leu Leu Phe Asp Asp Leu Lys Ala Gln
    370                 375                 380

Lys Leu Asp Leu Ser Lys Ile Tyr Phe Lys Asn Asp Lys Ser Leu Thr
385                 390                 395                 400

Asp Leu Ser Gln Gln Val Phe Asp Asp Tyr Ser Val Ile Gly Thr Ala
                405                 410                 415

Val Leu Glu Tyr Ile Thr Gln Gln Ile Ala Pro Lys Asn Leu Asp Asn
            420                 425                 430
```

```
Pro Ser Lys Lys Glu Gln Glu Leu Ile Ala Lys Lys Thr Glu Lys Ala
        435                 440                 445

Lys Tyr Leu Ser Leu Glu Thr Ile Lys Leu Ala Leu Glu Glu Phe Asn
    450                 455                 460

Lys His Arg Asp Ile Asp Lys Gln Cys Arg Phe Glu Glu Ile Leu Ala
465                 470                 475                 480

Asn Phe Ala Ala Ile Pro Met Ile Phe Asp Glu Ile Ala Gln Asn Lys
                485                 490                 495

Asp Asn Leu Ala Gln Ile Ser Ile Lys Tyr Gln Asn Gln Gly Lys Lys
            500                 505                 510

Asp Leu Leu Gln Ala Ser Ala Glu Asp Asp Val Lys Ala Ile Lys Asp
        515                 520                 525

Leu Leu Asp Gln Thr Asn Asn Leu Leu His Lys Leu Lys Ile Phe His
    530                 535                 540

Ile Ser Gln Ser Glu Asp Lys Ala Asn Ile Leu Asp Lys Asp Glu His
545                 550                 555                 560

Phe Tyr Leu Val Phe Glu Glu Cys Tyr Phe Glu Leu Ala Asn Ile Val
                565                 570                 575

Pro Leu Tyr Asn Lys Ile Arg Asn Tyr Ile Thr Gln Lys Pro Tyr Ser
            580                 585                 590

Asp Glu Lys Phe Lys Leu Asn Phe Glu Asn Ser Thr Leu Ala Asn Gly
        595                 600                 605

Trp Asp Lys Asn Lys Glu Pro Asp Asn Thr Ala Ile Leu Phe Ile Lys
    610                 615                 620

Asp Asp Lys Tyr Tyr Leu Gly Val Met Asn Lys Lys Asn Asn Lys Ile
625                 630                 635                 640
```

```
Phe Asp Asp Lys Ala Ile Lys Glu Asn Lys Gly Glu Gly Tyr Lys Lys
               645                 650                 655

Ile Val Tyr Lys Leu Leu Pro Gly Ala Asn Lys Met Leu Pro Lys Val
            660                 665                 670

Phe Phe Ser Ala Lys Ser Ile Lys Phe Tyr Asn Pro Ser Glu Asp Ile
        675                 680                 685

Leu Arg Ile Arg Asn His Ser Thr His Thr Lys Asn Gly Ser Pro Gln
    690                 695                 700

Lys Gly Tyr Glu Lys Phe Glu Phe Asn Ile Glu Asp Cys Arg Lys Phe
705                 710                 715                 720

Ile Asp Phe Tyr Lys Gln Ser Ile Ser Lys His Pro Glu Trp Lys Asp
               725                 730                 735

Phe Gly Phe Arg Phe Ser Asp Thr Gln Arg Tyr Asn Ser Ile Asp Glu
            740                 745                 750

Phe Tyr Arg Glu Val Glu Asn Gln Gly Tyr Lys Leu Thr Phe Glu Asn
        755                 760                 765

Ile Ser Glu Ser Tyr Ile Asp Ser Val Val Asn Gln Gly Lys Leu Tyr
    770                 775                 780

Leu Phe Gln Ile Tyr Asn Lys Asp Phe Ser Ala Tyr Ser Lys Gly Arg
785                 790                 795                 800

Pro Asn Leu His Thr Leu Tyr Trp Lys Ala Leu Phe Asp Glu Arg Asn
               805                 810                 815

Leu Gln Asp Val Val Tyr Lys Leu Asn Gly Glu Ala Glu Leu Phe Tyr
            820                 825                 830
```

```
Arg Lys Gln Ser Ile Pro Lys Lys Ile Thr His Pro Ala Lys Glu Ala
        835                 840                 845

Ile Ala Asn Lys Asn Lys Asp Asn Pro Lys Lys Glu Ser Val Phe Glu
    850                 855                 860

Tyr Asp Leu Ile Lys Asp Lys Arg Phe Thr Glu Asp Lys Phe Phe Phe
865                 870                 875                 880

His Cys Pro Ile Thr Ile Asn Phe Lys Ser Ser Gly Ala Asn Lys Phe
                885                 890                 895

Asn Asp Glu Ile Asn Leu Leu Leu Lys Glu Lys Ala Asn Asp Val His
            900                 905                 910

Ile Leu Ser Ile Asp Arg Gly Glu Arg His Leu Ala Tyr Tyr Thr Leu
        915                 920                 925

Val Asp Gly Lys Gly Asn Ile Ile Lys Gln Asp Thr Phe Asn Ile Ile
    930                 935                 940

Gly Asn Asp Arg Met Lys Thr Asn Tyr His Asp Lys Leu Ala Ala Ile
945                 950                 955                 960

Glu Lys Asp Arg Asp Ser Ala Arg Lys Asp Trp Lys Lys Ile Asn Asn
                965                 970                 975

Ile Lys Glu Met Lys Glu Gly Tyr Leu Ser Gln Val Val His Glu Ile
            980                 985                 990

Ala Lys Leu Val Ile Glu Tyr Asn  Ala Ile Val Val Phe  Glu Asp Leu
        995                 1000                1005

Asn Phe  Gly Phe Lys Arg Gly  Arg Phe Lys Val Glu  Lys Gln Val
    1010                1015                1020

Tyr Gln  Lys Leu Glu Lys Met  Leu Ile Glu Lys Leu  Asn Tyr Leu
    1025                1030                1035
```

```
Val Phe  Lys Asp Asn Glu Phe  Asp Lys Thr Gly Gly  Val Leu Arg
    1040                1045                1050

Ala Tyr  Gln Leu Thr Ala Pro  Phe Glu Thr Phe Lys  Lys Met Gly
    1055                1060                1065

Lys Gln  Thr Gly Ile Ile Tyr  Tyr Val Pro Ala Gly  Phe Thr Ser
    1070                1075                1080

Lys Ile  Cys Pro Val Thr Gly  Phe Val Asn Gln Leu  Tyr Pro Lys
    1085                1090                1095

Tyr Glu  Ser Val Ser Lys Ser  Gln Glu Phe Phe Ser  Lys Phe Asp
    1100                1105                1110

Lys Ile  Cys Tyr Asn Leu Asp  Lys Gly Tyr Phe Glu  Phe Ser Phe
    1115                1120                1125

Asp Tyr  Lys Asn Phe Gly Asp  Lys Ala Ala Lys Gly  Lys Trp Thr
    1130                1135                1140

Ile Ala  Ser Phe Gly Ser Arg  Leu Ile Asn Phe Arg  Asn Ser Asp
    1145                1150                1155

Lys Asn  His Asn Trp Asp Thr  Arg Glu Val Tyr Pro  Thr Lys Glu
    1160                1165                1170

Leu Glu  Lys Leu Leu Lys Asp  Tyr Ser Ile Glu Tyr  Gly His Gly
    1175                1180                1185

Glu Cys  Ile Lys Ala Ala Ile  Cys Gly Glu Ser Asp  Lys Lys Phe
    1190                1195                1200

Phe Ala  Lys Leu Thr Ser Val  Leu Asn Thr Ile Leu  Gln Met Arg
    1205                1210                1215
```

```
Asn Ser  Lys Thr Gly Thr Glu  Leu Asp Tyr Leu Ile  Ser Pro Val
    1220                1225                1230


Ala Asp  Val Asn Gly Asn Phe  Phe Asp Ser Arg Gln  Ala Pro Lys
    1235                1240                1245


Asn Met  Pro Gln Asp Ala Asp  Ala Asn Gly Ala Tyr  His Ile Gly
    1250                1255                1260


Leu Lys  Gly Leu Met Leu Leu  Gly Arg Ile Lys Asn  Asn Gln Glu
    1265                1270                1275


Gly Lys  Lys Leu Asn Leu Val  Ile Lys Asn Glu Glu  Tyr Phe Glu
    1280                1285                1290


Phe Val  Gln Asn Arg Asn Asn
    1295                1300


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<212>  PRT
<213>  unknown

<220>
<223>  Synthetic Sequence

<400>  818

Met Thr Gln Phe Glu Gly Phe Thr Asn Leu Tyr Gln Val Ser Lys Thr
1               5                   10                  15


Leu Arg Phe Glu Leu Ile Pro Gln Gly Lys Thr Leu Lys His Ile Gln
            20                  25                  30


Glu Gln Gly Phe Ile Glu Glu Asp Lys Ala Arg Asn Asp His Tyr Lys
        35                  40                  45


Glu Leu Lys Pro Ile Ile Asp Arg Ile Tyr Lys Thr Tyr Ala Asp Gln
    50                  55                  60
```

```
Cys Leu Gln Leu Val Gln Leu Asp Trp Glu Asn Leu Ser Ala Ala Ile
65                  70                  75                  80

Asp Ser Tyr Arg Lys Glu Lys Thr Glu Glu Thr Arg Asn Ala Leu Ile
                85                  90                  95

Glu Glu Gln Ala Thr Tyr Arg Asn Ala Ile His Asp Tyr Phe Ile Gly
            100                 105                 110

Arg Thr Asp Asn Leu Thr Asp Ala Ile Asn Lys Arg His Ala Glu Ile
        115                 120                 125

Tyr Lys Gly Leu Phe Lys Ala Glu Leu Phe Asn Gly Lys Val Leu Lys
    130                 135                 140

Gln Leu Gly Thr Val Thr Thr Thr Glu His Glu Asn Ala Leu Leu Arg
145                 150                 155                 160

Ser Phe Asp Lys Phe Thr Thr Tyr Phe Ser Gly Phe Tyr Glu Asn Arg
                165                 170                 175

Lys Asn Val Phe Ser Ala Glu Asp Ile Ser Thr Ala Ile Pro His Arg
            180                 185                 190

Ile Val Gln Asp Asn Phe Pro Lys Phe Lys Glu Asn Cys His Ile Phe
        195                 200                 205

Thr Arg Leu Ile Thr Ala Val Pro Ser Leu Arg Glu His Phe Glu Asn
    210                 215                 220

Val Lys Lys Ala Ile Gly Ile Phe Val Ser Thr Ser Ile Glu Glu Val
225                 230                 235                 240

Phe Ser Phe Pro Phe Tyr Asn Gln Leu Leu Thr Gln Thr Gln Ile Asp
                245                 250                 255

Leu Tyr Asn Gln Leu Leu Gly Gly Ile Ser Arg Glu Ala Gly Thr Glu
            260                 265                 270
```

```
Lys Ile Lys Gly Leu Asn Glu Val Leu Asn Leu Ala Ile Gln Lys Asn
        275                 280                 285

Asp Glu Thr Ala His Ile Ile Ala Ser Leu Pro His Arg Phe Ile Pro
    290                 295                 300

Leu Phe Lys Gln Ile Leu Ser Asp Arg Asn Thr Leu Ser Phe Ile Leu
305                 310                 315                 320

Glu Glu Phe Lys Ser Asp Glu Glu Val Ile Gln Ser Phe Cys Lys Tyr
                325                 330                 335

Lys Thr Leu Leu Arg Asn Glu Asn Val Leu Glu Thr Ala Glu Ala Leu
            340                 345                 350

Phe Asn Glu Leu Asn Ser Ile Asp Leu Thr His Ile Phe Ile Ser His
        355                 360                 365

Lys Lys Leu Glu Thr Ile Ser Ser Ala Leu Cys Asp His Trp Asp Thr
    370                 375                 380

Leu Arg Asn Ala Leu Tyr Glu Arg Arg Ile Ser Glu Leu Thr Gly Lys
385                 390                 395                 400

Ile Thr Lys Ser Ala Lys Glu Lys Val Gln Arg Ser Leu Lys His Glu
                405                 410                 415

Asp Ile Asn Leu Gln Glu Ile Ile Ser Ala Ala Gly Lys Glu Leu Ser
            420                 425                 430

Glu Ala Phe Lys Gln Lys Thr Ser Glu Ile Leu Ser His Ala His Ala
        435                 440                 445

Ala Leu Asp Gln Pro Leu Pro Thr Thr Leu Lys Lys Gln Glu Glu Lys
    450                 455                 460
```

```
Glu Ile Leu Lys Ser Gln Leu Asp Ser Leu Leu Gly Leu Tyr His Leu
465                 470                 475                 480

Leu Asp Trp Phe Ala Val Asp Glu Ser Asn Glu Val Asp Pro Glu Phe
                485                 490                 495

Ser Ala Arg Leu Thr Gly Ile Lys Leu Glu Met Glu Pro Ser Leu Ser
            500                 505                 510

Phe Tyr Asn Lys Ala Arg Asn Tyr Ala Thr Lys Lys Pro Tyr Ser Val
        515                 520                 525

Glu Lys Phe Lys Leu Asn Phe Gln Met Pro Thr Leu Ala Ser Gly Trp
    530                 535                 540

Asp Val Asn Lys Glu Lys Asn Asn Gly Ala Ile Leu Phe Val Lys Asn
545                 550                 555                 560

Gly Leu Tyr Tyr Leu Gly Ile Met Pro Lys Gln Lys Gly Arg Tyr Lys
                565                 570                 575

Ala Leu Ser Phe Glu Pro Thr Glu Lys Thr Ser Glu Gly Phe Asp Lys
            580                 585                 590

Met Tyr Tyr Asp Tyr Phe Pro Asp Ala Ala Lys Met Ile Pro Lys Cys
        595                 600                 605

Ser Thr Gln Leu Lys Ala Val Thr Ala His Phe Gln Thr His Thr Thr
    610                 615                 620

Pro Ile Leu Leu Ser Asn Asn Phe Ile Glu Pro Leu Glu Ile Thr Lys
625                 630                 635                 640

Glu Ile Tyr Asp Leu Asn Asn Pro Glu Lys Glu Pro Lys Lys Phe Gln
                645                 650                 655

Thr Ala Tyr Ala Lys Lys Thr Gly Asp Gln Lys Gly Tyr Arg Glu Ala
            660                 665                 670
```

```
Leu Cys Lys Trp Ile Asp Phe Thr Arg Asp Phe Leu Ser Lys Tyr Thr
        675                 680                 685

Lys Thr Thr Ser Ile Asp Leu Ser Ser Leu Arg Pro Ser Ser Gln Tyr
    690                 695                 700

Lys Asp Leu Gly Glu Tyr Tyr Ala Glu Leu Asn Pro Leu Leu Tyr His
705                 710                 715                 720

Ile Ser Phe Gln Arg Ile Ala Glu Lys Glu Ile Met Asp Ala Val Glu
                725                 730                 735

Thr Gly Lys Leu Tyr Leu Phe Gln Ile Tyr Asn Lys Asp Phe Ala Lys
            740                 745                 750

Gly His His Gly Lys Pro Asn Leu His Thr Leu Tyr Trp Thr Gly Leu
        755                 760                 765

Phe Ser Pro Glu Asn Leu Ala Lys Thr Ser Ile Lys Leu Asn Gly Gln
    770                 775                 780

Ala Glu Leu Phe Tyr Arg Pro Lys Ser Arg Met Lys Arg Met Ala His
785                 790                 795                 800

Arg Leu Gly Glu Lys Met Leu Asn Lys Lys Leu Lys Asp Gln Lys Thr
                805                 810                 815

Pro Ile Pro Asp Thr Leu Tyr Gln Glu Leu Tyr Asp Tyr Val Asn His
            820                 825                 830

Arg Leu Ser His Asp Leu Ser Asp Glu Ala Arg Ala Leu Leu Pro Asn
        835                 840                 845

Val Ile Thr Lys Glu Val Ser His Glu Ile Ile Lys Asp Arg Arg Phe
    850                 855                 860
```

```
Thr Ser Asp Lys Phe Phe Phe His Val Pro Ile Thr Leu Asn Tyr Gln
865                 870                 875                 880


Ala Ala Asn Ser Pro Ser Lys Phe Asn Gln Arg Val Asn Ala Tyr Leu
                885                 890                 895


Lys Glu His Pro Glu Thr Pro Ile Ile Gly Ile Asp Arg Gly Glu Arg
            900                 905                 910


Asn Leu Ile Tyr Ile Thr Val Ile Asp Ser Thr Gly Lys Ile Leu Glu
        915                 920                 925


Gln Arg Ser Leu Asn Thr Ile Gln Gln Phe Asp Tyr Gln Lys Lys Leu
    930                 935                 940


Asp Asn Arg Glu Lys Glu Arg Val Ala Ala Arg Gln Ala Trp Ser Val
945                 950                 955                 960


Val Gly Thr Ile Lys Asp Leu Lys Gln Gly Tyr Leu Ser Gln Val Ile
                965                 970                 975


His Glu Ile Val Asp Leu Met Ile His Tyr Gln Ala Val Val Val Leu
            980                 985                 990


Glu Asn Leu Asn Phe Gly Phe Lys  Ser Lys Arg Thr Gly  Ile Ala Glu
        995                 1000                1005


Lys Ala  Val Tyr Gln Gln Phe  Glu Lys Met Leu Ile  Asp Lys Leu
    1010                1015                1020


Asn Cys  Leu Val Leu Lys Asp  Tyr Pro Ala Glu Lys  Val Gly Gly
    1025                1030                1035


Val Leu  Asn Pro Tyr Gln Leu  Thr Asp Gln Phe Thr  Ser Phe Ala
    1040                1045                1050


Lys Met  Gly Thr Gln Ser Gly  Phe Leu Phe Tyr Val  Pro Ala Pro
    1055                1060                1065
```

```
Tyr Thr  Ser Lys Ile Asp Pro  Leu Thr Gly Phe Val  Asp Pro Phe
    1070                1075                1080

Val Trp  Lys Thr Ile Lys Asn  His Glu Ser Arg Lys  His Phe Leu
    1085                1090                1095

Glu Gly  Phe Asp Phe Leu His  Tyr Asp Val Lys Thr  Gly Asp Phe
    1100                1105                1110

Ile Leu  His Phe Lys Met Asn  Arg Asn Leu Ser Phe  Gln Arg Gly
    1115                1120                1125

Leu Pro  Gly Phe Met Pro Ala  Trp Asp Ile Val Phe  Glu Lys Asn
    1130                1135                1140

Glu Thr  Gln Phe Asp Ala Lys  Gly Thr Pro Phe Ile  Ala Gly Lys
    1145                1150                1155

Arg Ile  Val Pro Val Ile Glu  Asn His Arg Phe Thr  Gly Arg Tyr
    1160                1165                1170

Arg Asp  Leu Tyr Pro Ala Asn  Glu Leu Ile Ala Leu  Leu Glu Glu
    1175                1180                1185

Lys Gly  Ile Val Phe Arg Asp  Gly Ser Asn Ile Leu  Pro Lys Leu
    1190                1195                1200

Leu Glu  Asn Asp Asp Ser His  Ala Ile Asp Thr Met  Val Ala Leu
    1205                1210                1215

Ile Arg  Ser Val Leu Gln Met  Arg Asn Ser Asn Ala  Ala Thr Gly
    1220                1225                1230

Glu Asp  Tyr Ile Asn Ser Pro  Val Arg Asp Leu Asn  Gly Val Cys
    1235                1240                1245
```

Phe Asp Ser Arg Phe Gln Asn Pro Glu Trp Pro Met Asp Ala Asp
    1250   1255   1260

Ala Asn Gly Ala Tyr His Ile Ala Leu Lys Gly Gln Leu Leu Leu
    1265   1270   1275

Asn His Leu Lys Glu Ser Lys Asp Leu Lys Leu Gln Asn Gly Ile
    1280   1285   1290

Ser Asn Gln Asp Trp Leu Ala Tyr Ile Gln Glu Leu Arg Asn
    1295   1300   1305

<210> 819
<211> 1246
<212> PRT
<213> unknown

<220>
<223> Synthetic Sequence

<400> 819

Met Leu Lys Asn Val Gly Ile Asp Arg Leu Asp Val Glu Lys Gly Arg
1   5   10   15

Lys Asn Met Ser Lys Leu Glu Lys Phe Thr Asn Cys Tyr Ser Leu Ser
            20   25   30

Lys Thr Leu Arg Phe Lys Ala Ile Pro Val Gly Lys Thr Gln Glu Asn
        35   40   45

Ile Asp Asn Lys Arg Leu Leu Val Glu Asp Glu Lys Arg Ala Glu Asp
    50   55   60

Tyr Lys Gly Val Lys Lys Leu Leu Asp Arg Tyr Tyr Leu Ser Phe Ile
65   70   75   80

Asn Asp Val Leu His Ser Ile Lys Leu Lys Asn Leu Asn Asn Tyr Ile
                85   90   95

```
Ser Leu Phe Arg Lys Lys Thr Arg Thr Glu Lys Glu Asn Lys Glu Leu
            100                 105                 110

Glu Asn Leu Glu Ile Asn Leu Arg Lys Glu Ile Ala Lys Ala Phe Lys
        115                 120                 125

Gly Asn Glu Gly Tyr Lys Ser Leu Phe Lys Lys Asp Ile Ile Glu Thr
    130                 135                 140

Ile Leu Pro Glu Phe Leu Asp Asp Lys Asp Glu Ile Ala Leu Val Asn
145                 150                 155                 160

Ser Phe Asn Gly Phe Thr Thr Ala Phe Thr Gly Phe Phe Asp Asn Arg
                165                 170                 175

Glu Asn Met Phe Ser Glu Glu Ala Lys Ser Thr Ser Ile Ala Phe Arg
            180                 185                 190

Cys Ile Asn Glu Asn Leu Thr Arg Tyr Ile Ser Asn Met Asp Ile Phe
        195                 200                 205

Glu Lys Val Asp Ala Ile Phe Asp Lys His Glu Val Gln Glu Ile Lys
    210                 215                 220

Glu Lys Ile Leu Asn Ser Asp Tyr Asp Val Glu Asp Phe Phe Glu Gly
225                 230                 235                 240

Glu Phe Phe Asn Phe Val Leu Thr Gln Glu Gly Ile Asp Val Tyr Asn
                245                 250                 255

Ala Ile Ile Gly Gly Phe Val Thr Glu Ser Gly Glu Lys Ile Lys Gly
            260                 265                 270

Leu Asn Glu Tyr Ile Asn Leu Tyr Asn Gln Lys Thr Lys Gln Lys Leu
        275                 280                 285

Pro Lys Phe Lys Pro Leu Tyr Lys Gln Val Leu Ser Asp Arg Glu Ser
    290                 295                 300
```

```
Leu Ser Phe Tyr Gly Glu Gly Tyr Thr Ser Asp Glu Glu Val Leu Glu
305                 310                 315                 320

Val Phe Arg Asn Thr Leu Asn Lys Asn Ser Glu Ile Phe Ser Ser Ile
                325                 330                 335

Lys Lys Leu Glu Lys Leu Phe Lys Asn Phe Asp Glu Tyr Ser Ser Ala
            340                 345                 350

Gly Ile Phe Val Lys Asn Gly Pro Ala Ile Ser Thr Ile Ser Lys Asp
        355                 360                 365

Ile Phe Gly Glu Trp Asn Val Ile Arg Asp Lys Trp Asn Ala Glu Tyr
    370                 375                 380

Asp Asp Ile His Leu Lys Lys Lys Ala Val Val Thr Glu Lys Tyr Glu
385                 390                 395                 400

Asp Asp Arg Arg Lys Ser Phe Lys Lys Ile Gly Ser Phe Ser Leu Glu
                405                 410                 415

Gln Leu Gln Glu Tyr Ala Asp Ala Asp Leu Ser Val Val Glu Lys Leu
            420                 425                 430

Lys Glu Ile Ile Ile Gln Lys Val Asp Glu Ile Tyr Lys Val Tyr Gly
        435                 440                 445

Ser Ser Glu Lys Leu Phe Asp Ala Asp Phe Val Leu Glu Lys Ser Leu
    450                 455                 460

Lys Lys Asn Asp Ala Val Val Ala Ile Met Lys Asp Leu Leu Asp Ser
465                 470                 475                 480

Val Lys Ser Phe Glu Asn Tyr Ile Lys Ala Phe Phe Gly Glu Gly Lys
                485                 490                 495
```

```
Glu Thr Asn Arg Asp Glu Ser Phe Tyr Gly Asp Phe Val Leu Ala Tyr
            500                 505                 510

Asp Ile Leu Leu Lys Val Asp His Ile Tyr Asp Ala Ile Arg Asn Tyr
        515                 520                 525

Val Thr Gln Lys Pro Tyr Ser Lys Asp Lys Phe Lys Leu Tyr Phe Gln
    530                 535                 540

Asn Pro Gln Phe Met Gly Gly Trp Asp Lys Asp Lys Glu Thr Asp Tyr
545                 550                 555                 560

Arg Ala Thr Ile Leu Arg Tyr Gly Ser Lys Tyr Tyr Leu Ala Ile Met
                565                 570                 575

Asp Lys Lys Tyr Ala Lys Cys Leu Gln Lys Ile Asp Lys Asp Asp Val
            580                 585                 590

Asn Gly Asn Tyr Glu Lys Ile Asn Tyr Lys Leu Leu Pro Gly Pro Asn
        595                 600                 605

Lys Met Leu Pro Lys Val Phe Phe Ser Lys Lys Trp Met Ala Tyr Tyr
    610                 615                 620

Asn Pro Ser Glu Asp Ile Gln Lys Ile Tyr Lys Asn Gly Thr Phe Lys
625                 630                 635                 640

Lys Gly Asp Met Phe Asn Leu Asn Asp Cys His Lys Leu Ile Asp Phe
                645                 650                 655

Phe Lys Asp Ser Ile Ser Arg Tyr Pro Lys Trp Ser Asn Ala Tyr Asp
            660                 665                 670

Phe Asn Phe Ser Glu Thr Glu Lys Tyr Lys Asp Ile Ala Gly Phe Tyr
        675                 680                 685

Arg Glu Val Glu Glu Gln Gly Tyr Lys Val Ser Phe Glu Ser Ala Ser
    690                 695                 700
```

```
Lys Lys Glu Val Asp Lys Leu Val Glu Glu Gly Lys Leu Tyr Met Phe
705                 710                 715                 720

Gln Ile Tyr Asn Lys Asp Phe Ser Asp Lys Ser His Gly Thr Pro Asn
                725                 730                 735

Leu His Thr Met Tyr Phe Lys Leu Leu Phe Asp Glu Asn Asn His Gly
            740                 745                 750

Gln Ile Arg Leu Ser Gly Gly Ala Glu Leu Phe Met Arg Arg Ala Ser
        755                 760                 765

Leu Lys Lys Glu Glu Leu Val Val His Pro Ala Asn Ser Pro Ile Ala
    770                 775                 780

Asn Lys Asn Pro Asp Asn Pro Lys Lys Thr Thr Thr Leu Ser Tyr Asp
785                 790                 795                 800

Val Tyr Lys Asp Lys Arg Phe Ser Glu Asp Gln Tyr Glu Leu His Ile
                805                 810                 815

Pro Ile Ala Ile Asn Lys Cys Pro Lys Asn Ile Phe Lys Ile Asn Thr
            820                 825                 830

Glu Val Arg Val Leu Leu Lys His Asp Asp Asn Pro Tyr Val Ile Gly
        835                 840                 845

Ile Asp Arg Gly Glu Arg Asn Leu Leu Tyr Ile Val Val Val Asp Gly
    850                 855                 860

Lys Gly Asn Ile Val Glu Gln Tyr Ser Leu Asn Glu Ile Ile Asn Asn
865                 870                 875                 880

Phe Asn Gly Ile Arg Ile Lys Thr Asp Tyr His Ser Leu Leu Asp Lys
                885                 890                 895
```

```
Lys Glu Lys Glu Arg Phe Glu Ala Arg Gln Asn Trp Thr Ser Ile Glu
            900                 905                 910

Asn Ile Lys Glu Leu Lys Ala Gly Tyr Ile Ser Gln Val Val His Lys
        915                 920                 925

Ile Cys Glu Leu Val Glu Lys Tyr Asp Ala Val Ile Ala Leu Glu Asp
    930                 935                 940

Leu Asn Ser Gly Phe Lys Asn Ser Arg Val Lys Val Glu Lys Gln Val
945                 950                 955                 960

Tyr Gln Lys Phe Glu Lys Met Leu Ile Asp Lys Leu Asn Tyr Met Val
                965                 970                 975

Asp Lys Lys Ser Asn Pro Cys Ala Thr Gly Gly Ala Leu Lys Gly Tyr
            980                 985                 990

Gln Ile Thr Asn Lys Phe Glu Ser  Phe Lys Ser Met Ser  Thr Gln Asn
        995                 1000                1005

Gly Phe  Ile Phe Tyr Ile Pro  Ala Trp Leu Thr Ser  Lys Ile Asp
    1010                1015                1020

Pro Ser  Thr Gly Phe Val Asn  Leu Leu Lys Thr Lys  Tyr Thr Ser
    1025                1030                1035

Ile Ala  Asp Ser Lys Lys Phe  Ile Ser Ser Phe Asp  Arg Ile Met
    1040                1045                1050

Tyr Val  Pro Glu Glu Asp Leu  Phe Glu Phe Ala Leu  Asp Tyr Lys
    1055                1060                1065

Asn Phe  Ser Arg Thr Asp Ala  Asp Tyr Ile Lys Lys  Trp Lys Leu
    1070                1075                1080

Tyr Ser  Tyr Gly Asn Arg Ile  Arg Ile Phe Arg Asn  Pro Lys Lys
    1085                1090                1095
```

```
Asn Asn  Val Phe Asp Trp Glu  Glu Val Cys Leu Thr  Ser Ala Tyr
    1100                1105                1110

Lys Glu  Leu Phe Asn Lys Tyr  Gly Ile Asn Tyr Gln  Gln Gly Asp
    1115                1120                1125

Ile Arg  Ala Leu Leu Cys Glu  Gln Ser Asp Lys Ala  Phe Tyr Ser
    1130                1135                1140

Ser Phe  Met Ala Leu Met Ser  Leu Met Leu Gln Met  Arg Asn Ser
    1145                1150                1155

Ile Thr  Gly Arg Thr Asp Val  Asp Phe Leu Ile Ser  Pro Val Lys
    1160                1165                1170

Asn Ser  Asp Gly Ile Phe Tyr  Asp Ser Arg Asn Tyr  Glu Ala Gln
    1175                1180                1185

Glu Asn  Ala Ile Leu Pro Lys  Asn Ala Asp Ala Asn  Gly Ala Tyr
    1190                1195                1200

Asn Ile  Ala Arg Lys Val Leu  Trp Ala Ile Gly Gln  Phe Lys Lys
    1205                1210                1215

Ala Glu  Asp Glu Lys Leu Asp  Lys Val Lys Ile Ala  Ile Ser Asn
    1220                1225                1230

Lys Glu  Trp Leu Glu Tyr Ala  Gln Thr Ser Val Lys  His
    1235                1240                1245
```

<210> 820
<211> 1246
<212> PRT
<213> Porphyromonas macacae

<400> 820

```
Met Lys Thr Gln His Phe Phe Glu Asp Phe Thr Ser Leu Tyr Ser Leu
```

```
1               5                   10                  15

Ser Lys Thr Ile Arg Phe Glu Leu Lys Pro Ile Gly Lys Thr Leu Glu
            20                  25                  30

Asn Ile Lys Lys Asn Gly Leu Ile Arg Arg Asp Glu Gln Arg Leu Asp
        35                  40                  45

Asp Tyr Glu Lys Leu Lys Lys Val Ile Asp Glu Tyr His Glu Asp Phe
    50                  55                  60

Ile Ala Asn Ile Leu Ser Ser Phe Ser Phe Ser Glu Glu Ile Leu Gln
65                  70                  75                  80

Ser Tyr Ile Gln Asn Leu Ser Glu Ser Glu Ala Arg Ala Lys Ile Glu
                85                  90                  95

Lys Thr Met Arg Asp Thr Leu Ala Lys Ala Phe Ser Glu Asp Glu Arg
            100                 105                 110

Tyr Lys Ser Ile Phe Lys Lys Glu Leu Val Lys Lys Asp Ile Pro Val
        115                 120                 125

Trp Cys Pro Ala Tyr Lys Ser Leu Cys Lys Lys Phe Asp Asn Phe Thr
    130                 135                 140

Thr Ser Leu Val Pro Phe His Glu Asn Arg Lys Asn Leu Tyr Thr Ser
145                 150                 155                 160

Asn Glu Ile Thr Ala Ser Ile Pro Tyr Arg Ile Val His Val Asn Leu
                165                 170                 175

Pro Lys Phe Ile Gln Asn Ile Glu Ala Leu Cys Glu Leu Gln Lys Lys
            180                 185                 190

Met Gly Ala Asp Leu Tyr Leu Glu Met Met Glu Asn Leu Arg Asn Val
        195                 200                 205
```

```
Trp Pro Ser Phe Val Lys Thr Pro Asp Asp Leu Cys Asn Leu Lys Thr
    210                 215                 220

Tyr Asn His Leu Met Val Gln Ser Ser Ile Ser Glu Tyr Asn Arg Phe
225                 230                 235                 240

Val Gly Gly Tyr Ser Thr Glu Asp Gly Thr Lys His Gln Gly Ile Asn
                245                 250                 255

Glu Trp Ile Asn Ile Tyr Arg Gln Arg Asn Lys Glu Met Arg Leu Pro
            260                 265                 270

Gly Leu Val Phe Leu His Lys Gln Ile Leu Ala Lys Val Asp Ser Ser
        275                 280                 285

Ser Phe Ile Ser Asp Thr Leu Glu Asn Asp Asp Gln Val Phe Cys Val
    290                 295                 300

Leu Arg Gln Phe Arg Lys Leu Phe Trp Asn Thr Val Ser Ser Lys Glu
305                 310                 315                 320

Asp Asp Ala Ala Ser Leu Lys Asp Leu Phe Cys Gly Leu Ser Gly Tyr
                325                 330                 335

Asp Pro Glu Ala Ile Tyr Val Ser Asp Ala His Leu Ala Thr Ile Ser
            340                 345                 350

Lys Asn Ile Phe Asp Arg Trp Asn Tyr Ile Ser Asp Ala Ile Arg Arg
        355                 360                 365

Lys Thr Glu Val Leu Met Pro Arg Lys Lys Glu Ser Val Glu Arg Tyr
    370                 375                 380

Ala Glu Lys Ile Ser Lys Gln Ile Lys Lys Arg Gln Ser Tyr Ser Leu
385                 390                 395                 400

Ala Glu Leu Asp Asp Leu Leu Ala His Tyr Ser Glu Glu Ser Leu Pro
```

```
               405                 410                 415

Ala Gly Phe Ser Leu Leu Ser Tyr Phe Thr Ser Leu Gly Gly Gln Lys
            420                 425                 430

Tyr Leu Val Ser Asp Gly Glu Val Ile Leu Tyr Glu Glu Gly Ser Asn
        435                 440                 445

Ile Trp Asp Glu Val Leu Ile Ala Phe Arg Asp Leu Gln Val Ile Leu
    450                 455                 460

Asp Lys Asp Phe Thr Glu Lys Lys Leu Gly Lys Asp Glu Glu Ala Val
465                 470                 475                 480

Ser Val Ile Lys Lys Ala Leu Asp Ser Ala Leu Arg Leu Arg Lys Phe
                485                 490                 495

Phe Asp Leu Leu Ser Gly Thr Gly Ala Glu Ile Arg Arg Asp Ser Ser
            500                 505                 510

Phe Tyr Ala Leu Tyr Thr Asp Arg Met Asp Lys Leu Lys Gly Leu Leu
        515                 520                 525

Lys Met Tyr Asp Lys Val Arg Asn Tyr Leu Thr Lys Lys Pro Tyr Ser
    530                 535                 540

Ile Glu Lys Phe Lys Leu His Phe Asp Asn Pro Ser Leu Leu Ser Gly
545                 550                 555                 560

Trp Asp Lys Asn Lys Glu Leu Asn Asn Leu Ser Val Ile Phe Arg Gln
                565                 570                 575

Asn Gly Tyr Tyr Tyr Leu Gly Ile Met Thr Pro Lys Gly Lys Asn Leu
            580                 585                 590

Phe Lys Thr Leu Pro Lys Leu Gly Ala Glu Glu Met Phe Tyr Glu Lys
        595                 600                 605
```

```
Met Glu Tyr Lys Gln Ile Ala Glu Pro Met Leu Met Leu Pro Lys Val
    610                 615                 620

Phe Phe Pro Lys Lys Thr Lys Pro Ala Phe Ala Pro Asp Gln Ser Val
625                 630                 635                 640

Val Asp Ile Tyr Asn Lys Lys Thr Phe Lys Thr Gly Gln Lys Gly Phe
                645                 650                 655

Asn Lys Lys Asp Leu Tyr Arg Leu Ile Asp Phe Tyr Lys Glu Ala Leu
            660                 665                 670

Thr Val His Glu Trp Lys Leu Phe Asn Phe Ser Phe Ser Pro Thr Glu
        675                 680                 685

Gln Tyr Arg Asn Ile Gly Glu Phe Phe Asp Glu Val Arg Glu Gln Ala
    690                 695                 700

Tyr Lys Val Ser Met Val Asn Val Pro Ala Ser Tyr Ile Asp Glu Ala
705                 710                 715                 720

Val Glu Asn Gly Lys Leu Tyr Leu Phe Gln Ile Tyr Asn Lys Asp Phe
                725                 730                 735

Ser Pro Tyr Ser Lys Gly Ile Pro Asn Leu His Thr Leu Tyr Trp Lys
            740                 745                 750

Ala Leu Phe Ser Glu Gln Asn Gln Ser Arg Val Tyr Lys Leu Cys Gly
        755                 760                 765

Gly Gly Glu Leu Phe Tyr Arg Lys Ala Ser Leu His Met Gln Asp Thr
    770                 775                 780

Thr Val His Pro Lys Gly Ile Ser Ile His Lys Lys Asn Leu Asn Lys
785                 790                 795                 800

Lys Gly Glu Thr Ser Leu Phe Asn Tyr Asp Leu Val Lys Asp Lys Arg
```

```
               805                 810                 815

Phe Thr Glu Asp Lys Phe Phe Phe His Val Pro Ile Ser Ile Asn Tyr
            820                 825                 830

Lys Asn Lys Lys Ile Thr Asn Val Asn Gln Met Val Arg Asp Tyr Ile
        835                 840                 845

Ala Gln Asn Asp Asp Leu Gln Ile Ile Gly Ile Asp Arg Gly Glu Arg
    850                 855                 860

Asn Leu Leu Tyr Ile Ser Arg Ile Asp Thr Arg Gly Asn Leu Leu Glu
865                 870                 875                 880

Gln Phe Ser Leu Asn Val Ile Glu Ser Asp Lys Gly Asp Leu Arg Thr
               885                 890                 895

Asp Tyr Gln Lys Ile Leu Gly Asp Arg Glu Gln Glu Arg Leu Arg Arg
            900                 905                 910

Arg Gln Glu Trp Lys Ser Ile Glu Ser Ile Lys Asp Leu Lys Asp Gly
        915                 920                 925

Tyr Met Ser Gln Val Val His Lys Ile Cys Asn Met Val Val Glu His
    930                 935                 940

Lys Ala Ile Val Val Leu Glu Asn Leu Asn Leu Ser Phe Met Lys Gly
945                 950                 955                 960

Arg Lys Lys Val Glu Lys Ser Val Tyr Glu Lys Phe Glu Arg Met Leu
               965                 970                 975

Val Asp Lys Leu Asn Tyr Leu Val Val Asp Lys Lys Asn Leu Ser Asn
            980                 985                 990

Glu Pro Gly Gly Leu Tyr Ala Ala  Tyr Gln Leu Thr Asn  Pro Leu Phe
        995                 1000                1005
```

```
Ser Phe  Glu Glu Leu His Arg  Tyr Pro Gln Ser Gly  Ile Leu Phe
    1010                1015                1020

Phe Val  Asp Pro Trp Asn Thr  Ser Leu Thr Asp Pro  Ser Thr Gly
    1025                1030                1035

Phe Val  Asn Leu Leu Gly Arg  Ile Asn Tyr Thr Asn  Val Gly Asp
    1040                1045                1050

Ala Arg  Lys Phe Phe Asp Arg  Phe Asn Ala Ile Arg  Tyr Asp Gly
    1055                1060                1065

Lys Gly  Asn Ile Leu Phe Asp  Leu Asp Leu Ser Arg  Phe Asp Val
    1070                1075                1080

Arg Val  Glu Thr Gln Arg Lys  Leu Trp Thr Leu Thr  Thr Phe Gly
    1085                1090                1095

Ser Arg  Ile Ala Lys Ser Lys  Lys Ser Gly Lys Trp  Met Val Glu
    1100                1105                1110

Arg Ile  Glu Asn Leu Ser Leu  Cys Phe Leu Glu Leu  Phe Glu Gln
    1115                1120                1125

Phe Asn  Ile Gly Tyr Arg Val  Glu Lys Asp Leu Lys  Lys Ala Ile
    1130                1135                1140

Leu Ser  Gln Asp Arg Lys Glu  Phe Tyr Val Arg Leu  Ile Tyr Leu
    1145                1150                1155

Phe Asn  Leu Met Met Gln Ile  Arg Asn Ser Asp Gly  Glu Glu Asp
    1160                1165                1170

Tyr Ile  Leu Ser Pro Ala Leu  Asn Glu Lys Asn Leu  Gln Phe Asp
    1175                1180                1185

Ser Arg  Leu Ile Glu Ala Lys  Asp Leu Pro Val Asp  Ala Asp Ala
```

```
    1190                1195                1200

Asn Gly  Ala Tyr Asn Val Ala  Arg Lys Gly Leu Met  Val Val Gln
    1205                1210                1215

Arg Ile  Lys Arg Gly Asp His  Glu Ser Ile His Arg  Ile Gly Arg
    1220                1225                1230

Ala Gln  Trp Leu Arg Tyr Val  Gln Glu Gly Ile Val  Glu
    1235                1240                1245
```

<210> 821
<211> 1326
<212> PRT
<213> Prevotella disiens

<400> 821

```
Met Lys Val Met Glu Asn Tyr Gln Glu Phe Thr Asn Leu Phe Gln Leu
1               5                   10                  15

Asn Lys Thr Leu Arg Phe Glu Leu Lys Pro Ile Gly Lys Thr Cys Glu
            20                  25                  30

Leu Leu Glu Glu Gly Lys Ile Phe Ala Ser Gly Ser Phe Leu Glu Lys
        35                  40                  45

Asp Lys Val Arg Ala Asp Asn Val Ser Tyr Val Lys Lys Glu Ile Asp
    50                  55                  60

Lys Lys His Lys Ile Phe Ile Glu Glu Thr Leu Ser Ser Phe Ser Ile
65                  70                  75                  80

Ser Asn Asp Leu Leu Lys Gln Tyr Phe Asp Cys Tyr Asn Glu Leu Lys
                85                  90                  95

Ala Phe Lys Lys Asp Cys Lys Ser Asp Glu Glu Glu Val Lys Lys Thr
            100                 105                 110
```

```
Ala Leu Arg Asn Lys Cys Thr Ser Ile Gln Arg Ala Met Arg Glu Ala
        115                 120                 125

Ile Ser Gln Ala Phe Leu Lys Ser Pro Gln Lys Lys Leu Leu Ala Ile
    130                 135                 140

Lys Asn Leu Ile Glu Asn Val Phe Lys Ala Asp Glu Asn Val Gln His
145                 150                 155                 160

Phe Ser Glu Phe Thr Ser Tyr Phe Ser Gly Phe Glu Thr Asn Arg Glu
                165                 170                 175

Asn Phe Tyr Ser Asp Glu Glu Lys Ser Thr Ser Ile Ala Tyr Arg Leu
            180                 185                 190

Val His Asp Asn Leu Pro Ile Phe Ile Lys Asn Ile Tyr Ile Phe Glu
        195                 200                 205

Lys Leu Lys Glu Gln Phe Asp Ala Lys Thr Leu Ser Glu Ile Phe Glu
    210                 215                 220

Asn Tyr Lys Leu Tyr Val Ala Gly Ser Ser Leu Asp Glu Val Phe Ser
225                 230                 235                 240

Leu Glu Tyr Phe Asn Asn Thr Leu Thr Gln Lys Gly Ile Asp Asn Tyr
                245                 250                 255

Asn Ala Val Ile Gly Lys Ile Val Lys Glu Asp Lys Gln Glu Ile Gln
            260                 265                 270

Gly Leu Asn Glu His Ile Asn Leu Tyr Asn Gln Lys His Lys Asp Arg
        275                 280                 285

Arg Leu Pro Phe Phe Ile Ser Leu Lys Lys Gln Ile Leu Ser Asp Arg
    290                 295                 300

Glu Ala Leu Ser Trp Leu Pro Asp Met Phe Lys Asn Asp Ser Glu Val
305                 310                 315                 320
```

```
Ile Lys Ala Leu Lys Gly Phe Tyr Ile Glu Asp Gly Phe Glu Asn Asn
               325                 330                 335

Val Leu Thr Pro Leu Ala Thr Leu Leu Ser Ser Leu Asp Lys Tyr Asn
            340                 345                 350

Leu Asn Gly Ile Phe Ile Arg Asn Asn Glu Ala Leu Ser Ser Leu Ser
        355                 360                 365

Gln Asn Val Tyr Arg Asn Phe Ser Ile Asp Glu Ala Ile Asp Ala Asn
    370                 375                 380

Ala Glu Leu Gln Thr Phe Asn Asn Tyr Glu Leu Ile Ala Asn Ala Leu
385                 390                 395                 400

Arg Ala Lys Ile Lys Lys Glu Thr Lys Gln Gly Arg Lys Ser Phe Glu
               405                 410                 415

Lys Tyr Glu Glu Tyr Ile Asp Lys Lys Val Lys Ala Ile Asp Ser Leu
            420                 425                 430

Ser Ile Gln Glu Ile Asn Glu Leu Val Glu Asn Tyr Val Ser Glu Phe
        435                 440                 445

Asn Ser Asn Ser Gly Asn Met Pro Arg Lys Val Glu Asp Tyr Phe Ser
    450                 455                 460

Leu Met Arg Lys Gly Asp Phe Gly Ser Asn Asp Leu Ile Glu Asn Ile
465                 470                 475                 480

Lys Thr Lys Leu Ser Ala Ala Glu Lys Leu Leu Gly Thr Lys Tyr Gln
               485                 490                 495

Glu Thr Ala Lys Asp Ile Phe Lys Lys Asp Glu Asn Ser Lys Leu Ile
            500                 505                 510
```

```
Lys Glu Leu Leu Asp Ala Thr Lys Gln Phe Gln His Phe Ile Lys Pro
        515                 520                 525

Leu Leu Gly Thr Gly Glu Glu Ala Asp Arg Asp Leu Val Phe Tyr Gly
    530                 535                 540

Asp Phe Leu Pro Leu Tyr Glu Lys Phe Glu Glu Leu Thr Leu Leu Tyr
545                 550                 555                 560

Asn Lys Val Arg Asn Arg Leu Thr Gln Lys Pro Tyr Ser Lys Asp Lys
                565                 570                 575

Ile Arg Leu Cys Phe Asn Lys Pro Lys Leu Met Thr Gly Trp Val Asp
            580                 585                 590

Ser Lys Thr Glu Lys Ser Asp Asn Gly Thr Gln Tyr Gly Gly Tyr Leu
        595                 600                 605

Phe Arg Lys Lys Asn Glu Ile Gly Glu Tyr Asp Tyr Phe Leu Gly Ile
    610                 615                 620

Ser Ser Lys Ala Gln Leu Phe Arg Lys Asn Glu Ala Val Ile Gly Asp
625                 630                 635                 640

Tyr Glu Arg Leu Asp Tyr Tyr Gln Pro Lys Ala Asn Thr Ile Tyr Gly
                645                 650                 655

Ser Ala Tyr Glu Gly Glu Asn Ser Tyr Lys Glu Asp Lys Lys Arg Leu
            660                 665                 670

Asn Lys Val Ile Ile Ala Tyr Ile Glu Gln Ile Lys Gln Thr Asn Ile
        675                 680                 685

Lys Lys Ser Ile Ile Glu Ser Ile Ser Lys Tyr Pro Asn Ile Ser Asp
    690                 695                 700

Asp Asp Lys Val Thr Pro Ser Ser Leu Leu Glu Lys Ile Lys Lys Val
705                 710                 715                 720
```

```
Ser Ile Asp Ser Tyr Asn Gly Ile Leu Ser Phe Lys Ser Phe Gln Ser
               725                 730                 735

Val Asn Lys Glu Val Ile Asp Asn Leu Leu Lys Thr Ile Ser Pro Leu
            740                 745                 750

Lys Asn Lys Ala Glu Phe Leu Asp Leu Ile Asn Lys Asp Tyr Gln Ile
        755                 760                 765

Phe Thr Glu Val Gln Ala Val Ile Asp Glu Ile Cys Lys Gln Lys Thr
    770                 775                 780

Phe Ile Tyr Phe Pro Ile Ser Asn Val Glu Leu Glu Lys Glu Met Gly
785                 790                 795                 800

Asp Lys Asp Lys Pro Leu Cys Leu Phe Gln Ile Ser Asn Lys Asp Leu
               805                 810                 815

Ser Phe Ala Lys Thr Phe Ser Ala Asn Leu Arg Lys Lys Arg Gly Ala
            820                 825                 830

Glu Asn Leu His Thr Met Leu Phe Lys Ala Leu Met Glu Gly Asn Gln
        835                 840                 845

Asp Asn Leu Asp Leu Gly Ser Gly Ala Ile Phe Tyr Arg Ala Lys Ser
    850                 855                 860

Leu Asp Gly Asn Lys Pro Thr His Pro Ala Asn Glu Ala Ile Lys Cys
865                 870                 875                 880

Arg Asn Val Ala Asn Lys Asp Lys Val Ser Leu Phe Thr Tyr Asp Ile
               885                 890                 895

Tyr Lys Asn Arg Arg Tyr Met Glu Asn Lys Phe Leu Phe His Leu Ser
            900                 905                 910
```

```
Ile Val Gln Asn Tyr Lys Ala Ala Asn Asp Ser Ala Gln Leu Asn Ser
        915                 920                 925

Ser Ala Thr Glu Tyr Ile Arg Lys Ala Asp Asp Leu His Ile Ile Gly
    930                 935                 940

Ile Asp Arg Gly Glu Arg Asn Leu Leu Tyr Tyr Ser Val Ile Asp Met
945                 950                 955                 960

Lys Gly Asn Ile Val Glu Gln Asp Ser Leu Asn Ile Ile Arg Asn Asn
                965                 970                 975

Asp Leu Glu Thr Asp Tyr His Asp Leu Leu Asp Lys Arg Glu Lys Glu
            980                 985                 990

Arg Lys Ala Asn Arg Gln Asn Trp  Glu Ala Val Glu Gly  Ile Lys Asp
        995                 1000                1005

Leu Lys  Lys Gly Tyr Leu Ser  Gln Ala Val His Gln  Ile Ala Gln
    1010                1015                1020

Leu Met  Leu Lys Tyr Asn Ala  Ile Ile Ala Leu Glu  Asp Leu Gly
    1025                1030                1035

Gln Met  Phe Val Thr Arg Gly  Gln Lys Ile Glu Lys  Ala Val Tyr
    1040                1045                1050

Gln Gln  Phe Glu Lys Ser Leu  Val Asp Lys Leu Ser  Tyr Leu Val
    1055                1060                1065

Asp Lys  Lys Arg Pro Tyr Asn  Glu Leu Gly Gly Ile  Leu Lys Ala
    1070                1075                1080

Tyr Gln  Leu Ala Ser Ser Ile  Thr Lys Asn Asn Ser  Asp Lys Gln
    1085                1090                1095

Asn Gly  Phe Leu Phe Tyr Val  Pro Ala Trp Asn Thr  Ser Lys Ile
    1100                1105                1110
```

```
Asp Pro  Val Thr Gly Phe Thr  Asp Leu Leu Arg Pro  Lys Ala Met
    1115                1120                1125

Thr Ile  Lys Glu Ala Gln Asp  Phe Phe Gly Ala Phe  Asp Asn Ile
    1130                1135                1140

Ser Tyr  Asn Asp Lys Gly Tyr  Phe Glu Phe Glu Thr  Asn Tyr Asp
    1145                1150                1155

Lys Phe  Lys Ile Arg Met Lys  Ser Ala Gln Thr Arg  Trp Thr Ile
    1160                1165                1170

Cys Thr  Phe Gly Asn Arg Ile  Lys Arg Lys Lys Asp  Lys Asn Tyr
    1175                1180                1185

Trp Asn  Tyr Glu Glu Val Glu  Leu Thr Glu Glu Phe  Lys Lys Leu
    1190                1195                1200

Phe Lys  Asp Ser Asn Ile Asp  Tyr Glu Asn Cys Asn  Leu Lys Glu
    1205                1210                1215

Glu Ile  Gln Asn Lys Asp Asn  Arg Lys Phe Phe Asp  Asp Leu Ile
    1220                1225                1230

Lys Leu  Leu Gln Leu Thr Leu  Gln Met Arg Asn Ser  Asp Asp Lys
    1235                1240                1245

Gly Asn  Asp Tyr Ile Ile Ser  Pro Val Ala Asn Ala  Glu Gly Gln
    1250                1255                1260

Phe Phe  Asp Ser Arg Asn Gly  Asp Lys Lys Leu Pro  Leu Asp Ala
    1265                1270                1275

Asp Ala  Asn Gly Ala Tyr Asn  Ile Ala Arg Lys Gly  Leu Trp Asn
    1280                1285                1290
```

Ile Arg Gln Ile Lys Gln Thr Lys Asn Asp Lys Lys Leu Asn Leu
    1295   1300   1305

Ser Ile Ser Ser Thr Glu Trp Leu Asp Phe Val Arg Glu Lys Pro
    1310   1315   1320

Tyr Leu Lys
    1325

<210> 822
<211> 1129
<212> PRT
<213> Alicyclobacillus acidoterrestris

<400> 822

Met Ala Val Lys Ser Ile Lys Val Lys Leu Arg Leu Asp Asp Met Pro
1   5   10   15

Glu Ile Arg Ala Gly Leu Trp Lys Leu His Lys Glu Val Asn Ala Gly
            20   25   30

Val Arg Tyr Tyr Thr Glu Trp Leu Ser Leu Leu Arg Gln Glu Asn Leu
        35   40   45

Tyr Arg Arg Ser Pro Asn Gly Asp Gly Glu Gln Glu Cys Asp Lys Thr
    50   55   60

Ala Glu Glu Cys Lys Ala Glu Leu Leu Glu Arg Leu Arg Ala Arg Gln
65   70   75   80

Val Glu Asn Gly His Arg Gly Pro Ala Gly Ser Asp Asp Glu Leu Leu
                85   90   95

Gln Leu Ala Arg Gln Leu Tyr Glu Leu Leu Val Pro Gln Ala Ile Gly
            100   105   110

Ala Lys Gly Asp Ala Gln Gln Ile Ala Arg Lys Phe Leu Ser Pro Leu
        115   120   125

```
Ala Asp Lys Asp Ala Val Gly Gly Leu Gly Ile Ala Lys Ala Gly Asn
    130                 135                 140

Lys Pro Arg Trp Val Arg Met Arg Glu Ala Gly Glu Pro Gly Trp Glu
145                 150                 155                 160

Glu Glu Lys Glu Lys Ala Glu Thr Arg Lys Ser Ala Asp Arg Thr Ala
                165                 170                 175

Asp Val Leu Arg Ala Leu Ala Asp Phe Gly Leu Lys Pro Leu Met Arg
            180                 185                 190

Val Tyr Thr Asp Ser Glu Met Ser Ser Val Glu Trp Lys Pro Leu Arg
        195                 200                 205

Lys Gly Gln Ala Val Arg Thr Trp Asp Arg Asp Met Phe Gln Gln Ala
    210                 215                 220

Ile Glu Arg Met Met Ser Trp Glu Ser Trp Asn Gln Arg Val Gly Gln
225                 230                 235                 240

Glu Tyr Ala Lys Leu Val Glu Gln Lys Asn Arg Phe Glu Gln Lys Asn
                245                 250                 255

Phe Val Gly Gln Glu His Leu Val His Leu Val Asn Gln Leu Gln Gln
            260                 265                 270

Asp Met Lys Glu Ala Ser Pro Gly Leu Glu Ser Lys Glu Gln Thr Ala
        275                 280                 285

His Tyr Val Thr Gly Arg Ala Leu Arg Gly Ser Asp Lys Val Phe Glu
    290                 295                 300

Lys Trp Gly Lys Leu Ala Pro Asp Ala Pro Phe Asp Leu Tyr Asp Ala
305                 310                 315                 320

Glu Ile Lys Asn Val Gln Arg Arg Asn Thr Arg Arg Phe Gly Ser His
```

```
                325                 330                 335

Asp Leu Phe Ala Lys Leu Ala Glu Pro Glu Tyr Gln Ala Leu Trp Arg
            340                 345                 350

Glu Asp Ala Ser Phe Leu Thr Arg Tyr Ala Val Tyr Asn Ser Ile Leu
        355                 360                 365

Arg Lys Leu Asn His Ala Lys Met Phe Ala Thr Phe Thr Leu Pro Asp
    370                 375                 380

Ala Thr Ala His Pro Ile Trp Thr Arg Phe Asp Lys Leu Gly Gly Asn
385                 390                 395                 400

Leu His Gln Tyr Thr Phe Leu Phe Asn Glu Phe Gly Glu Arg Arg His
                405                 410                 415

Ala Ile Arg Phe His Lys Leu Leu Lys Val Glu Asn Gly Val Ala Arg
            420                 425                 430

Glu Val Asp Asp Val Thr Val Pro Ile Ser Met Ser Glu Gln Leu Asp
        435                 440                 445

Asn Leu Leu Pro Arg Asp Pro Asn Glu Pro Ile Ala Leu Tyr Phe Arg
    450                 455                 460

Asp Tyr Gly Ala Glu Gln His Phe Thr Gly Glu Phe Gly Gly Ala Lys
465                 470                 475                 480

Ile Gln Cys Arg Arg Asp Gln Leu Ala His Met His Arg Arg Arg Gly
                485                 490                 495

Ala Arg Asp Val Tyr Leu Asn Val Ser Val Arg Val Gln Ser Gln Ser
            500                 505                 510

Glu Ala Arg Gly Glu Arg Arg Pro Pro Tyr Ala Ala Val Phe Arg Leu
        515                 520                 525
```

```
Val Gly Asp Asn His Arg Ala Phe Val His Phe Asp Lys Leu Ser Asp
    530                 535                 540

Tyr Leu Ala Glu His Pro Asp Asp Gly Lys Leu Gly Ser Glu Gly Leu
545                 550                 555                 560

Leu Ser Gly Leu Arg Val Met Ser Val Asp Leu Gly Leu Arg Thr Ser
                565                 570                 575

Ala Ser Ile Ser Val Phe Arg Val Ala Arg Lys Asp Glu Leu Lys Pro
            580                 585                 590

Asn Ser Lys Gly Arg Val Pro Phe Phe Phe Pro Ile Lys Gly Asn Asp
        595                 600                 605

Asn Leu Val Ala Val His Glu Arg Ser Gln Leu Leu Lys Leu Pro Gly
    610                 615                 620

Glu Thr Glu Ser Lys Asp Leu Arg Ala Ile Arg Glu Glu Arg Gln Arg
625                 630                 635                 640

Thr Leu Arg Gln Leu Arg Thr Gln Leu Ala Tyr Leu Arg Leu Leu Val
                645                 650                 655

Arg Cys Gly Ser Glu Asp Val Gly Arg Arg Glu Arg Ser Trp Ala Lys
            660                 665                 670

Leu Ile Glu Gln Pro Val Asp Ala Ala Asn His Met Thr Pro Asp Trp
        675                 680                 685

Arg Glu Ala Phe Glu Asn Glu Leu Gln Lys Leu Lys Ser Leu His Gly
    690                 695                 700

Ile Cys Ser Asp Lys Glu Trp Met Asp Ala Val Tyr Glu Ser Val Arg
705                 710                 715                 720

Arg Val Trp Arg His Met Gly Lys Gln Val Arg Asp Trp Arg Lys Asp
```

```
                725                 730                 735

Val Arg Ser Gly Glu Arg Pro Lys Ile Arg Gly Tyr Ala Lys Asp Val
            740                 745                 750

Val Gly Gly Asn Ser Ile Glu Gln Ile Glu Tyr Leu Glu Arg Gln Tyr
        755                 760                 765

Lys Phe Leu Lys Ser Trp Ser Phe Phe Gly Lys Val Ser Gly Gln Val
    770                 775                 780

Ile Arg Ala Glu Lys Gly Ser Arg Phe Ala Ile Thr Leu Arg Glu His
785                 790                 795                 800

Ile Asp His Ala Lys Glu Asp Arg Leu Lys Lys Leu Ala Asp Arg Ile
                805                 810                 815

Ile Met Glu Ala Leu Gly Tyr Val Tyr Ala Leu Asp Glu Arg Gly Lys
            820                 825                 830

Gly Lys Trp Val Ala Lys Tyr Pro Pro Cys Gln Leu Ile Leu Leu Glu
        835                 840                 845

Glu Leu Ser Glu Tyr Gln Phe Asn Asn Asp Arg Pro Pro Ser Glu Asn
    850                 855                 860

Asn Gln Leu Met Gln Trp Ser His Arg Gly Val Phe Gln Glu Leu Ile
865                 870                 875                 880

Asn Gln Ala Gln Val His Asp Leu Leu Val Gly Thr Met Tyr Ala Ala
                885                 890                 895

Phe Ser Ser Arg Phe Asp Ala Arg Thr Gly Ala Pro Gly Ile Arg Cys
            900                 905                 910

Arg Arg Val Pro Ala Arg Cys Thr Gln Glu His Asn Pro Glu Pro Phe
        915                 920                 925
```

```
Pro Trp Trp Leu Asn Lys Phe Val Val Glu His Thr Leu Asp Ala Cys
    930                 935                 940

Pro Leu Arg Ala Asp Asp Leu Ile Pro Thr Gly Glu Gly Glu Ile Phe
945                 950                 955                 960

Val Ser Pro Phe Ser Ala Glu Glu Gly Asp Phe His Gln Ile His Ala
                965                 970                 975

Asp Leu Asn Ala Ala Gln Asn Leu Gln Gln Arg Leu Trp Ser Asp Phe
            980                 985                 990

Asp Ile Ser Gln Ile Arg Leu Arg  Cys Asp Trp Gly Glu  Val Asp Gly
        995                 1000                1005

Glu Leu  Val Leu Ile Pro Arg  Leu Thr Gly Lys Arg  Thr Ala Asp
    1010                1015                1020

Ser Tyr  Ser Asn Lys Val Phe  Tyr Thr Asn Thr Gly  Val Thr Tyr
    1025                1030                1035

Tyr Glu  Arg Glu Arg Gly Lys  Lys Arg Arg Lys Val  Phe Ala Gln
    1040                1045                1050

Glu Lys  Leu Ser Glu Glu Glu  Ala Glu Leu Leu Val  Glu Ala Asp
    1055                1060                1065

Glu Ala  Arg Glu Lys Ser Val  Val Leu Met Arg Asp  Pro Ser Gly
    1070                1075                1080

Ile Ile  Asn Arg Gly Asn Trp  Thr Arg Gln Lys Glu  Phe Trp Ser
    1085                1090                1095

Met Val  Asn Gln Arg Ile Glu  Gly Tyr Leu Val Lys  Gln Ile Arg
    1100                1105                1110

Ser Arg  Val Pro Leu Gln Asp  Ser Ala Cys Glu Asn  Thr Gly Asp
```

1115 1120 1125

Ile

<210> 823
<211> 872
<212> PRT
<213> Alicyclobacillus contaminans

<400> 823

Met Gly Phe Asn Thr Ala Glu Leu Leu Arg Lys Val Glu Glu Glu Met
1 5 10 15

Arg Lys Thr Ser Val Gly Phe Asp Thr Asp Asn Pro Phe Ala His Arg
20 25 30

Ile Thr Arg Arg Ala Ile Arg Gly Trp Asp Arg Ile Ala Glu Ala Trp
35 40 45

Arg Arg Leu Pro Pro Asp Ala Pro Glu Ser Glu Tyr Ile Glu Ala Phe
50 55 60

Lys Asp Ile Gln Arg Lys Asn Pro Arg Lys Ile Gly Ser Glu Pro Leu
65 70 75 80

Phe Lys Asn Leu Ala Ala Pro Gly Val Arg Ser Glu Leu Leu Asn Asn
85 90 95

Pro Gln Val Leu Ile Thr Phe Ala Lys Tyr Asn Glu Leu Gln Arg Gln
100 105 110

Leu Ala Lys Ala Lys Gln Phe Ala Gln Lys Thr Leu Pro His Pro Val
115 120 125

Phe His Pro Val Trp Val Arg Tyr Asp Lys Leu Gly Gly Asn Leu His
130 135 140

```
His Tyr Gln Ile Glu Pro Ala Val His Ala Asn Asp Thr His Lys Val
145                 150                 155                 160

Lys Phe Ser Ser Leu Leu Leu Pro Gln Glu Asp Gly Ser Tyr Ala Glu
                165                 170                 175

Val Lys Asp Val Thr Val Ser Leu Ala Pro Ser Leu Gln Phe Pro Thr
            180                 185                 190

Gly Leu Val His Pro Lys Val Thr Thr Pro Pro Arg Thr Gly Leu Val
        195                 200                 205

Thr Val Met Asp Glu Glu Ala Gly Lys Pro Val Val Cys Tyr Arg Asp
    210                 215                 220

Arg Gly His Asp Ala Leu Val Pro Val Ala Phe Gly Gly Ala Lys Leu
225                 230                 235                 240

Gln Phe Asn Arg Ala His Leu Ser Ala Gly Tyr Arg Lys Gly Val Leu
                245                 250                 255

Ser Ala Gly Gly Gly Gly Ser Ile Tyr Phe Asn Val Thr Leu Asp Val
            260                 265                 270

Gln Val Pro Asn Glu Arg Asp Val Ser Lys Thr Phe Ser Phe Ser Arg
        275                 280                 285

Asp Arg Asp Leu Val Ser Leu Lys Ala Glu Glu Leu Lys Arg Tyr Met
    290                 295                 300

Glu Thr Lys Pro Leu Gly Met Pro Gly Val Arg Val Met Ser Val Asp
305                 310                 315                 320

Leu Gly Val Arg Tyr Gly Ala Ala Ile Ser Val Phe Glu Val Lys Pro
                325                 330                 335

Phe Ala Glu Val Arg Lys Asp Lys Leu His Tyr Pro Ile Thr Gly Cys
            340                 345                 350
```

```
Glu Gly Phe Val Ala Glu His Glu Arg Ser Val Ile Leu Lys Leu Pro
        355                 360                 365

Gly Glu Gly Val Arg Thr Ala Gly Lys Gln Ser Glu Arg Lys Gln Ala
    370                 375                 380

Leu Ala Ala Ile Arg Ala Glu Met Ser Ile Leu Arg Lys Trp Leu Arg
385                 390                 395                 400

Val Ser Gln Val Thr Glu Glu Asp Arg Ala Lys Ala Val Arg Gly Leu
                405                 410                 415

Leu Glu Asp Glu Arg Gly Gly Gly Trp Thr Met Asp Pro Gly Glu Asp
            420                 425                 430

Ser Asp His Gln Pro Leu Gln Gln Phe Leu His Glu Ala Arg Leu Ala
        435                 440                 445

Val Gly Glu Leu Val Asn Leu Val His Leu Ser Pro Ala Glu Trp Glu
    450                 455                 460

Arg Ala Val Ile Glu Arg His Arg Arg Leu Glu Arg Ile Thr Ala Ser
465                 470                 475                 480

His Ile Arg Val Phe Gln Thr Met Arg Lys Val Trp Gly Lys Arg Arg
                485                 490                 495

Asn Glu Asp Ala Ala His Thr Gly Gly Ile Ser Leu Ala His Ile Glu
            500                 505                 510

His Leu Ile Gln Gln Arg Lys Leu Phe Ile Arg Trp Ser Thr His Ala
        515                 520                 525

Arg Thr Tyr Gly Glu Val Arg Arg Leu Pro Lys His Glu Gly Phe Ala
    530                 535                 540
```

```
Lys Arg Leu Gln Lys His Thr Asn His Val Lys Glu Asp Arg Ile Lys
545                 550                 555                 560

Lys Leu Ala Asp Met Ile Val Met Ala Ala Arg Gly Tyr Arg Phe Leu
                565                 570                 575

Asp Lys Arg Ala Arg Trp Val Lys Thr Arg His Ala Pro Cys Asp Leu
            580                 585                 590

Ile Leu Phe Glu Asp Leu Ser Arg Tyr Arg Phe Thr Met Asp Arg Pro
        595                 600                 605

Pro Thr Glu Asn Ser Gln Leu Met Asn Trp Ser His Arg Glu Leu Leu
    610                 615                 620

Lys Thr Val Lys Met Gln Ala Ala Leu Phe Gly Ile Gly Val Gly Thr
625                 630                 635                 640

Val Pro Ala Ala Phe Thr Ser Arg Phe Asp Ala Gln Thr Gly Ala Pro
                645                 650                 655

Gly Leu Arg Cys Lys Arg Val Thr Lys Gln Asp Lys Glu Lys Thr Pro
            660                 665                 670

Phe Trp Leu Ile Gln Phe Ala Glu Ile Thr Gly Val Asn Val Thr Asn
        675                 680                 685

Val Glu Pro Gly Gln Leu Ile Pro Val Asp Gly Gly Glu Trp Phe Val
    690                 695                 700

Ser Pro Lys Gly Pro Arg Ala Ala Asp Gly Leu Lys Cys Val His Ala
705                 710                 715                 720

Asp Ile Asn Ala Ala His Asn Leu Gln Arg Arg Phe Trp Ile Pro Arg
                725                 730                 735

Leu Pro Ser Val Lys Cys Arg Arg Tyr Val Glu Ala Glu Gly Phe Ala
            740                 745                 750
```

```
Ala Val Pro Ser Ser Thr Ala Phe Met Lys Val His Gly Lys Gly Ala
        755                 760                 765

Phe Val Ser Val Asp Gly Glu Phe Tyr Glu Tyr Gln Lys Gly Arg Arg
    770                 775                 780

Val Ala Val Asn Arg Ala Asp Arg Thr Ser Ser Thr Leu Asp Glu Asp
785                 790                 795                 800

Glu Gly Asp Ile Gly Glu Glu Met Leu Val Ser Ser Asn Gly Ala Gly
                805                 810                 815

Glu Phe Val Arg Met Phe Tyr Asp Glu Ser Gly Tyr Val Gly Tyr Gly
            820                 825                 830

Arg Trp Met Asp Ser Lys Val Phe Trp Gly Lys Val Arg Gln Ile Val
        835                 840                 845

His Arg Ala Ile Gln Asp Gln Val Glu Lys Arg Ala Ala Ala Arg Gly
    850                 855                 860

Glu Asn Gly Ala Thr Ser Ser Arg
865                 870
```

<210> 824
<211> 1149
<212> PRT
<213> Desulfovibrio inopinatus

<400> 824

```
Met Pro Thr Arg Thr Ile Asn Leu Lys Leu Val Leu Gly Lys Asn Pro
1               5                   10                  15

Glu Asn Ala Thr Leu Arg Arg Ala Leu Phe Ser Thr His Arg Leu Val
            20                  25                  30

Asn Gln Ala Thr Lys Arg Ile Glu Glu Phe Leu Leu Leu Cys Arg Gly
```

```
        35                  40                  45

Glu Ala Tyr Arg Thr Val Asp Asn Glu Gly Lys Glu Ala Glu Ile Pro
    50                  55                  60

Arg His Ala Val Gln Glu Glu Ala Leu Ala Phe Ala Lys Ala Ala Gln
65                  70                  75                  80

Arg His Asn Gly Cys Ile Ser Thr Tyr Glu Asp Gln Glu Ile Leu Asp
                85                  90                  95

Val Leu Arg Gln Leu Tyr Glu Arg Leu Val Pro Ser Val Asn Glu Asn
            100                 105                 110

Asn Glu Ala Gly Asp Ala Gln Ala Ala Asn Ala Trp Val Ser Pro Leu
        115                 120                 125

Met Ser Ala Glu Ser Glu Gly Gly Leu Ser Val Tyr Asp Lys Val Leu
    130                 135                 140

Asp Pro Pro Pro Val Trp Met Lys Leu Lys Glu Glu Lys Ala Pro Gly
145                 150                 155                 160

Trp Glu Ala Ala Ser Gln Ile Trp Ile Gln Ser Asp Glu Gly Gln Ser
                165                 170                 175

Leu Leu Asn Lys Pro Gly Ser Pro Pro Arg Trp Ile Arg Lys Leu Arg
            180                 185                 190

Ser Gly Gln Pro Trp Gln Asp Asp Phe Val Ser Asp Gln Lys Lys Lys
        195                 200                 205

Gln Asp Glu Leu Thr Lys Gly Asn Ala Pro Leu Ile Lys Gln Leu Lys
    210                 215                 220

Glu Met Gly Leu Leu Pro Leu Val Asn Pro Phe Phe Arg His Leu Leu
225                 230                 235                 240
```

```
Asp Pro Glu Gly Lys Gly Val Ser Pro Trp Asp Arg Leu Ala Val Arg
                245                 250                 255

Ala Ala Val Ala His Phe Ile Ser Trp Glu Ser Trp Asn His Arg Thr
            260                 265                 270

Arg Ala Glu Tyr Asn Ser Leu Lys Leu Arg Arg Asp Glu Phe Glu Ala
        275                 280                 285

Ala Ser Asp Glu Phe Lys Asp Asp Phe Thr Leu Leu Arg Gln Tyr Glu
    290                 295                 300

Ala Lys Arg His Ser Thr Leu Lys Ser Ile Ala Leu Ala Asp Asp Ser
305                 310                 315                 320

Asn Pro Tyr Arg Ile Gly Val Arg Ser Leu Arg Ala Trp Asn Arg Val
                325                 330                 335

Arg Glu Glu Trp Ile Asp Lys Gly Ala Thr Glu Glu Gln Arg Val Thr
            340                 345                 350

Ile Leu Ser Lys Leu Gln Thr Gln Leu Arg Gly Lys Phe Gly Asp Pro
        355                 360                 365

Asp Leu Phe Asn Trp Leu Ala Gln Asp Arg His Val His Leu Trp Ser
    370                 375                 380

Pro Arg Asp Ser Val Thr Pro Leu Val Arg Ile Asn Ala Val Asp Lys
385                 390                 395                 400

Val Leu Arg Arg Arg Lys Pro Tyr Ala Leu Met Thr Phe Ala His Pro
                405                 410                 415

Arg Phe His Pro Arg Trp Ile Leu Tyr Glu Ala Pro Gly Gly Ser Asn
            420                 425                 430

Leu Arg Gln Tyr Ala Leu Asp Cys Thr Glu Asn Ala Leu His Ile Thr
```

```
        435                 440                 445

Leu Pro Leu Leu Val Asp Asp Ala His Gly Thr Trp Ile Glu Lys Lys
    450                 455                 460

Ile Arg Val Pro Leu Ala Pro Ser Gly Gln Ile Gln Asp Leu Thr Leu
465                 470                 475                 480

Glu Lys Leu Glu Lys Lys Lys Asn Arg Leu Tyr Tyr Arg Ser Gly Phe
                485                 490                 495

Gln Gln Phe Ala Gly Leu Ala Gly Gly Ala Glu Val Leu Phe His Arg
            500                 505                 510

Pro Tyr Met Glu His Asp Glu Arg Ser Glu Glu Ser Leu Leu Glu Arg
        515                 520                 525

Pro Gly Ala Val Trp Phe Lys Leu Thr Leu Asp Val Ala Thr Gln Ala
    530                 535                 540

Pro Pro Asn Trp Leu Asp Gly Lys Gly Arg Val Arg Thr Pro Pro Glu
545                 550                 555                 560

Val His His Phe Lys Thr Ala Leu Ser Asn Lys Ser Lys His Thr Arg
                565                 570                 575

Thr Leu Gln Pro Gly Leu Arg Val Leu Ser Val Asp Leu Gly Met Arg
            580                 585                 590

Thr Phe Ala Ser Cys Ser Val Phe Glu Leu Ile Glu Gly Lys Pro Glu
        595                 600                 605

Thr Gly Arg Ala Phe Pro Val Ala Asp Glu Arg Ser Met Asp Ser Pro
    610                 615                 620

Asn Lys Leu Trp Ala Lys His Glu Arg Ser Phe Lys Leu Thr Leu Pro
625                 630                 635                 640
```

```
Gly Glu Thr Pro Ser Arg Lys Glu Glu Glu Glu Arg Ser Ile Ala Arg
                645                 650                 655

Ala Glu Ile Tyr Ala Leu Lys Arg Asp Ile Gln Arg Leu Lys Ser Leu
            660                 665                 670

Leu Arg Leu Gly Glu Glu Asp Asn Asp Asn Arg Arg Asp Ala Leu Leu
        675                 680                 685

Glu Gln Phe Phe Lys Gly Trp Gly Glu Glu Asp Val Val Pro Gly Gln
    690                 695                 700

Ala Phe Pro Arg Ser Leu Phe Gln Gly Leu Gly Ala Ala Pro Phe Arg
705                 710                 715                 720

Ser Thr Pro Glu Leu Trp Arg Gln His Cys Gln Thr Tyr Tyr Asp Lys
                725                 730                 735

Ala Glu Ala Cys Leu Ala Lys His Ile Ser Asp Trp Arg Lys Arg Thr
            740                 745                 750

Arg Pro Arg Pro Thr Ser Arg Glu Met Trp Tyr Lys Thr Arg Ser Tyr
        755                 760                 765

His Gly Gly Lys Ser Ile Trp Met Leu Glu Tyr Leu Asp Ala Val Arg
    770                 775                 780

Lys Leu Leu Leu Ser Trp Ser Leu Arg Gly Arg Thr Tyr Gly Ala Ile
785                 790                 795                 800

Asn Arg Gln Asp Thr Ala Arg Phe Gly Ser Leu Ala Ser Arg Leu Leu
                805                 810                 815

His His Ile Asn Ser Leu Lys Glu Asp Arg Ile Lys Thr Gly Ala Asp
            820                 825                 830

Ser Ile Val Gln Ala Ala Arg Gly Tyr Ile Pro Leu Pro His Gly Lys
```

```
        835                 840                 845

Gly Trp Glu Gln Arg Tyr Glu Pro Cys Gln Leu Ile Leu Phe Glu Asp
    850                 855                 860

Leu Ala Arg Tyr Arg Phe Arg Val Asp Arg Pro Arg Arg Glu Asn Ser
865                 870                 875                 880

Gln Leu Met Gln Trp Asn His Arg Ala Ile Val Ala Glu Thr Thr Met
                885                 890                 895

Gln Ala Glu Leu Tyr Gly Gln Ile Val Glu Asn Thr Ala Ala Gly Phe
            900                 905                 910

Ser Ser Arg Phe His Ala Ala Thr Gly Ala Pro Gly Val Arg Cys Arg
        915                 920                 925

Phe Leu Leu Glu Arg Asp Phe Asp Asn Asp Leu Pro Lys Pro Tyr Leu
    930                 935                 940

Leu Arg Glu Leu Ser Trp Met Leu Gly Asn Thr Lys Val Glu Ser Glu
945                 950                 955                 960

Glu Glu Lys Leu Arg Leu Leu Ser Glu Lys Ile Arg Pro Gly Ser Leu
                965                 970                 975

Val Pro Trp Asp Gly Gly Glu Gln Phe Ala Thr Leu His Pro Lys Arg
            980                 985                 990

Gln Thr Leu Cys Val Ile His Ala  Asp Met Asn Ala Ala  Gln Asn Leu
        995                 1000                1005

Gln Arg  Arg Phe Phe Gly Arg  Cys Gly Glu Ala Phe  Arg Leu Val
    1010                1015                1020

Cys Gln  Pro His Gly Asp Asp  Val Leu Arg Leu Ala  Ser Thr Pro
    1025                1030                1035
```

```
Gly Ala  Arg Leu Leu Gly Ala  Leu Gln Gln Leu Glu  Asn Gly Gln
    1040                1045                1050


Gly Ala  Phe Glu Leu Val Arg  Asp Met Gly Ser Thr  Ser Gln Met
    1055                1060                1065


Asn Arg  Phe Val Met Lys Ser  Leu Gly Lys Lys Lys  Ile Lys Pro
    1070                1075                1080


Leu Gln  Asp Asn Asn Gly Asp  Asp Glu Leu Glu Asp  Val Leu Ser
    1085                1090                1095


Val Leu  Pro Glu Glu Asp Asp  Thr Gly Arg Ile Thr  Val Phe Arg
    1100                1105                1110


Asp Ser  Ser Gly Ile Phe Phe  Pro Cys Asn Val Trp  Ile Pro Ala
    1115                1120                1125


Lys Gln  Phe Trp Pro Ala Val  Arg Ala Met Ile Trp  Lys Val Met
    1130                1135                1140


Ala Ser  His Ser Leu Gly
    1145
```

<210> 825
<211> 1194
<212> PRT
<213> Desulfonatronum thiodismutans

<400> 825

```
Met Val Leu Gly Arg Lys Asp Asp Thr Ala Glu Leu Arg Arg Ala Leu
1               5                   10                  15


Trp Thr Thr His Glu His Val Asn Leu Ala Val Ala Glu Val Glu Arg
            20                  25                  30


Val Leu Leu Arg Cys Arg Gly Arg Ser Tyr Trp Thr Leu Asp Arg Arg
        35                  40                  45
```

```
Gly Asp Pro Val His Val Pro Glu Ser Gln Val Ala Glu Asp Ala Leu
    50                  55                  60

Ala Met Ala Arg Glu Ala Gln Arg Arg Asn Gly Trp Pro Val Val Gly
65                  70                  75                  80

Glu Asp Glu Glu Ile Leu Leu Ala Leu Arg Tyr Leu Tyr Glu Gln Ile
                85                  90                  95

Val Pro Ser Cys Leu Leu Asp Asp Leu Gly Lys Pro Leu Lys Gly Asp
            100                 105                 110

Ala Gln Lys Ile Gly Thr Asn Tyr Ala Gly Pro Leu Phe Asp Ser Asp
        115                 120                 125

Thr Cys Arg Arg Asp Glu Gly Lys Asp Val Ala Cys Cys Gly Pro Phe
    130                 135                 140

His Glu Val Ala Gly Lys Tyr Leu Gly Ala Leu Pro Glu Trp Ala Thr
145                 150                 155                 160

Pro Ile Ser Lys Gln Glu Phe Asp Gly Lys Asp Ala Ser His Leu Arg
                165                 170                 175

Phe Lys Ala Thr Gly Gly Asp Asp Ala Phe Phe Arg Val Ser Ile Glu
            180                 185                 190

Lys Ala Asn Ala Trp Tyr Glu Asp Pro Ala Asn Gln Asp Ala Leu Lys
        195                 200                 205

Asn Lys Ala Tyr Asn Lys Asp Asp Trp Lys Lys Glu Lys Asp Lys Gly
    210                 215                 220

Ile Ser Ser Trp Ala Val Lys Tyr Ile Gln Lys Gln Leu Gln Leu Gly
225                 230                 235                 240
```

```
Gln Asp Pro Arg Thr Glu Val Arg Arg Lys Leu Trp Leu Glu Leu Gly
                245                 250                 255

Leu Leu Pro Leu Phe Ile Pro Val Phe Asp Lys Thr Met Val Gly Asn
            260                 265                 270

Leu Trp Asn Arg Leu Ala Val Arg Leu Ala Leu Ala His Leu Leu Ser
        275                 280                 285

Trp Glu Ser Trp Asn His Arg Ala Val Gln Asp Gln Ala Leu Ala Arg
    290                 295                 300

Ala Lys Arg Asp Glu Leu Ala Ala Leu Phe Leu Gly Met Glu Asp Gly
305                 310                 315                 320

Phe Ala Gly Leu Arg Glu Tyr Glu Leu Arg Arg Asn Glu Ser Ile Lys
                325                 330                 335

Gln His Ala Phe Glu Pro Val Asp Arg Pro Tyr Val Val Ser Gly Arg
            340                 345                 350

Ala Leu Arg Ser Trp Thr Arg Val Arg Glu Glu Trp Leu Arg His Gly
        355                 360                 365

Asp Thr Gln Glu Ser Arg Lys Asn Ile Cys Asn Arg Leu Gln Asp Arg
    370                 375                 380

Leu Arg Gly Lys Phe Gly Asp Pro Asp Val Phe His Trp Leu Ala Glu
385                 390                 395                 400

Asp Gly Gln Glu Ala Leu Trp Lys Glu Arg Asp Cys Val Thr Ser Phe
                405                 410                 415

Ser Leu Leu Asn Asp Ala Asp Gly Leu Leu Glu Lys Arg Lys Gly Tyr
            420                 425                 430

Ala Leu Met Thr Phe Ala Asp Ala Arg Leu His Pro Arg Trp Ala Met
        435                 440                 445
```

```
Tyr Glu Ala Pro Gly Gly Ser Asn Leu Arg Thr Tyr Gln Ile Arg Lys
    450                 455                 460

Thr Glu Asn Gly Leu Trp Ala Asp Val Val Leu Leu Ser Pro Arg Asn
465                 470                 475                 480

Glu Ser Ala Ala Val Glu Glu Lys Thr Phe Asn Val Arg Leu Ala Pro
                485                 490                 495

Ser Gly Gln Leu Ser Asn Val Ser Phe Asp Gln Ile Gln Lys Gly Ser
            500                 505                 510

Lys Met Val Gly Arg Cys Arg Tyr Gln Ser Ala Asn Gln Gln Phe Glu
        515                 520                 525

Gly Leu Leu Gly Gly Ala Glu Ile Leu Phe Asp Arg Lys Arg Ile Ala
    530                 535                 540

Asn Glu Gln His Gly Ala Thr Asp Leu Ala Ser Lys Pro Gly His Val
545                 550                 555                 560

Trp Phe Lys Leu Thr Leu Asp Val Arg Pro Gln Ala Pro Gln Gly Trp
                565                 570                 575

Leu Asp Gly Lys Gly Arg Pro Ala Leu Pro Pro Glu Ala Lys His Phe
            580                 585                 590

Lys Thr Ala Leu Ser Asn Lys Ser Lys Phe Ala Asp Gln Val Arg Pro
        595                 600                 605

Gly Leu Arg Val Leu Ser Val Asp Leu Gly Val Arg Ser Phe Ala Ala
    610                 615                 620

Cys Ser Val Phe Glu Leu Val Arg Gly Gly Pro Asp Gln Gly Thr Tyr
625                 630                 635                 640
```

```
Phe Pro Ala Ala Asp Gly Arg Thr Val Asp Asp Pro Glu Lys Leu Trp
                645                 650                 655

Ala Lys His Glu Arg Ser Phe Lys Ile Thr Leu Pro Gly Glu Asn Pro
            660                 665                 670

Ser Arg Lys Glu Glu Ile Ala Arg Arg Ala Ala Met Glu Glu Leu Arg
        675                 680                 685

Ser Leu Asn Gly Asp Ile Arg Arg Leu Lys Ala Ile Leu Arg Leu Ser
    690                 695                 700

Val Leu Gln Glu Asp Asp Pro Arg Thr Glu His Leu Arg Leu Phe Met
705                 710                 715                 720

Glu Ala Ile Val Asp Asp Pro Ala Lys Ser Ala Leu Asn Ala Glu Leu
                725                 730                 735

Phe Lys Gly Phe Gly Asp Asp Arg Phe Arg Ser Thr Pro Asp Leu Trp
            740                 745                 750

Lys Gln His Cys His Phe Phe His Asp Lys Ala Glu Lys Val Val Ala
        755                 760                 765

Glu Arg Phe Ser Arg Trp Arg Thr Glu Thr Arg Pro Lys Ser Ser Ser
    770                 775                 780

Trp Gln Asp Trp Arg Glu Arg Arg Gly Tyr Ala Gly Gly Lys Ser Tyr
785                 790                 795                 800

Trp Ala Val Thr Tyr Leu Glu Ala Val Arg Gly Leu Ile Leu Arg Trp
                805                 810                 815

Asn Met Arg Gly Arg Thr Tyr Gly Glu Val Asn Arg Gln Asp Lys Lys
            820                 825                 830

Gln Phe Gly Thr Val Ala Ser Ala Leu Leu His His Ile Asn Gln Leu
        835                 840                 845
```

```
Lys Glu Asp Arg Ile Lys Thr Gly Ala Asp Met Ile Ile Gln Ala Ala
    850                 855                 860

Arg Gly Phe Val Pro Arg Lys Asn Gly Ala Gly Trp Val Gln Val His
865                 870                 875                 880

Glu Pro Cys Arg Leu Ile Leu Phe Glu Asp Leu Ala Arg Tyr Arg Phe
                885                 890                 895

Arg Thr Asp Arg Ser Arg Arg Glu Asn Ser Arg Leu Met Arg Trp Ser
            900                 905                 910

His Arg Glu Ile Val Asn Glu Val Gly Met Gln Gly Glu Leu Tyr Gly
        915                 920                 925

Leu His Val Asp Thr Thr Glu Ala Gly Phe Ser Ser Arg Tyr Leu Ala
    930                 935                 940

Ser Ser Gly Ala Pro Gly Val Arg Cys Arg His Leu Val Glu Glu Asp
945                 950                 955                 960

Phe His Asp Gly Leu Pro Gly Met His Leu Val Gly Glu Leu Asp Trp
                965                 970                 975

Leu Leu Pro Lys Asp Lys Asp Arg Thr Ala Asn Glu Ala Arg Arg Leu
            980                 985                 990

Leu Gly Gly Met Val Arg Pro Gly  Met Leu Val Pro Trp  Asp Gly Gly
        995                 1000                1005

Glu Leu  Phe Ala Thr Leu Asn  Ala Ala Ser Gln Leu  His Val Ile
    1010                1015                1020

His Ala  Asp Ile Asn Ala Ala  Gln Asn Leu Gln Arg  Arg Phe Trp
    1025                1030                1035
```

```
Gly Arg  Cys Gly Glu Ala Ile  Arg Ile Val Cys Asn  Gln Leu Ser
    1040                1045                1050

Val Asp  Gly Ser Thr Arg Tyr  Glu Met Ala Lys Ala  Pro Lys Ala
    1055                1060                1065

Arg Leu  Leu Gly Ala Leu Gln  Gln Leu Lys Asn Gly  Asp Ala Pro
    1070                1075                1080

Phe His  Leu Thr Ser Ile Pro  Asn Ser Gln Lys Pro  Glu Asn Ser
    1085                1090                1095

Tyr Val  Met Thr Pro Thr Asn  Ala Gly Lys Lys Tyr  Arg Ala Gly
    1100                1105                1110

Pro Gly  Glu Lys Ser Ser Gly  Glu Glu Asp Glu Leu  Ala Leu Asp
    1115                1120                1125

Ile Val  Glu Gln Ala Glu Glu  Leu Ala Gln Gly Arg  Lys Thr Phe
    1130                1135                1140

Phe Arg  Asp Pro Ser Gly Val  Phe Phe Ala Pro Asp  Arg Trp Leu
    1145                1150                1155

Pro Ser  Glu Ile Tyr Trp Ser  Arg Ile Arg Arg Arg  Ile Trp Gln
    1160                1165                1170

Val Thr  Leu Glu Arg Asn Ser  Ser Gly Arg Gln Glu  Arg Ala Glu
    1175                1180                1185

Met Asp  Glu Met Pro Tyr
    1190
```

<210> 826
<211> 1132
<212> PRT
<213> Tuberibacillus calidus

<400> 826

```
Met Ala Thr Lys Ser Phe Ile Leu Lys Met Lys Thr Lys Asn Asn Pro
1               5                  10                  15

Gln Leu Arg Leu Ser Leu Trp Lys Thr His Glu Leu Phe Asn Phe Gly
            20                  25                  30

Val Ala Tyr Tyr Met Asp Leu Leu Ser Leu Phe Arg Gln Lys Asp Leu
        35                  40                  45

Tyr Met His Asn Asp Glu Asp Pro Asp His Pro Val Val Leu Lys Lys
    50                  55                  60

Glu Glu Ile Gln Glu Arg Leu Trp Met Lys Val Arg Glu Thr Gln Gln
65                  70                  75                  80

Lys Asn Gly Phe His Gly Glu Val Ser Lys Asp Glu Val Leu Glu Thr
                85                  90                  95

Leu Arg Ala Leu Tyr Glu Glu Leu Val Pro Ser Ala Val Gly Lys Ser
            100                 105                 110

Gly Glu Ala Asn Gln Ile Ser Asn Lys Tyr Leu Tyr Pro Leu Thr Asp
        115                 120                 125

Pro Ala Ser Gln Ser Gly Lys Gly Thr Ala Asn Ser Gly Arg Lys Pro
    130                 135                 140

Arg Trp Lys Lys Leu Lys Glu Ala Gly Asp Pro Ser Trp Lys Asp Ala
145                 150                 155                 160

Tyr Glu Lys Trp Glu Lys Glu Arg Gln Glu Asp Pro Lys Leu Lys Ile
                165                 170                 175

Leu Ala Ala Leu Gln Ser Phe Gly Leu Ile Pro Leu Phe Arg Pro Phe
            180                 185                 190

Thr Glu Asn Asp His Lys Ala Val Ile Ser Val Lys Trp Met Pro Lys
```

```
        195                 200                 205

Ser Lys Asn Gln Ser Val Arg Lys Phe Asp Lys Asp Met Phe Asn Gln
    210                 215                 220

Ala Ile Glu Arg Phe Leu Ser Trp Glu Ser Trp Asn Glu Lys Val Ala
225                 230                 235                 240

Glu Asp Tyr Glu Lys Thr Val Ser Ile Tyr Glu Ser Leu Gln Lys Glu
                245                 250                 255

Leu Lys Gly Ile Ser Thr Lys Ala Phe Glu Ile Met Glu Arg Val Glu
            260                 265                 270

Lys Ala Tyr Glu Ala His Leu Arg Glu Ile Thr Phe Ser Asn Ser Thr
        275                 280                 285

Tyr Arg Ile Gly Asn Arg Ala Ile Arg Gly Trp Thr Glu Ile Val Lys
    290                 295                 300

Lys Trp Met Lys Leu Asp Pro Ser Ala Pro Gln Gly Asn Tyr Leu Asp
305                 310                 315                 320

Val Val Lys Asp Tyr Gln Arg Arg His Pro Arg Glu Ser Gly Asp Phe
                325                 330                 335

Lys Leu Phe Glu Leu Leu Ser Arg Pro Glu Asn Gln Ala Ala Trp Arg
            340                 345                 350

Glu Tyr Pro Glu Phe Leu Pro Leu Tyr Val Lys Tyr Arg His Ala Glu
        355                 360                 365

Gln Arg Met Lys Thr Ala Lys Lys Gln Ala Thr Phe Thr Leu Cys Asp
    370                 375                 380

Pro Ile Arg His Pro Leu Trp Val Arg Tyr Glu Glu Arg Ser Gly Thr
385                 390                 395                 400
```

```
Asn Leu Asn Lys Tyr Arg Leu Ile Met Asn Glu Lys Glu Lys Val Val
               405                 410                 415

Gln Phe Asp Arg Leu Ile Cys Leu Asn Ala Asp Gly His Tyr Glu Glu
            420                 425                 430

Gln Glu Asp Val Thr Val Pro Leu Ala Pro Ser Gln Gln Phe Asp Asp
        435                 440                 445

Gln Ile Lys Phe Ser Ser Glu Asp Thr Gly Lys Gly Lys His Asn Phe
    450                 455                 460

Ser Tyr Tyr His Lys Gly Ile Asn Tyr Glu Leu Lys Gly Thr Leu Gly
465                 470                 475                 480

Gly Ala Arg Ile Gln Phe Asp Arg Glu His Leu Leu Arg Arg Gln Gly
               485                 490                 495

Val Lys Ala Gly Asn Val Gly Arg Ile Phe Leu Asn Val Thr Leu Asn
            500                 505                 510

Ile Glu Pro Met Gln Pro Phe Ser Arg Ser Gly Asn Leu Gln Thr Ser
        515                 520                 525

Val Gly Lys Ala Leu Lys Val Tyr Val Asp Gly Tyr Pro Lys Val Val
    530                 535                 540

Asn Phe Lys Pro Lys Glu Leu Thr Glu His Ile Lys Glu Ser Glu Lys
545                 550                 555                 560

Asn Thr Leu Thr Leu Gly Val Glu Ser Leu Pro Thr Gly Leu Arg Val
               565                 570                 575

Met Ser Val Asp Leu Gly Gln Arg Gln Ala Ala Ala Ile Ser Ile Phe
            580                 585                 590

Glu Val Val Ser Glu Lys Pro Asp Asp Asn Lys Leu Phe Tyr Pro Val
```

```
        595                 600                 605

Lys Asp Thr Asp Leu Phe Ala Val His Arg Thr Ser Phe Asn Ile Lys
    610                 615                 620

Leu Pro Gly Glu Lys Arg Thr Glu Arg Arg Met Leu Glu Gln Gln Lys
625                 630                 635                 640

Arg Asp Gln Ala Ile Arg Asp Leu Ser Arg Lys Leu Lys Phe Leu Lys
                645                 650                 655

Asn Val Leu Asn Met Gln Lys Leu Glu Lys Thr Asp Glu Arg Glu Lys
            660                 665                 670

Arg Val Asn Arg Trp Ile Lys Asp Arg Glu Arg Glu Glu Glu Asn Pro
        675                 680                 685

Val Tyr Val Gln Glu Phe Glu Met Ile Ser Lys Val Leu Tyr Ser Pro
    690                 695                 700

His Ser Val Trp Val Asp Gln Leu Lys Ser Ile His Arg Lys Leu Glu
705                 710                 715                 720

Glu Gln Leu Gly Lys Glu Ile Ser Lys Trp Arg Gln Ser Ile Ser Gln
                725                 730                 735

Gly Arg Gln Gly Val Tyr Gly Ile Ser Leu Lys Asn Ile Glu Asp Ile
            740                 745                 750

Glu Lys Thr Arg Arg Leu Leu Phe Arg Trp Ser Met Arg Pro Glu Asn
        755                 760                 765

Pro Gly Glu Val Lys Gln Leu Gln Pro Gly Glu Arg Phe Ala Ile Asp
    770                 775                 780

Gln Gln Asn His Leu Asn His Leu Lys Asp Asp Arg Ile Lys Lys Leu
785                 790                 795                 800
```

```
Ala Asn Gln Ile Val Met Thr Ala Leu Gly Tyr Arg Tyr Asp Gly Lys
                805                 810                 815

Arg Lys Lys Trp Ile Ala Lys His Pro Ala Cys Gln Leu Val Leu Phe
            820                 825                 830

Glu Asp Leu Ser Arg Tyr Ala Phe Tyr Asp Glu Arg Ser Arg Leu Glu
        835                 840                 845

Asn Arg Asn Leu Met Arg Trp Ser Arg Arg Glu Ile Pro Lys Gln Val
    850                 855                 860

Ala Gln Ile Gly Gly Leu Tyr Gly Leu Leu Val Gly Glu Val Gly Ala
865                 870                 875                 880

Gln Tyr Ser Ser Arg Phe His Ala Lys Ser Gly Ala Pro Gly Ile Arg
                885                 890                 895

Cys Arg Val Val Lys Glu His Glu Leu Tyr Ile Thr Glu Gly Gly Gln
            900                 905                 910

Lys Val Arg Asn Gln Lys Phe Leu Asp Ser Leu Val Glu Asn Asn Ile
        915                 920                 925

Ile Glu Pro Asp Asp Ala Arg Arg Leu Glu Pro Gly Asp Leu Ile Arg
    930                 935                 940

Asp Gln Gly Gly Asp Lys Phe Ala Thr Leu Asp Glu Arg Gly Glu Leu
945                 950                 955                 960

Val Ile Thr His Ala Asp Ile Asn Ala Ala Gln Asn Leu Gln Lys Arg
                965                 970                 975

Phe Trp Thr Arg Thr His Gly Leu Tyr Arg Ile Arg Cys Glu Ser Arg
            980                 985                 990

Glu Ile Lys Asp Ala Val Val Leu  Val Pro Ser Asp Lys  Asp Gln Lys
```

995 1000 1005

Glu Lys Met Glu Asn Leu Phe Gly Ile Gly Tyr Leu Gln Pro Phe
1010 1015 1020

Lys Gln Glu Asn Asp Val Tyr Lys Trp Val Lys Gly Glu Lys Ile
1025 1030 1035

Lys Gly Lys Lys Thr Ser Ser Gln Ser Asp Asp Lys Glu Leu Val
1040 1045 1050

Ser Glu Ile Leu Gln Glu Ala Ser Val Met Ala Asp Glu Leu Lys
1055 1060 1065

Gly Asn Arg Lys Thr Leu Phe Arg Asp Pro Ser Gly Tyr Val Phe
1070 1075 1080

Pro Lys Asp Arg Trp Tyr Thr Gly Gly Arg Tyr Phe Gly Thr Leu
1085 1090 1095

Glu His Leu Leu Lys Arg Lys Leu Ala Glu Arg Arg Leu Phe Asp
1100 1105 1110

Gly Gly Ser Ser Arg Arg Gly Leu Phe Asn Gly Thr Asp Ser Asn
1115 1120 1125

Thr Asn Val Glu
1130

<210> 827
<211> 1108
<212> PRT
<213> Bacillus thermoamylovorans

<400> 827

Met Ala Thr Arg Ser Phe Ile Leu Lys Ile Glu Pro Asn Glu Glu Val
1 5 10 15

```
Lys Lys Gly Leu Trp Lys Thr His Glu Val Leu Asn His Gly Ile Ala
            20                  25                  30

Tyr Tyr Met Asn Ile Leu Lys Leu Ile Arg Gln Glu Ala Ile Tyr Glu
        35                  40                  45

His His Glu Gln Asp Pro Lys Asn Pro Lys Lys Val Ser Lys Ala Glu
    50                  55                  60

Ile Gln Ala Glu Leu Trp Asp Phe Val Leu Lys Met Gln Lys Cys Asn
65                  70                  75                  80

Ser Phe Thr His Glu Val Asp Lys Asp Val Val Phe Asn Ile Leu Arg
                85                  90                  95

Glu Leu Tyr Glu Glu Leu Val Pro Ser Ser Val Glu Lys Lys Gly Glu
            100                 105                 110

Ala Asn Gln Leu Ser Asn Lys Phe Leu Tyr Pro Leu Val Asp Pro Asn
        115                 120                 125

Ser Gln Ser Gly Lys Gly Thr Ala Ser Ser Gly Arg Lys Pro Arg Trp
    130                 135                 140

Tyr Asn Leu Lys Ile Ala Gly Asp Pro Ser Trp Glu Glu Glu Lys Lys
145                 150                 155                 160

Lys Trp Glu Glu Asp Lys Lys Lys Asp Pro Leu Ala Lys Ile Leu Gly
                165                 170                 175

Lys Leu Ala Glu Tyr Gly Leu Ile Pro Leu Phe Ile Pro Phe Thr Asp
            180                 185                 190

Ser Asn Glu Pro Ile Val Lys Glu Ile Lys Trp Met Glu Lys Ser Arg
        195                 200                 205

Asn Gln Ser Val Arg Arg Leu Asp Lys Asp Met Phe Ile Gln Ala Leu
    210                 215                 220
```

```
Glu Arg Phe Leu Ser Trp Glu Ser Trp Asn Leu Lys Val Lys Glu Glu
225                 230                 235                 240

Tyr Glu Lys Val Glu Lys Glu His Lys Thr Leu Glu Glu Arg Ile Lys
                245                 250                 255

Glu Asp Ile Gln Ala Phe Lys Ser Leu Glu Gln Tyr Glu Lys Glu Arg
            260                 265                 270

Gln Glu Gln Leu Leu Arg Asp Thr Leu Asn Thr Asn Glu Tyr Arg Leu
        275                 280                 285

Ser Lys Arg Gly Leu Arg Gly Trp Arg Glu Ile Ile Gln Lys Trp Leu
    290                 295                 300

Lys Met Asp Glu Asn Glu Pro Ser Glu Lys Tyr Leu Glu Val Phe Lys
305                 310                 315                 320

Asp Tyr Gln Arg Lys His Pro Arg Glu Ala Gly Asp Tyr Ser Val Tyr
                325                 330                 335

Glu Phe Leu Ser Lys Lys Glu Asn His Phe Ile Trp Arg Asn His Pro
            340                 345                 350

Glu Tyr Pro Tyr Leu Tyr Ala Thr Phe Cys Glu Ile Asp Lys Lys Lys
        355                 360                 365

Lys Asp Ala Lys Gln Gln Ala Thr Phe Thr Leu Ala Asp Pro Ile Asn
    370                 375                 380

His Pro Leu Trp Val Arg Phe Glu Glu Arg Ser Gly Ser Asn Leu Asn
385                 390                 395                 400

Lys Tyr Arg Ile Leu Thr Glu Gln Leu His Thr Glu Lys Leu Lys Lys
                405                 410                 415
```

```
Lys Leu Thr Val Gln Leu Asp Arg Leu Ile Tyr Pro Thr Glu Ser Gly
            420                 425                 430

Gly Trp Glu Glu Lys Gly Lys Val Asp Ile Val Leu Leu Pro Ser Arg
        435                 440                 445

Gln Phe Tyr Asn Gln Ile Phe Leu Asp Ile Glu Glu Lys Gly Lys His
    450                 455                 460

Ala Phe Thr Tyr Lys Asp Glu Ser Ile Lys Phe Pro Leu Lys Gly Thr
465                 470                 475                 480

Leu Gly Gly Ala Arg Val Gln Phe Asp Arg Asp His Leu Arg Arg Tyr
                485                 490                 495

Pro His Lys Val Glu Ser Gly Asn Val Gly Arg Ile Tyr Phe Asn Met
            500                 505                 510

Thr Val Asn Ile Glu Pro Thr Glu Ser Pro Val Ser Lys Ser Leu Lys
        515                 520                 525

Ile His Arg Asp Asp Phe Pro Lys Phe Val Asn Phe Lys Pro Lys Glu
    530                 535                 540

Leu Thr Glu Trp Ile Lys Asp Ser Lys Gly Lys Lys Leu Lys Ser Gly
545                 550                 555                 560

Ile Glu Ser Leu Glu Ile Gly Leu Arg Val Met Ser Ile Asp Leu Gly
                565                 570                 575

Gln Arg Gln Ala Ala Ala Ala Ser Ile Phe Glu Val Val Asp Gln Lys
            580                 585                 590

Pro Asp Ile Glu Gly Lys Leu Phe Phe Pro Ile Lys Gly Thr Glu Leu
        595                 600                 605

Tyr Ala Val His Arg Ala Ser Phe Asn Ile Lys Leu Pro Gly Glu Thr
    610                 615                 620
```

```
Leu Val Lys Ser Arg Glu Val Leu Arg Lys Ala Arg Glu Asp Asn Leu
625                 630                 635                 640

Lys Leu Met Asn Gln Lys Leu Asn Phe Leu Arg Asn Val Leu His Phe
                645                 650                 655

Gln Gln Phe Glu Asp Ile Thr Glu Arg Glu Lys Arg Val Thr Lys Trp
            660                 665                 670

Ile Ser Arg Gln Glu Asn Ser Asp Val Pro Leu Val Tyr Gln Asp Glu
        675                 680                 685

Leu Ile Gln Ile Arg Glu Leu Met Tyr Lys Pro Tyr Lys Asp Trp Val
    690                 695                 700

Ala Phe Leu Lys Gln Leu His Lys Arg Leu Glu Val Glu Ile Gly Lys
705                 710                 715                 720

Glu Val Lys His Trp Arg Lys Ser Leu Ser Asp Gly Arg Lys Gly Leu
                725                 730                 735

Tyr Gly Ile Ser Leu Lys Asn Ile Asp Glu Ile Asp Arg Thr Arg Lys
            740                 745                 750

Phe Leu Leu Arg Trp Ser Leu Arg Pro Thr Glu Pro Gly Glu Val Arg
        755                 760                 765

Arg Leu Glu Pro Gly Gln Arg Phe Ala Ile Asp Gln Leu Asn His Leu
    770                 775                 780

Asn Ala Leu Lys Glu Asp Arg Leu Lys Lys Met Ala Asn Thr Ile Ile
785                 790                 795                 800

Met His Ala Leu Gly Tyr Cys Tyr Asp Val Arg Lys Lys Lys Trp Gln
                805                 810                 815
```

```
Ala Lys Asn Pro Ala Cys Gln Ile Ile Leu Phe Glu Asp Leu Ser Asn
            820                 825                 830

Tyr Asn Pro Tyr Glu Glu Arg Ser Arg Phe Glu Asn Ser Lys Leu Met
        835                 840                 845

Lys Trp Ser Arg Arg Glu Ile Pro Arg Gln Val Ala Leu Gln Gly Glu
    850                 855                 860

Ile Tyr Gly Leu Gln Val Gly Glu Val Gly Ala Gln Phe Ser Ser Arg
865                 870                 875                 880

Phe His Ala Lys Thr Gly Ser Pro Gly Ile Arg Cys Ser Val Val Thr
                885                 890                 895

Lys Glu Lys Leu Gln Asp Asn Arg Phe Phe Lys Asn Leu Gln Arg Glu
            900                 905                 910

Gly Arg Leu Thr Leu Asp Lys Ile Ala Val Leu Lys Glu Gly Asp Leu
        915                 920                 925

Tyr Pro Asp Lys Gly Gly Glu Lys Phe Ile Ser Leu Ser Lys Asp Arg
    930                 935                 940

Lys Leu Val Thr Thr His Ala Asp Ile Asn Ala Ala Gln Asn Leu Gln
945                 950                 955                 960

Lys Arg Phe Trp Thr Arg Thr His Gly Phe Tyr Lys Val Tyr Cys Lys
                965                 970                 975

Ala Tyr Gln Val Asp Gly Gln Thr Val Tyr Ile Pro Glu Ser Lys Asp
            980                 985                 990

Gln Lys Gln Lys Ile Ile Glu Glu  Phe Gly Glu Gly Tyr  Phe Ile Leu
        995                 1000                1005

Lys Asp  Gly Val Tyr Glu Trp  Gly Asn Ala Gly Lys  Leu Lys Ile
    1010                1015                1020
```

```
Lys Lys  Gly Ser Ser Lys Gln  Ser Ser Ser Glu Leu  Val Asp Ser
    1025                1030                1035


Asp Ile  Leu Lys Asp Ser Phe  Asp Leu Ala Ser Glu  Leu Lys Gly
    1040                1045                1050


Glu Lys  Leu Met Leu Tyr Arg  Asp Pro Ser Gly Asn  Val Phe Pro
    1055                1060                1065


Ser Asp  Lys Trp Met Ala Ala  Gly Val Phe Phe Gly  Lys Leu Glu
    1070                1075                1080


Arg Ile  Leu Ile Ser Lys Leu  Thr Asn Gln Tyr Ser  Ile Ser Thr
    1085                1090                1095


Ile Glu  Asp Asp Ser Ser Lys  Gln Ser Met
    1100                1105
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<210> 828
<211> 1108
<212> PRT
<213> unknown

<220>
<223> Synthetic Sequence

<400> 828

```
Met Ala Ile Arg Ser Ile Lys Leu Lys Leu Lys Thr His Thr Gly Pro
1               5                   10                  15


Glu Ala Gln Asn Leu Arg Lys Gly Ile Trp Arg Thr His Arg Leu Leu
            20                  25                  30


Asn Glu Gly Val Ala Tyr Tyr Met Lys Met Leu Leu Leu Phe Arg Gln
        35                  40                  45


Glu Ser Thr Gly Glu Arg Pro Lys Glu Glu Leu Gln Glu Glu Leu Ile
    50                  55                  60
```

```
Cys His Ile Arg Glu Gln Gln Gln Arg Asn Gln Ala Asp Lys Asn Thr
65                  70                  75                  80

Gln Ala Leu Pro Leu Asp Lys Ala Leu Glu Ala Leu Arg Gln Leu Tyr
                85                  90                  95

Glu Leu Leu Val Pro Ser Ser Val Gly Gln Ser Gly Asp Ala Gln Ile
            100                 105                 110

Ile Ser Arg Lys Phe Leu Ser Pro Leu Val Asp Pro Asn Ser Glu Gly
        115                 120                 125

Gly Lys Gly Thr Ser Lys Ala Gly Ala Lys Pro Thr Trp Gln Lys Lys
    130                 135                 140

Lys Glu Ala Asn Asp Pro Thr Trp Glu Gln Asp Tyr Glu Lys Trp Lys
145                 150                 155                 160

Lys Arg Arg Glu Glu Asp Pro Thr Ala Ser Val Ile Thr Thr Leu Glu
                165                 170                 175

Glu Tyr Gly Ile Arg Pro Ile Phe Pro Leu Tyr Thr Asn Thr Val Thr
            180                 185                 190

Asp Ile Ala Trp Leu Pro Leu Gln Ser Asn Gln Phe Val Arg Thr Trp
        195                 200                 205

Asp Arg Asp Met Leu Gln Gln Ala Ile Glu Arg Leu Leu Ser Trp Glu
    210                 215                 220

Ser Trp Asn Lys Arg Val Gln Glu Glu Tyr Ala Lys Leu Lys Glu Lys
225                 230                 235                 240

Met Ala Gln Leu Asn Glu Gln Leu Glu Gly Gly Gln Glu Trp Ile Ser
                245                 250                 255
```

```
Leu Leu Glu Gln Tyr Glu Glu Asn Arg Glu Arg Glu Leu Arg Glu Asn
            260                 265                 270

Met Thr Ala Ala Asn Asp Lys Tyr Arg Ile Thr Lys Arg Gln Met Lys
        275                 280                 285

Gly Trp Asn Glu Leu Tyr Glu Leu Trp Ser Thr Phe Pro Ala Ser Ala
    290                 295                 300

Ser His Glu Gln Tyr Lys Glu Ala Leu Lys Arg Val Gln Gln Arg Leu
305                 310                 315                 320

Arg Gly Arg Phe Gly Asp Ala His Phe Phe Gln Tyr Leu Met Glu Glu
                325                 330                 335

Lys Asn Arg Leu Ile Trp Lys Gly Asn Pro Gln Arg Ile His Tyr Phe
            340                 345                 350

Val Ala Arg Asn Glu Leu Thr Lys Arg Leu Glu Glu Ala Lys Gln Ser
        355                 360                 365

Ala Thr Met Thr Leu Pro Asn Ala Arg Lys His Pro Leu Trp Val Arg
    370                 375                 380

Phe Asp Ala Arg Gly Gly Asn Leu Gln Asp Tyr Tyr Leu Thr Ala Glu
385                 390                 395                 400

Ala Asp Lys Pro Arg Ser Arg Arg Phe Val Thr Phe Ser Gln Leu Ile
                405                 410                 415

Trp Pro Ser Glu Ser Gly Trp Met Glu Lys Lys Asp Val Glu Val Glu
            420                 425                 430

Leu Ala Leu Ser Arg Gln Phe Tyr Gln Gln Val Lys Leu Leu Lys Asn
        435                 440                 445

Asp Lys Gly Lys Gln Lys Ile Glu Phe Lys Asp Lys Gly Ser Gly Ser
    450                 455                 460
```

```
Thr Phe Asn Gly His Leu Gly Gly Ala Lys Leu Gln Leu Glu Arg Gly
465                 470                 475                 480

Asp Leu Glu Lys Glu Glu Lys Asn Phe Glu Asp Gly Glu Ile Gly Ser
                485                 490                 495

Val Tyr Leu Asn Val Val Ile Asp Phe Glu Pro Leu Gln Glu Val Lys
            500                 505                 510

Asn Gly Arg Val Gln Ala Pro Tyr Gly Gln Val Leu Gln Leu Ile Arg
        515                 520                 525

Arg Pro Asn Glu Phe Pro Lys Val Thr Thr Tyr Lys Ser Glu Gln Leu
    530                 535                 540

Val Glu Trp Ile Lys Ala Ser Pro Gln His Ser Ala Gly Val Glu Ser
545                 550                 555                 560

Leu Ala Ser Gly Phe Arg Val Met Ser Ile Asp Leu Gly Leu Arg Ala
                565                 570                 575

Ala Ala Ala Thr Ser Ile Phe Ser Val Glu Glu Ser Ser Asp Lys Asn
            580                 585                 590

Ala Ala Asp Phe Ser Tyr Trp Ile Glu Gly Thr Pro Leu Val Ala Val
        595                 600                 605

His Gln Arg Ser Tyr Met Leu Arg Leu Pro Gly Glu Gln Val Glu Lys
    610                 615                 620

Gln Val Met Glu Lys Arg Asp Glu Arg Phe Gln Leu His Gln Arg Val
625                 630                 635                 640

Lys Phe Gln Ile Arg Val Leu Ala Gln Ile Met Arg Met Ala Asn Lys
                645                 650                 655
```

```
Gln Tyr Gly Asp Arg Trp Asp Glu Leu Asp Ser Leu Lys Gln Ala Val
            660                 665                 670

Glu Gln Lys Lys Ser Pro Leu Asp Gln Thr Asp Arg Thr Phe Trp Glu
        675                 680                 685

Gly Ile Val Cys Asp Leu Thr Lys Val Leu Pro Arg Asn Glu Ala Asp
    690                 695                 700

Trp Glu Gln Ala Val Val Gln Ile His Arg Lys Ala Glu Glu Tyr Val
705                 710                 715                 720

Gly Lys Ala Val Gln Ala Trp Arg Lys Arg Phe Ala Ala Asp Glu Arg
                725                 730                 735

Lys Gly Ile Ala Gly Leu Ser Met Trp Asn Ile Glu Glu Leu Glu Gly
            740                 745                 750

Leu Arg Lys Leu Leu Ile Ser Trp Ser Arg Arg Thr Arg Asn Pro Gln
        755                 760                 765

Glu Val Asn Arg Phe Glu Arg Gly His Thr Ser His Gln Arg Leu Leu
    770                 775                 780

Thr His Ile Gln Asn Val Lys Glu Asp Arg Leu Lys Gln Leu Ser His
785                 790                 795                 800

Ala Ile Val Met Thr Ala Leu Gly Tyr Val Tyr Asp Glu Arg Lys Gln
                805                 810                 815

Glu Trp Cys Ala Glu Tyr Pro Ala Cys Gln Val Ile Leu Phe Glu Asn
            820                 825                 830

Leu Ser Gln Tyr Arg Ser Asn Leu Asp Arg Ser Thr Lys Glu Asn Ser
        835                 840                 845

Thr Leu Met Lys Trp Ala His Arg Ser Ile Pro Lys Tyr Val His Met
    850                 855                 860
```

```
Gln Ala Glu Pro Tyr Gly Ile Gln Ile Gly Asp Val Arg Ala Glu Tyr
865                 870                 875                 880

Ser Ser Arg Phe Tyr Ala Lys Thr Gly Thr Pro Gly Ile Arg Cys Lys
                885                 890                 895

Lys Val Arg Gly Gln Asp Leu Gln Gly Arg Arg Phe Glu Asn Leu Gln
            900                 905                 910

Lys Arg Leu Val Asn Glu Gln Phe Leu Thr Glu Glu Gln Val Lys Gln
        915                 920                 925

Leu Arg Pro Gly Asp Ile Val Pro Asp Asp Ser Gly Glu Leu Phe Met
    930                 935                 940

Thr Leu Thr Asp Gly Ser Gly Ser Lys Glu Val Val Phe Leu Gln Ala
945                 950                 955                 960

Asp Ile Asn Ala Ala His Asn Leu Gln Lys Arg Phe Trp Gln Arg Tyr
                965                 970                 975

Asn Glu Leu Phe Lys Val Ser Cys Arg Val Ile Val Arg Asp Glu Glu
            980                 985                 990

Glu Tyr Leu Val Pro Lys Thr Lys  Ser Val Gln Ala Lys  Leu Gly Lys
        995                 1000                1005

Gly Leu  Phe Val Lys Lys Ser  Asp Thr Ala Trp Lys  Asp Val Tyr
    1010                1015                1020

Val Trp  Asp Ser Gln Ala Lys  Leu Lys Gly Lys Thr  Thr Phe Thr
    1025                1030                1035

Glu Glu  Ser Glu Ser Pro Glu  Gln Leu Glu Asp Phe  Gln Glu Ile
    1040                1045                1050
```

```
Ile Glu  Glu Ala Glu Glu Ala  Lys Gly Thr Tyr Arg  Thr Leu Phe
    1055                1060                1065


Arg Asp  Pro Ser Gly Val Phe  Phe Pro Glu Ser Val  Trp Tyr Pro
    1070                1075                1080


Gln Lys  Asp Phe Trp Gly Glu  Val Lys Arg Lys Leu  Tyr Gly Lys
    1085                1090                1095


Leu Arg  Glu Arg Phe Leu Thr  Lys Ala Arg
    1100                1105
```

<210> 829
<211> 658
<212> PRT
<213> Methylobacterium nodulans

<400> 829

```
Met Leu Thr Lys Gln Asp Lys Gln Gln Lys Ile Thr Tyr Cys Thr Asn
1               5                   10                  15


Met Asn Glu Val Phe Glu Ala Lys Leu Gly Ser Ala Asp Leu Leu Leu
            20                  25                  30


Asn Trp Asp His Leu Arg Gly Arg Ile Arg Asp Arg Val Asp Ala Gly
        35                  40                  45


Asp Ile Gly Ser Ala Phe Leu Lys Leu Ala Leu Asp Val Ala His Val
    50                  55                  60


Leu Pro Asp Gly Val Asp Asp Gln Leu Ala Arg Ala Ala Phe His Phe
65                  70                  75                  80


Gln Ser Ala Lys Gly Ala Lys Ser Lys His Ala Asp Ser Val Gln Ala
                85                  90                  95


Gly Leu Arg Val Leu Ser Ile Asp Leu Gly Val Arg Ser Phe Ala Thr
            100                 105                 110
```

```
Cys Ser Val Phe Glu Leu Lys Asp Thr Ala Pro Thr Thr Gly Val Ala
        115                 120                 125

Phe Pro Leu Ala Glu Phe Arg Leu Trp Ala Val His Glu Arg Ser Phe
    130                 135                 140

Thr Leu Glu Leu Pro Gly Glu Asn Val Gly Ala Ala Gly Gln Gln Trp
145                 150                 155                 160

Arg Ala Gln Ala Asp Ala Glu Leu Arg Gln Leu Arg Gly Gly Leu Asn
                165                 170                 175

Arg His Arg Gln Leu Leu Arg Ala Ala Thr Val Gln Lys Gly Glu Arg
            180                 185                 190

Asp Ala Tyr Leu Thr Asp Leu Arg Glu Ala Trp Ser Ala Lys Glu Leu
        195                 200                 205

Trp Pro Phe Glu Ala Ser Leu Leu Ser Glu Leu Glu Arg Cys Ser Thr
    210                 215                 220

Val Ala Asp Pro Leu Trp Gln Asp Thr Cys Lys Arg Ala Ala Arg Leu
225                 230                 235                 240

Tyr Arg Thr Glu Phe Gly Ala Val Val Ser Glu Trp Arg Ser Arg Thr
                245                 250                 255

Arg Ser Arg Glu Asp Arg Lys Tyr Ala Gly Lys Ser Met Trp Ser Val
            260                 265                 270

Gln His Leu Thr Asp Val Arg Arg Phe Leu Gln Ser Trp Ser Leu Ala
        275                 280                 285

Gly Arg Ala Ser Gly Asp Ile Arg Arg Leu Asp Arg Glu Arg Gly Gly
    290                 295                 300

Val Phe Ala Lys Asp Leu Leu Asp His Ile Asp Ala Leu Lys Asp Asp
```

```
305                 310                 315                 320

Arg Leu Lys Thr Gly Ala Asp Leu Ile Val Gln Ala Ala Arg Gly Phe
                325                 330                 335

Gln Arg Asn Glu Phe Gly Tyr Trp Val Gln Lys His Ala Pro Cys His
            340                 345                 350

Val Ile Leu Phe Glu Asp Leu Ser Arg Tyr Arg Met Arg Thr Asp Arg
        355                 360                 365

Pro Arg Arg Glu Asn Ser Gln Leu Met Gln Trp Ala His Arg Gly Val
    370                 375                 380

Pro Asp Met Val Gly Met Gln Gly Glu Ile Tyr Gly Ile Gln Asp Arg
385                 390                 395                 400

Arg Asp Pro Asp Ser Ala Arg Lys His Ala Arg Gln Pro Leu Ala Ala
                405                 410                 415

Phe Cys Leu Asp Thr Pro Ala Ala Phe Ser Ser Arg Tyr His Ala Ser
            420                 425                 430

Thr Met Thr Pro Gly Ile Arg Cys His Pro Leu Arg Lys Arg Glu Phe
        435                 440                 445

Glu Asp Gln Gly Phe Leu Glu Leu Leu Lys Arg Glu Asn Glu Gly Leu
    450                 455                 460

Asp Leu Asn Gly Tyr Lys Pro Gly Asp Leu Val Pro Leu Pro Gly Gly
465                 470                 475                 480

Glu Val Phe Val Cys Leu Asn Ala Asn Gly Leu Ser Arg Ile His Ala
                485                 490                 495

Asp Ile Asn Ala Ala Gln Asn Leu Gln Arg Arg Phe Trp Thr Gln His
            500                 505                 510
```

```
Gly Asp Ala Phe Arg Leu Pro Cys Gly Lys Ser Ala Val Gln Gly Gln
        515                 520                 525

Ile Arg Trp Ala Pro Leu Ser Met Gly Lys Arg Gln Ala Gly Ala Leu
    530                 535                 540

Gly Gly Phe Gly Tyr Leu Glu Pro Thr Gly His Asp Ser Gly Ser Cys
545                 550                 555                 560

Gln Trp Arg Lys Thr Thr Glu Ala Glu Trp Arg Arg Leu Ser Gly Ala
                565                 570                 575

Gln Lys Asp Arg Asp Glu Ala Ala Ala Ala Glu Asp Glu Glu Leu Gln
            580                 585                 590

Gly Leu Glu Glu Glu Leu Leu Glu Arg Ser Gly Glu Arg Val Val Phe
        595                 600                 605

Phe Arg Asp Pro Ser Gly Val Val Leu Pro Thr Asp Leu Trp Phe Pro
    610                 615                 620

Ser Ala Ala Phe Trp Ser Ile Val Arg Ala Lys Thr Val Gly Arg Leu
625                 630                 635                 640

Arg Ser His Leu Asp Ala Gln Ala Glu Ala Ser Tyr Ala Val Ala Ala
                645                 650                 655

Gly Leu
```

<210> 830
<211> 1302
<212> PRT
<213> unknown

<220>
<223> Synthetic Sequence

<400> 830

```
Met Lys Lys Phe Glu Leu Lys Gln Asn Phe Arg Asn Asn Tyr Ser Gly
1               5                  10                  15

Lys Thr Leu Arg Asn Phe Arg Gln Thr Leu Ala Gln Ile Ala Asn Lys
            20                  25                  30

Lys Ser Ser Asp Ser Ile Leu Thr Ile Lys Phe Lys Leu Asp Cys Ser
        35                  40                  45

Lys Thr Gly Lys Leu Pro Lys Tyr Glu Asn Leu Ile Ser Leu Tyr Asp
    50                  55                  60

Thr Ile Glu Asp Ile Lys Lys Gly Thr Leu Ser Tyr Tyr Leu Phe Thr
65                  70                  75                  80

Leu Ile Val Ser Gly Phe Lys Phe Phe Gly Ser Ala Ser Gln Ala Lys
                85                  90                  95

Ala Phe Ser Thr Lys Asp Ile Phe Lys Asp Asn Asp Phe Tyr Asn Gln
            100                 105                 110

Phe Lys Ile Gln Ser His Leu Asp Leu Pro Asp Phe Val Pro Ser Lys
        115                 120                 125

Ile Tyr Gln Arg Leu Lys Lys Asn Val Arg Ser Thr Asn Gly Lys Asp
    130                 135                 140

Asn Ala Phe Lys Ala Ser Val Ile Val Ala Glu Tyr Arg Lys Glu Ile
145                 150                 155                 160

Gly Lys Leu Lys Asn Lys Asp Glu Ser Ser Glu His Gln Cys Glu Glu
                165                 170                 175

Leu Phe Lys Lys Ile Gly Thr Ala Leu Glu Thr Arg Phe Ser Ser Trp
            180                 185                 190

Gln Asp Leu Ile Asn Asn Cys Ser Thr Gly Cys Glu Ile Ile Asp Glu
```

```
        195                 200                 205

Ile Leu Asn Asp Ser Phe Gly Thr Leu Pro Ser Ile Lys Lys Met Val
    210                 215                 220

Leu Ala Ser Thr Thr Gln Ser Ser Asp Gly Glu Gln Asp Gly Ile Ala
225                 230                 235                 240

Ile Ala Tyr Asp Pro Asp Ser Thr Phe Ile Lys Ser Asp Glu Leu Leu
                245                 250                 255

Asn Pro Tyr Phe Ala Val Ala Thr Ile Leu Lys Ser Met Pro Pro Glu
            260                 265                 270

Ile Gln Gln Asp Lys Lys Ser Ala Tyr Val Lys Ala Asn Leu Thr Thr
        275                 280                 285

Pro Thr His Asn Ala Leu Ser Trp Ile Phe Gly Lys Gly Leu Thr Leu
    290                 295                 300

Phe Gln Thr Glu Ser Thr Glu Lys Leu Cys Ala Met Phe Asn Val Ser
305                 310                 315                 320

Asp Lys Arg Val Ile Glu Gln Val Gln Asp Ala Ala Lys Ala Val Lys
                325                 330                 335

Leu Pro Ala Glu Leu Asp Leu Asn His Cys Thr Leu Lys Phe Gln Asp
            340                 345                 350

Phe Arg Ser Ser Leu Gly Gly His Leu Asp Ser Trp Thr Thr Asn Tyr
        355                 360                 365

Leu Lys Arg Leu Asp Glu Leu Asn Asp Leu Leu Leu Asn Leu Pro Lys
    370                 375                 380

Asn Leu Ser Leu Pro Asp Ile Phe Met Ile Asp Gly Lys Asp Phe Ile
385                 390                 395                 400
```

```
Glu Tyr Ser Gly Cys Asn Arg Asp Glu Ile Gln Gln Met Ile Asp Phe
               405                 410                 415

Val Val Asn Glu Gln Asn Arg Ile Lys Leu Gln Glu Ser Leu Asn Ala
            420                 425                 430

Leu Leu Gly Lys Gly Asn Asn Gln Ile Cys Ser Asp Asp Ile Ser Thr
        435                 440                 445

Val Lys Asp Phe Ser Glu Ile Val Asn Ser Leu His Ser Phe Val Gln
    450                 455                 460

Gln Ile Asp Asn Ser Leu Glu Gln Ser Ser Asn Glu Ala Asn Ser Ile
465                 470                 475                 480

Phe Ser Glu Leu Lys Lys Lys Ile Glu Lys Asn Glu Lys Trp Asp Ile
               485                 490                 495

Trp Lys Asn Asn Leu Lys Lys Ile Pro Lys Leu Asn Lys Leu Ser Gly
            500                 505                 510

Gly Val Pro Asp Ala Trp Lys Glu Ile Arg Glu Ile Glu Gln Lys Phe
        515                 520                 525

His Glu Ile Ser Glu Asn Gln Lys Lys His Phe Thr Glu Val Met Glu
    530                 535                 540

Trp Ile Asp Ala Gly Asn Gly Thr Ile Asp Ile Phe Glu Ser Arg Phe
545                 550                 555                 560

Lys Tyr Asp Glu Leu Leu Lys Lys Ser Lys Lys Asn Asn Leu Gln Ser
               565                 570                 575

Ala Asp Glu Leu Ala Phe Arg Ser Val Leu Asn Lys Leu Gly Arg Phe
            580                 585                 590

Ala Arg Gln Gly Asn Asp Leu Val Cys Glu Lys Ile Lys Asn Trp Phe
```

```
        595                 600                 605

Lys Glu Gln Asn Ile Phe Asp Ser Ser Lys Asp Phe Asn Arg Tyr Phe
    610                 615                 620

Ile Asn Gln Lys Gly Phe Ile Phe Lys His Pro Ser Ser Lys Lys Asp
625                 630                 635                 640

Asn Ser Pro Tyr Asn Leu Ser Ala Asn Leu Leu Glu Lys Arg Tyr Glu
                645                 650                 655

Val Thr Asn Thr Val Gly Ala Leu Leu Glu Gln Cys Glu Ser Asp Pro
            660                 665                 670

Ala Ile Val Asn Asp Pro Phe Ser Met Arg Ser Leu Val Glu Phe Arg
        675                 680                 685

Ala Leu Trp Phe Ser Ile Asn Ile Ser Gly Ile Ser Lys Glu Gln His
    690                 695                 700

Ile Pro Thr Lys Ile Ala Gln Pro Lys Leu Asp Asp Ser Thr Tyr Gln
705                 710                 715                 720

Glu Ser Val Ser Pro Thr Leu Lys Tyr Arg Leu Glu Lys Glu Gln Ile
                725                 730                 735

Thr Ser Ser Glu Leu Asn Ser Ile Phe Thr Val Tyr Lys Ser Leu Leu
            740                 745                 750

Ser Gly Leu Ser Ile Arg Leu Ser Arg Asn Ser Phe Tyr Leu Arg Thr
        755                 760                 765

Lys Phe Ser Trp Ile Gly Asn Asn Ser Leu Ile Tyr Cys Pro Lys Glu
    770                 775                 780

Thr Thr Trp Lys Ile Pro Ala Ala Tyr Phe Lys Ser Asp Leu Trp Asn
785                 790                 795                 800
```

```
Glu Tyr Lys Asp Lys Gln Ile Leu Ile Val Asn Glu Glu Tyr Asp Val
                805                 810                 815

Asp Val Val Lys Thr Phe Glu Ser Val Tyr Lys Ile Val Lys Ser Lys
            820                 825                 830

Asp Asn Asn Glu Lys Asn Arg Ile Leu Pro Leu Leu Lys Gln Leu Pro
        835                 840                 845

His Asp Trp Met Phe Lys Leu Pro Phe Gly Ala Ser Asn Ala Glu Lys
    850                 855                 860

Cys Lys Val Leu Lys Leu Glu Lys Asn Asn Lys Lys Phe Lys Pro Leu
865                 870                 875                 880

Ser Val Ser Lys Asp Ser Leu Ala Arg Leu Ser Gly Pro Ser Thr Tyr
                885                 890                 895

Phe Asn Gln Ile Asp Glu Ile Met Met Asn Asp Glu Ser Glu Leu Ser
            900                 905                 910

Glu Met Thr Leu Leu Ala Asp Glu Pro Val Arg Gln Gln Met Ser Asn
        915                 920                 925

Gly Lys Ile Glu Ile Ile Pro Asp Asp Tyr Val Met Ser Leu Ala Ile
    930                 935                 940

Pro Ile Thr Arg Ser Leu Lys Lys Gly Asn Thr Glu Ser Phe Pro Phe
945                 950                 955                 960

Lys Asn Ile Val Ser Ile Asp Gln Gly Glu Ala Gly Phe Ala Tyr Ala
                965                 970                 975

Val Phe Lys Leu Ser Asp Cys Gly Asn Glu Arg Ala Glu Pro Ile Ala
            980                 985                 990

Thr Gly Leu Ile Pro Ile Pro Ser  Ile Arg Arg Leu Ile  His Ser Val
```

995 1000 1005

Lys Lys Tyr Arg Gly Lys Lys Gln Arg Ile Gln Asn Phe Asn Gln
1010 1015 1020

Lys Phe Asp Ser Thr Met Phe Thr Leu Arg Glu Asn Val Thr Gly
1025 1030 1035

Asp Ile Cys Gly Leu Ile Val Ala Leu Met Lys Lys Tyr Asn Ala
1040 1045 1050

Phe Pro Ile Leu Glu Lys Gln Val Gly Asn Leu Glu Ser Gly Ser
1055 1060 1065

Lys Gln Leu Met Leu Val Tyr Lys Ala Val Asn Ser Lys Phe Leu
1070 1075 1080

Ala Ala Lys Val Asp Met Gln Asn Asp Gln Arg Arg Ser Trp Trp
1085 1090 1095

Tyr Gln Gly Asn Ser Trp Asn Thr Pro Ile Leu Arg Ile Ser Asn
1100 1105 1110

Pro Asn Gln Ser Asn Asn Lys Asn Ile Val Lys Asn Ile Asn Gly
1115 1120 1125

Lys Lys Tyr Glu Glu Leu Lys Ile Tyr Pro Gly Tyr Ser Val Ser
1130 1135 1140

Ala Tyr Met Thr Ser Cys Ile Cys His Val Cys Gly Arg Asn Ala
1145 1150 1155

Leu Glu Leu Leu Lys Asn Asp Asp Ser Thr Gly Lys Val Lys Lys
1160 1165 1170

Tyr Gln Ile Asn Gln Asp Gly Glu Val Thr Ile Gly Gly Glu Val
1175 1180 1185

```
Ile Lys  Leu Tyr Arg Lys Pro  Asp Arg Leu Thr Pro  Val Lys Asn
    1190                1195                1200


Leu Ala  Lys Lys Gly Asn Arg  Glu Arg Thr Tyr Ala  Ser Ile Asn
    1205                1210                1215


Glu Arg  Ala Pro Thr Val Ser  Val Gln Lys Ala Glu  Leu Ser Ala
    1220                1225                1230


Asp Glu  Leu Gln Lys Ile Ile  Lys Lys Asn Met Arg  Arg Ala Pro
    1235                1240                1245


Arg Ser  Leu Met Ser Lys Asp  Thr Thr Gln Ser Arg  Tyr Phe Cys
    1250                1255                1260


Val Phe  Lys Asn Cys Pro Cys  His Asn Lys Glu Gln  His Ala Asp
    1265                1270                1275


Val Asn  Ala Ala Ile Asn Ile  Gly Arg Arg Phe Leu  Lys Asp Cys
    1280                1285                1290


Ile Leu  Asp Asp Asn Lys Glu  Lys Asp
    1295                1300


<210>  831
<211>  1255
<212>  PRT
<213>  unknown

<220>
<223>  Synthetic Sequence

<400>  831

Met Arg Ser Asn Tyr His Gly Gly Arg Asn Ala Arg Gln Trp Arg Lys
1               5                   10                  15


Gln Ile Ser Gly Leu Ala Arg Arg Thr Lys Glu Thr Val Phe Thr Tyr
            20                  25                  30
```

```
Lys Phe Pro Leu Glu Thr Asp Ala Ala Glu Ile Asp Phe Asp Lys Ala
        35                  40                  45

Val Gln Thr Tyr Gly Ile Ala Glu Gly Val Gly His Gly Ser Leu Ile
    50                  55                  60

Gly Leu Val Cys Ala Phe His Leu Ser Gly Phe Arg Leu Phe Ser Lys
65                  70                  75                  80

Ala Gly Glu Ala Met Ala Phe Arg Asn Arg Ser Arg Tyr Pro Thr Asp
                85                  90                  95

Ala Phe Ala Glu Lys Leu Ser Ala Ile Met Gly Ile Gln Leu Pro Thr
            100                 105                 110

Leu Ser Pro Glu Gly Leu Asp Leu Ile Phe Gln Ser Pro Pro Arg Ser
        115                 120                 125

Arg Asp Gly Ile Ala Pro Val Trp Ser Glu Asn Glu Val Arg Asn Arg
    130                 135                 140

Leu Tyr Thr Asn Trp Thr Gly Arg Gly Pro Ala Asn Lys Pro Asp Glu
145                 150                 155                 160

His Leu Leu Glu Ile Ala Gly Glu Ile Ala Lys Gln Val Phe Pro Lys
                165                 170                 175

Phe Gly Gly Trp Asp Asp Leu Ala Ser Asp Pro Asp Lys Ala Leu Ala
            180                 185                 190

Ala Ala Asp Lys Tyr Phe Gln Ser Gln Gly Asp Phe Pro Ser Ile Ala
        195                 200                 205

Ser Leu Pro Ala Ala Ile Met Leu Ser Pro Ala Asn Ser Thr Val Asp
    210                 215                 220

Phe Glu Gly Asp Tyr Ile Ala Ile Asp Pro Ala Ala Glu Thr Leu Leu
```

```
225                 230                 235                 240

His Gln Ala Val Ser Arg Cys Ala Ala Arg Leu Gly Arg Glu Arg Pro
                245                 250                 255

Asp Leu Asp Gln Asn Lys Gly Pro Phe Val Ser Ser Leu Gln Asp Ala
            260                 265                 270

Leu Val Ser Ser Gln Asn Asn Gly Leu Ser Trp Leu Phe Gly Val Gly
        275                 280                 285

Phe Gln His Trp Lys Glu Lys Ser Pro Lys Glu Leu Ile Asp Glu Tyr
    290                 295                 300

Lys Val Pro Ala Asp Gln His Gly Ala Val Thr Gln Val Lys Ser Phe
305                 310                 315                 320

Val Asp Ala Ile Pro Leu Asn Pro Leu Phe Asp Thr Thr His Tyr Gly
                325                 330                 335

Glu Phe Arg Ala Ser Val Ala Gly Lys Val Arg Ser Trp Val Ala Asn
            340                 345                 350

Tyr Trp Lys Arg Leu Leu Asp Leu Lys Ser Leu Leu Ala Thr Thr Glu
        355                 360                 365

Phe Thr Leu Pro Glu Ser Ile Ser Asp Pro Lys Ala Val Ser Leu Phe
    370                 375                 380

Ser Gly Leu Leu Val Asp Pro Gln Gly Leu Lys Lys Val Ala Asp Ser
385                 390                 395                 400

Leu Pro Ala Arg Leu Val Ser Ala Glu Glu Ala Ile Asp Arg Leu Met
                405                 410                 415

Gly Val Gly Ile Pro Thr Ala Ala Asp Ile Ala Gln Val Glu Arg Val
            420                 425                 430
```

```
Ala Asp Glu Ile Gly Ala Phe Ile Gly Gln Val Gln Gln Phe Asn Asn
        435                 440                 445

Gln Val Lys Gln Lys Leu Glu Asn Leu Gln Asp Ala Asp Asp Glu Glu
    450                 455                 460

Phe Leu Lys Gly Leu Lys Ile Glu Leu Pro Ser Gly Asp Lys Glu Pro
465                 470                 475                 480

Pro Ala Ile Asn Arg Ile Ser Gly Gly Ala Pro Asp Ala Ala Ala Glu
                485                 490                 495

Ile Ser Glu Leu Glu Glu Lys Leu Gln Arg Leu Leu Asp Ala Arg Ser
            500                 505                 510

Glu His Phe Gln Thr Ile Ser Glu Trp Ala Glu Glu Asn Ala Val Thr
        515                 520                 525

Leu Asp Pro Ile Ala Ala Met Val Glu Leu Glu Arg Leu Arg Leu Ala
    530                 535                 540

Glu Arg Gly Ala Thr Gly Asp Pro Glu Glu Tyr Ala Leu Arg Leu Leu
545                 550                 555                 560

Leu Gln Arg Ile Gly Arg Leu Ala Asn Arg Val Ser Pro Val Ser Ala
                565                 570                 575

Gly Ser Ile Arg Glu Leu Leu Lys Pro Val Phe Met Glu Glu Arg Glu
            580                 585                 590

Phe Asn Leu Phe Phe His Asn Arg Leu Gly Ser Leu Tyr Arg Ser Pro
        595                 600                 605

Tyr Ser Thr Ser Arg His Gln Pro Phe Ser Ile Asp Val Gly Lys Ala
    610                 615                 620

Lys Ala Ile Asp Trp Ile Ala Gly Leu Asp Gln Ile Ser Ser Asp Ile
```

625 630 635 640

Glu Lys Ala Leu Ser Gly Ala Gly Glu Ala Leu Gly Asp Gln Leu Arg
645 650 655

Asp Trp Ile Asn Leu Ala Gly Phe Ala Ile Ser Gln Arg Leu Arg Gly
660 665 670

Leu Pro Asp Thr Val Pro Asn Ala Leu Ala Gln Val Arg Cys Pro Asp
675 680 685

Asp Val Arg Ile Pro Pro Leu Leu Ala Met Leu Leu Glu Glu Asp Asp
690 695 700

Ile Ala Arg Asp Val Cys Leu Lys Ala Phe Asn Leu Tyr Val Ser Ala
705 710 715 720

Ile Asn Gly Cys Leu Phe Gly Ala Leu Arg Glu Gly Phe Ile Val Arg
725 730 735

Thr Arg Phe Gln Arg Ile Gly Thr Asp Gln Ile His Tyr Val Pro Lys
740 745 750

Asp Lys Ala Trp Glu Tyr Pro Asp Arg Leu Asn Thr Ala Lys Gly Pro
755 760 765

Ile Asn Ala Ala Val Ser Ser Asp Trp Ile Glu Lys Asp Gly Ala Val
770 775 780

Ile Lys Pro Val Glu Thr Val Arg Asn Leu Ser Ser Thr Gly Phe Ala
785 790 795 800

Gly Ala Gly Val Ser Glu Tyr Leu Val Gln Ala Pro His Asp Trp Tyr
805 810 815

Thr Pro Leu Asp Leu Arg Asp Val Ala His Leu Val Thr Gly Leu Pro
820 825 830

```
Val Glu Lys Asn Ile Thr Lys Leu Lys Arg Leu Thr Asn Arg Thr Ala
        835                 840                 845

Phe Arg Met Val Gly Ala Ser Ser Phe Lys Thr His Leu Asp Ser Val
    850                 855                 860

Leu Leu Ser Asp Lys Ile Lys Leu Gly Asp Phe Thr Ile Ile Ile Asp
865                 870                 875                 880

Gln His Tyr Arg Gln Ser Val Thr Tyr Gly Gly Lys Val Lys Ile Ser
                885                 890                 895

Tyr Glu Pro Glu Arg Leu Gln Val Glu Ala Ala Val Pro Val Val Asp
            900                 905                 910

Thr Arg Asp Arg Thr Val Pro Glu Pro Asp Thr Leu Phe Asp His Ile
        915                 920                 925

Val Ala Ile Asp Leu Gly Glu Arg Ser Val Gly Phe Ala Val Phe Asp
    930                 935                 940

Ile Lys Ser Cys Leu Arg Thr Gly Glu Val Lys Pro Ile His Asp Asn
945                 950                 955                 960

Asn Gly Asn Pro Val Val Gly Thr Val Ala Val Pro Ser Ile Arg Arg
                965                 970                 975

Leu Met Lys Ala Val Arg Ser His Arg Arg Arg Arg Gln Pro Asn Gln
            980                 985                 990

Lys Val Asn Gln Thr Tyr Ser Thr  Ala Leu Gln Asn Tyr  Arg Glu Asn
        995                 1000                1005

Val Ile  Gly Asp Val Cys Asn  Arg Ile Asp Thr Leu  Met Glu Arg
    1010                1015                1020

Tyr Asn  Ala Phe Pro Val Leu  Glu Phe Gln Ile Lys  Asn Phe Gln
```

```
    1025                1030                1035

Ala Gly  Ala Lys Gln Leu Glu  Ile Val Tyr Gly Ser  Val Leu His
    1040                1045                1050

Arg Tyr  Thr Phe Ser Gly Val  Asp Ala His Lys Ala  Lys Arg Arg
    1055                1060                1065

Glu Tyr  Trp Tyr Asn Gly Glu  Leu Trp Glu His Pro  Tyr Leu Met
    1070                1075                1080

Ala Lys  Lys Trp Asn Glu Glu  Thr Asn Ser Met Ser  Gly Ala Pro
    1085                1090                1095

Lys Pro  Val Ser Leu Phe Pro  Gly Val Thr Val Asn  Ala Ala Arg
    1100                1105                1110

Thr Ser  Gln Ile Cys His Gln  Cys Gln Arg Asn Pro  Met Ser His
    1115                1120                1125

Leu Arg  Gly Leu Thr Gly Thr  Ile Glu Ile Ser Ser  Asp Gly Leu
    1130                1135                1140

Leu Glu  Leu Asp Asp Gly Thr  Ile Arg Leu Phe Glu  Thr Ser Asp
    1145                1150                1155

Tyr Asp  Glu Asp Lys Phe Lys  Gln Ser Arg Arg Glu  Lys Arg Arg
    1160                1165                1170

Leu Asp  Ala Asn Val Leu Leu  Ser Gly Arg His Arg  Ala Glu Tyr
    1175                1180                1185

Ile Tyr  Thr Val Ala Lys Arg  Asn Leu Arg Arg Pro  Pro Lys Asn
    1190                1195                1200

Val Met  Thr Lys Asp Thr Thr  Gln Ser Arg Tyr Thr  Cys Leu Tyr
    1205                1210                1215
```

```
Lys Asn  Cys Ser Trp Thr Gly  His Ala Asp Glu Asn  Ala Ala Ile
    1220                1225                1230


Asn Ile  Gly Arg Arg Tyr Leu  Ala Glu Arg Ile Asp  Met Pro Ala
    1235                1240                1245


Ser Lys  Thr Lys Ala Ala Val
    1250                1255
```

<210> 832
<211> 1266
<212> PRT
<213> unknown

<220>
<223> Synthetic Sequence

<400> 832

```
Met Arg Pro Arg Phe His Gly Gly Met Asn Ala Arg Asp Trp Arg Lys
1               5                   10                  15


His Val Gly Val Leu Ala Gln Gln His Lys Glu Thr Thr Arg Thr Tyr
            20                  25                  30


Thr Phe Pro Leu Asp Thr Thr Gly Ser Ala Ile Asp Phe Asp Ala Ala
        35                  40                  45


Leu Gln Ala Tyr Asn Ala Val Glu Gly Val Gly Tyr Gly Ser Leu Leu
    50                  55                  60


Gly Leu Ala Cys Ala Val His Leu Ser Gly Phe Arg Leu Phe Ser Thr
65                  70                  75                  80


Gly Lys Glu Ala Ala Thr Phe Arg Asn Arg Ala Arg Tyr Pro Asn Ala
                85                  90                  95


Ala Phe Gln Ala Ala Leu Arg Lys Glu Leu Gly Thr Thr Ile Thr Thr
            100                 105                 110
```

```
Leu Thr Pro Glu Thr Leu Asp Arg Leu Phe Ser Ser Arg Pro Lys Arg
        115                 120                 125

Arg Asn Gly Val Pro Leu Pro Trp Asn Gln Asp Ser Ile Arg Asp Arg
    130                 135                 140

Leu Tyr Thr Asn Trp Val Lys Pro Arg Pro Gly Asp Thr Pro Asp Ala
145                 150                 155                 160

Val Leu Phe Gln Ile Ala Thr Gly Ile Ala Gln Glu Ile Thr Glu Asp
                165                 170                 175

Val Ser Ser Trp Thr Asp Leu Ala Lys Asn Ser Asp Arg Gly Leu Lys
            180                 185                 190

Ala Ala His Arg Tyr Phe Ala Arg Val Gly Gly Phe Pro Ala Phe Asp
        195                 200                 205

Asn Leu Thr Pro Pro Ala Thr Val Gln Pro Thr Asp Thr Thr Ile Asp
    210                 215                 220

Tyr Asp Pro Asn Ala Pro Phe His Leu Val Ser His Ala Asp Gln Thr
225                 230                 235                 240

Leu Ile His Gln Ser Ile Ser Leu Cys Ala His Arg Ile Arg Gln Glu
                245                 250                 255

Asp Pro Ala Leu Asp Pro Asn Lys Ser Gly Phe Ile Lys Gln Leu Gln
            260                 265                 270

Asn Asn Phe Leu Ser Gln Thr Phe Tyr Gly Leu Ser Trp Leu Phe Gly
        275                 280                 285

Ala Gly Tyr Val His Phe Arg Glu Cys Thr Ala Asn Asp Leu Ala Ile
    290                 295                 300

Gln Tyr Gly Ile Pro Asn Asn Cys Arg Asp Gly Ile His Gln Ile Lys
```

```
305                 310                 315                 320

Ser Phe Ala Asp Ala Ile Leu Pro Asn Thr Phe Phe Glu Lys Lys His
                325                 330                 335

Tyr Arg Lys Asp Ser Arg Ser Val Gly Lys Lys Ala Lys Ser Trp Ile
            340                 345                 350

Ser Asn Tyr Trp Gln Arg Leu Leu Gln Leu Gln Thr Trp Val Asp Asp
        355                 360                 365

His Thr Trp Val Thr Leu Pro Gln Glu Leu Thr Glu Ala Gln Phe Lys
    370                 375                 380

Pro Leu Phe Arg Gly Leu Leu Val Asp Ala Val Glu Leu Met Ala Ile
385                 390                 395                 400

Ala Glu Arg Leu Pro Gln Arg Leu Ala Asp Cys Arg Asp Ser Leu Asp
                405                 410                 415

Cys Leu Met Gly Lys Gly Pro Gln Ala Ala Thr Lys Asn Asp Val Glu
            420                 425                 430

Ile Val Glu Lys Val Arg Glu Glu Ile Glu Ser Phe Val Gly Gln Ile
        435                 440                 445

Glu Gln Leu Gly Asn Gln Leu Arg His Gln Leu Glu Asn Glu Asn Asn
    450                 455                 460

Asp Gln Val His Arg Asp Asn Leu His Gln Leu Lys Asn Arg Leu Pro
465                 470                 475                 480

Leu Asp Leu Arg Arg Pro Gln Ala Leu Asn Lys Ile Ser Gly Gly Val
                485                 490                 495

Pro Asp Val Ala Lys Ser Ile Arg Gly Leu Glu Thr Gln Leu Asp Gln
            500                 505                 510
```

```
Val Leu Lys Glu Arg Arg Ser His Phe Gly Arg Leu Thr Lys Trp Ala
        515                 520                 525

Lys Glu Cys Gly Ile Thr Leu Asp Pro Leu Gln Pro Leu Ile Glu Ser
    530                 535                 540

Glu Lys Gln Arg Val Ala Glu Arg Gly Ser Ala His Asp Ala Lys Glu
545                 550                 555                 560

Leu Ala Ile Arg Leu Leu Leu Gln Arg Ile Gly Arg Leu Gly His Arg
                565                 570                 575

Leu Ser Pro Thr Asn Ala Thr Ala Ile Gln Glu Leu Leu Arg Pro Val
            580                 585                 590

Phe Ala Val Lys Arg Glu Phe Asn Leu Phe Phe His Asn His Met Gly
        595                 600                 605

Ala Leu Tyr Arg Ser Pro Tyr Ser Thr Ser Arg His Gln Pro Phe Gln
    610                 615                 620

Ile Asn Val Asp Val Ala His Gly Thr Asp Trp Ile Gly Thr Ile Glu
625                 630                 635                 640

Thr Leu Ile Gln Asn Leu Phe Thr Gln Ile Gln Asp Asp Ala Leu Leu
                645                 650                 655

Arg Asp Leu Val Gln Leu Glu Gly Phe Val Phe Ser His Lys Leu Arg
            660                 665                 670

Ala Leu Pro Gly Val Ile Pro Ser Glu Leu Ala Arg Pro Asn Asn Leu
        675                 680                 685

Gln Gln Met Gly Leu Pro Ala Leu Leu Leu Val Leu Leu Gln Ala Asp
    690                 695                 700

Gln Val His Arg Glu Thr Val Leu Arg Val Phe Asn Leu Tyr Gly Ser
```

```
705                 710                 715                 720

Ala Ile Asn Gly Tyr Leu Phe Gln Ala Leu Arg Pro Gly Phe Ile Val
                725                 730                 735

Arg Ala Gly Phe Gln Arg Leu Glu Thr Lys Lys Leu Arg Tyr Val Pro
            740                 745                 750

Lys Ala Gln Ser Trp Gln Tyr Pro Asp Arg Leu His His Ala Lys Ser
        755                 760                 765

Ala Ile Lys Asn Ser Leu Ser Ala Gly Trp Ile Lys Lys Asn His Gln
    770                 775                 780

Gly Ala Ile Leu Pro Gln Lys Thr Leu Thr Ala Leu Val Lys Gln Lys
785                 790                 795                 800

Ser Leu Lys Asp Thr Gly Val Pro Glu Tyr Leu Val Gln Ala Pro His
                805                 810                 815

Asp Trp Tyr Val Pro Ile Asp Leu Arg Gly Pro Ala Ile Pro Ile Glu
            820                 825                 830

Gly Leu Thr Val Gly Thr Glu Gly Pro Glu Leu Thr Gln Leu Gly Pro
        835                 840                 845

Met Lys Asp Asp Cys Ala Phe Arg Ala Ile Gly Pro Ser Ser Phe Lys
    850                 855                 860

Ser Lys Ile Asp Ala Gly Leu Leu Pro Gln Asp Val Lys Tyr Gly Asp
865                 870                 875                 880

Met Thr Leu Ile Phe Asp Gln His Tyr Gln Gln Ser Ile Ser Phe Ala
                885                 890                 895

Asn Gly Thr Phe Ser Ile Gln Tyr Gln Pro Thr Ser Leu Gln Val Lys
            900                 905                 910
```

```
Ala Ala Ile Pro Val Val Asp Lys Arg Pro Arg Asp Thr Arg Asn Asn
        915                 920                 925


Ser His Leu Tyr Asp Arg Ile Val Ala Ile Asp Leu Gly Glu Arg Lys
    930                 935                 940


Ile Gly Tyr Ala Ile Phe Asp Leu Lys Gln Val Leu Lys Ser Glu Gln
945                 950                 955                 960


Leu Glu Pro Met Arg Glu Asp Gly Lys Pro Leu Ile Gly Ser Ile Ser
                965                 970                 975


Ile Arg Ser Ile Arg Gly Leu Met Lys Ala Val Gln Thr His Arg Asn
            980                 985                 990


Arg Arg Gln Pro Asn Tyr Arg Ile  Asp Gln Thr Tyr Ser  Lys Ala Leu
        995                 1000                1005


Met His  Tyr Arg Glu Ser Val  Ile Gly Asp Val Cys  Asn Ala Ile
    1010                1015                1020


Asp Thr  Leu Cys Ala Arg Tyr  Gly Gly Phe Pro Val  Leu Glu Ser
    1025                1030                1035


Ser Val  Arg Asn Phe Glu Val  Gly Ser Ala Gln Leu  Lys Thr Val
    1040                1045                1050


Tyr Gly  Ser Val Ser Arg Arg  Tyr Thr Trp Ser Ala  Val Asp Ala
    1055                1060                1065


His Lys  Asn Gln Arg Gln Gln  Tyr Trp Leu Gly Gly  Thr Lys Asp
    1070                1075                1080


Lys Ile  Pro Ile Trp Thr His  Pro Tyr Leu Met Thr  Arg Glu Trp
    1085                1090                1095


Asp Glu  Lys Asn Ser Lys Trp  Ser Asn Arg Ser Lys  Pro Leu Lys
```

```
    1100                1105                1110

Met His  Pro Gly Val Glu Val  His Pro Ala Gly Thr  Ser Gln Ile
    1115                1120                1125

Cys His  Gln Cys Lys Arg Asn  Pro Ile Gly Ala Leu  Trp Asn Val
    1130                1135                1140

Ala Asp  Thr Val Val Leu Asp  Asp Gln Gly Gln Leu  Asp Leu Asp
    1145                1150                1155

Asp Gly  Thr Ile Arg Leu Asn  Ser Gly Tyr Ile Asp  Thr Thr Glu
    1160                1165                1170

Ile Lys  Arg Ala Arg Arg Lys  Lys Ile Arg Leu Pro  Glu Asn Lys
    1175                1180                1185

Pro Leu  Thr Gly Ser His Lys  Thr Ser His Val Arg  Ala Val Ala
    1190                1195                1200

Arg Arg  Asn Leu Arg Gln Pro  Pro Lys Ser Thr Arg  Ala Lys Asp
    1205                1210                1215

Thr Thr  Gln Ser Arg Tyr Thr  Cys Leu Tyr Val Asp  Cys Gly His
    1220                1225                1230

Glu Cys  His Ala Asp Glu Asn  Ala Ala Ile Asn Ile  Gly Arg Lys
    1235                1240                1245

Tyr Leu  Gln Glu Arg Ile His  Ile Glu Ala Ser Arg  Gln Ala Leu
    1250                1255                1260

Ser Thr  Arg
    1265


<210>  833
<211>  1269
<212>  PRT
```

<213> unknown

<220>
<223> Synthetic Sequence

<400> 833

```
Met Val Ala Gly Leu Lys Lys Ile Lys Arg Asp Gly Val Thr Met Lys
1               5                  10                  15


Ser Asn Tyr His Gly Gly Val Lys Ala Arg Ala Trp Arg Lys Arg Ile
            20                  25                  30


Gly Gly Leu Ala Arg Arg Gln Lys Glu Thr Val Phe Thr Tyr Lys Phe
        35                  40                  45


Pro Leu Glu Thr Glu Glu Ala Gly Ile Asp Phe Asp Lys Ala Val Gln
    50                  55                  60


Thr Tyr Gly Ile Ala Glu Gly Ile Ser Gln Gly Ser Leu Ile Gly Leu
65                  70                  75                  80


Val Cys Ala Phe His Leu Ser Gly Phe Arg Leu Phe Ser Lys Ala Asp
                85                  90                  95


Glu Thr Lys Ala Phe Cys Asn Gln Gly Arg Tyr Pro Asn Gln Ala Phe
            100                 105                 110


Ala Glu Lys Leu Arg Asn Glu Leu Ser Val Thr Leu Pro Lys Leu Ser
        115                 120                 125


Pro Gln Ser Leu Asp Val Leu Phe Gln Ser Ser Pro Lys Ser Lys Asn
    130                 135                 140


Gly Val Ala Pro Glu Trp Ser Lys Asn Ala Ile Arg Asn Arg Leu Tyr
145                 150                 155                 160


Thr Asn Trp Thr Gly Lys Gly Ala Gly Thr Asn Pro Asp Glu His Leu
                165                 170                 175
```

```
Leu Glu Ile Ala Glu Asp Ile Ala Ala Glu Ile Asp Ser Asp Leu Asp
            180                 185                 190

Gly Trp Lys Asp Leu Glu Glu His Pro Glu Lys Gly Leu Ser Ala Ala
        195                 200                 205

Asp Arg Tyr Phe Gln Ala Gln Gly Asp Phe Pro Ser Leu Thr Gly Leu
    210                 215                 220

Pro Pro Ser Val Pro Leu Thr Pro Gln Asn Ser Thr Val Ala Phe Glu
225                 230                 235                 240

Gly Asp Pro Val Cys Leu Asn Pro Ser Asp Asn Thr Leu Leu His Gln
                245                 250                 255

Ala Val Ala Arg Cys Ala Gly Arg Ile Leu Gln Glu Gln Pro Asn Leu
            260                 265                 270

Ser Pro Asp Lys Asn Arg Phe Ile Asn Gln Leu Gln Asp Glu Leu Val
        275                 280                 285

Ser Ser Gln Asn Asn Gly Leu Ser Trp Leu Phe Gly Val Gly Phe Lys
    290                 295                 300

Tyr Trp Lys Glu Met Ser Val Asp Gln Leu Ala Asp Asp Tyr Lys Val
305                 310                 315                 320

Lys Ser Thr Asp Leu Asp Ala Leu Lys Gln Val Lys Ser Phe Ile Asp
                325                 330                 335

Ala Ile Pro Leu Asn Pro Leu Phe Asp Thr Pro His Tyr Gly Glu Phe
            340                 345                 350

Arg Ala Ser Val Ala Gly Lys Met Arg Ser Trp Val Lys Asn Tyr Trp
        355                 360                 365

Lys Arg Leu Leu Asp Leu Lys Ser Gln Leu Gly Thr Ala Asn Ile Asn
```

```
    370                 375                 380

Leu Pro Glu Gly Leu Asp Glu Gln Arg Ala Glu Asn Leu Phe Ser Gly
385                 390                 395                 400

Leu Leu Ile Asp Ser Lys Gly Leu Arg Gln Val Thr Asp Lys Leu Pro
                405                 410                 415

Ser Arg Leu Lys Lys Ala Glu Asp Thr Ile Asp Arg Leu Met Gly Asp
            420                 425                 430

Gly Asn Pro Thr Ser Asp Asp Ile Glu Gln Val Glu Thr Val Ala Ala
        435                 440                 445

Glu Ile Ser Ala Phe Ile Gly Gln Val Glu Gln Phe Asn Asn Gln Leu
    450                 455                 460

Glu Gln Arg Leu Glu Asn Pro Leu Glu Gly Asp Asp Glu Thr Phe Leu
465                 470                 475                 480

Lys Gln Leu Lys Ile Asp Leu Pro Ala Glu Phe Lys Lys Pro Pro Ala
                485                 490                 495

Ile Asn Arg Ile Ser Gly Gly Ser Pro Asp Pro Thr Ala Glu Ile Ala
            500                 505                 510

Glu Leu Glu Glu Lys Leu Asp Arg Leu Met Ser Ala Arg Lys Glu His
        515                 520                 525

Tyr Glu Thr Ile Ala Glu Trp Ala Ser Ala Asn Lys Val Thr Leu Asp
    530                 535                 540

Pro Met Glu Ala Met Thr Thr Leu Glu Ala Gln Arg Leu Thr Glu Arg
545                 550                 555                 560

Gly Ala Glu Gly Asp Gln Glu Glu Phe Ala Leu Arg Leu Leu Leu Gln
                565                 570                 575
```

```
Arg Ile Gly Arg Leu Ala Asn Arg Leu Ser Pro Gln Gly Ala Thr Ala
            580                 585                 590

Ile Arg Asp Leu Leu Arg Pro Val Phe Thr Glu Lys Arg Glu Phe Asn
        595                 600                 605

Leu Phe Phe His Asn Arg Met Gly Ser Leu Tyr Arg Ser Pro Tyr Ser
    610                 615                 620

Thr Ser Arg His Gln Pro Phe Thr Ile Asp Val Ala Val Ala Lys Asn
625                 630                 635                 640

Thr Asp Trp Met Asp Ala Leu Asp Gly Ile Ala Glu Thr Ile Met Lys
                645                 650                 655

Gly Leu Ser Gln Ala Gly Asp Glu Leu Ser Leu Arg Leu Arg Asp Trp
            660                 665                 670

Ile Asn Ile Ser Gly Phe Ser Leu Ser Gln Arg Leu Arg Gly Leu Pro
        675                 680                 685

Asp Thr Val Pro Gly Glu Leu Ala Leu Val Arg Ser Ala Asp Asp Val
    690                 695                 700

Arg Ile Pro Pro Met Leu Ala Leu Gln Leu Glu Glu Asp Glu Val Ser
705                 710                 715                 720

Arg Glu Val Cys Leu Lys Ala Phe Asn Leu Tyr Val Ser Ala Ile Asn
                725                 730                 735

Gly Cys Leu Phe Arg Ala Leu Arg Glu Gly Phe Ile Val Arg Thr Lys
            740                 745                 750

Phe Gln Arg Leu Glu Arg Asp Val Leu Ser Tyr Val Pro Lys Thr Lys
        755                 760                 765

Leu Trp Asn Tyr Pro Gln Arg Leu Asp Thr Ala Arg Gly Pro Ile His
```

```
    770                 775                 780

Ser Ala Leu Ala Ala Ala Trp Ile Asn Lys Glu Gly Ser Val Ile Asp
785                 790                 795                 800

Pro Val Glu Thr Val Thr Ala Leu Ser Asp Thr Gly Phe Ser Asp Asp
                805                 810                 815

Gly Ile Pro Glu Tyr Leu Val Gln Ala Pro His Asp Trp Tyr Thr Pro
            820                 825                 830

Ile Asp Leu Arg Asp Ile Ser Lys Pro Val Ser Gly Leu Pro Val Lys
        835                 840                 845

Lys Asn Ile Thr Gly Leu Lys Arg Gln Lys Lys Gln Thr Ala Phe Arg
    850                 855                 860

Met Val Gly Pro Ser Ser Phe Lys Ser His Leu Asp Ser Thr Leu Leu
865                 870                 875                 880

Ser Glu Glu Val Lys Leu Gly Asp Phe Thr Leu Ile Phe Asp Gln Tyr
                885                 890                 895

Tyr Lys Gln Arg Val Ser Tyr Asn Gly Arg Val Lys Ile Thr Phe Glu
            900                 905                 910

Pro Asp Arg Leu His Val Glu Ala Ala Val Pro Val Ile Asp Lys Arg
        915                 920                 925

Val Arg Pro Ser Thr Glu Glu Asp Ala Leu Phe Asp His Leu Leu Ala
    930                 935                 940

Ile Asp Leu Gly Glu Lys Arg Val Gly Tyr Ala Val Tyr Asp Ile Lys
945                 950                 955                 960

Ala Cys Leu Arg Thr Gly Asp Ile Lys Pro Leu Glu Asp Gly Asp Gly
                965                 970                 975
```

```
Lys Pro Ile Val Gly Ser Val Ala Val Pro Ser Ile Arg Arg Leu Met
            980                 985                 990


Lys Ala Val Arg Ser His Arg Gln  Gln Arg Gln Pro Asn  Gln Lys Val
        995                 1000                1005


Asn Gln  Thr Tyr Ser Thr Ala  Leu Met Asn Tyr Arg  Glu Asn Val
    1010                1015                1020


Ile Gly  Asp Val Cys Asn Arg  Ile Asp Thr Leu Met  Glu Lys Tyr
    1025                1030                1035


Asn Ala  Phe Pro Val Leu Glu  Ser Ser Val Met Asn  Phe Glu Ala
    1040                1045                1050


Gly Ser  Arg Gln Leu Glu Met  Val Tyr Gly Ser Val  Leu His Arg
    1055                1060                1065


Tyr Thr  Tyr Ser Lys Ile Asp  Ala His Thr Ala Lys  Arg Lys Glu
    1070                1075                1080


Tyr Trp  Tyr Thr Gly Glu Tyr  Trp Asp His Pro Tyr  Leu Met Ala
    1085                1090                1095


His Lys  Trp Asn Glu Arg Thr  Arg Ser Tyr Ser Gly  Ser Leu Ser
    1100                1105                1110


Ala Leu  Thr Leu Tyr Pro Gly  Val Met Val His Pro  Ala Gly Thr
    1115                1120                1125


Ser Gln  Arg Cys His Gln Cys  Lys Arg Asn Pro Met  Val Glu Ile
    1130                1135                1140


Lys Gln  Leu Thr Gly Gln Val  Glu Ile Asn Ala Asp  Gly Ser Leu
    1145                1150                1155


Glu Leu  Asp Asp Gly Thr Ile  Cys Leu Tyr Glu Gly  Tyr Asp Tyr
```

```
    1160                1165                1170

Ser Pro  Glu Glu Tyr Lys Lys  Ala Lys Arg Glu Lys  Arg Arg Leu
    1175                1180                1185

Asp Pro  Asn Val Pro Leu Ser  Gly Arg His Gln Ala  Lys His Val
    1190                1195                1200

Ser Ala  Val Ala Lys Arg Asn  Leu Arg Arg Pro Thr  Val Ser Met
    1205                1210                1215

Met Ser  Gly Asp Thr Thr Gln  Ala Arg Tyr Val Cys  Leu Tyr Thr
    1220                1225                1230

Asp Cys  Asp Phe Thr Gly His  Ala Asp Glu Asn Ala  Ala Ile Asn
    1235                1240                1245

Ile Gly  Trp Lys Tyr Leu Thr  Glu Arg Ile Ala Leu  Ser Glu Ser
    1250                1255                1260

Lys Asp  Lys Ala Gly Val
    1265
```

<210> 834
<211> 1340
<212> PRT
<213> unknown

<220>
<223> Synthetic Sequence

<400> 834

```
Met Gln Ile Ser Lys Val Asn His Lys His Val Ala Val Gly Gln Lys
1               5                   10                  15

Asp Arg Glu Arg Ile Thr Gly Phe Ile Tyr Asn Asp Pro Val Gly Asp
            20                  25                  30

Glu Lys Ser Leu Glu Asp Val Val Ala Lys Arg Ala Asn Asp Thr Lys
```

```
        35                  40                  45

Val Leu Phe Asn Val Phe Asn Thr Lys Asp Leu Tyr Asp Ser Gln Glu
    50                  55                  60

Ser Asp Lys Ser Glu Lys Asp Lys Glu Ile Ile Ser Lys Gly Ala Lys
65                  70                  75                  80

Phe Val Ala Lys Ser Phe Asn Ser Ala Ile Thr Ile Leu Lys Lys Gln
                85                  90                  95

Asn Lys Ile Tyr Ser Thr Leu Thr Ser Gln Gln Val Ile Lys Glu Leu
            100                 105                 110

Lys Asp Lys Phe Gly Gly Ala Arg Ile Tyr Asp Asp Asp Ile Glu Glu
        115                 120                 125

Ala Leu Thr Glu Thr Leu Lys Lys Ser Phe Arg Lys Glu Asn Val Arg
    130                 135                 140

Asn Ser Ile Lys Val Leu Ile Glu Asn Ala Ala Gly Ile Arg Ser Ser
145                 150                 155                 160

Leu Ser Lys Asp Glu Glu Glu Leu Ile Gln Glu Tyr Phe Val Lys Gln
                165                 170                 175

Leu Val Glu Glu Tyr Thr Lys Thr Lys Leu Gln Lys Asn Val Val Lys
            180                 185                 190

Ser Ile Lys Asn Gln Asn Met Val Ile Gln Pro Asp Ser Asp Ser Gln
        195                 200                 205

Val Leu Ser Leu Ser Glu Ser Arg Arg Glu Lys Gln Ser Ser Ala Val
    210                 215                 220

Ser Ser Asp Thr Leu Val Asn Cys Lys Glu Lys Asp Val Leu Lys Ala
225                 230                 235                 240
```

```
Phe Leu Thr Asp Tyr Ala Val Leu Asp Glu Asp Glu Arg Asn Ser Leu
                245                 250                 255

Leu Trp Lys Leu Arg Asn Leu Val Asn Leu Tyr Phe Tyr Gly Ser Glu
            260                 265                 270

Ser Ile Arg Asp Tyr Ser Tyr Thr Lys Glu Lys Ser Val Trp Lys Glu
        275                 280                 285

His Asp Glu Gln Lys Ala Asn Lys Thr Leu Phe Ile Asp Glu Ile Cys
    290                 295                 300

His Ile Thr Lys Ile Gly Lys Asn Gly Lys Glu Gln Lys Val Leu Asp
305                 310                 315                 320

Tyr Glu Glu Asn Arg Ser Arg Cys Arg Lys Gln Asn Ile Asn Tyr Tyr
                325                 330                 335

Arg Ser Ala Leu Asn Tyr Ala Lys Asn Asn Thr Ser Gly Ile Phe Glu
            340                 345                 350

Asn Glu Asp Ser Asn His Phe Trp Ile His Leu Ile Glu Asn Glu Val
        355                 360                 365

Glu Arg Leu Tyr Asn Gly Ile Glu Asn Gly Glu Glu Phe Lys Phe Glu
    370                 375                 380

Thr Gly Tyr Ile Ser Glu Lys Val Trp Lys Ala Val Ile Asn His Leu
385                 390                 395                 400

Ser Ile Lys Tyr Ile Ala Leu Gly Lys Ala Val Tyr Asn Tyr Ala Met
                405                 410                 415

Lys Glu Leu Ser Ser Pro Gly Asp Ile Glu Pro Gly Lys Ile Asp Asp
            420                 425                 430

Ser Tyr Ile Asn Gly Ile Thr Ser Phe Asp Tyr Glu Ile Ile Lys Ala
```

```
        435                 440                 445

Glu Glu Ser Leu Gln Arg Asp Ile Ser Met Asn Val Val Phe Ala Thr
    450                 455                 460

Asn Tyr Leu Ala Cys Ala Thr Val Asp Thr Asp Lys Asp Phe Leu Leu
465                 470                 475                 480

Phe Ser Lys Glu Asp Ile Arg Ser Cys Thr Lys Lys Asp Gly Asn Leu
                485                 490                 495

Cys Lys Asn Ile Met Gln Phe Trp Gly Gly Tyr Ser Thr Trp Lys Asn
            500                 505                 510

Phe Cys Glu Glu Tyr Leu Lys Asp Asp Lys Asp Ala Leu Glu Leu Leu
        515                 520                 525

Tyr Ser Leu Lys Ser Met Leu Tyr Ser Met Arg Asn Ser Ser Phe His
    530                 535                 540

Phe Ser Thr Glu Asn Val Asp Asn Gly Ser Trp Asp Thr Glu Leu Ile
545                 550                 555                 560

Gly Lys Leu Phe Glu Glu Asp Cys Asn Arg Ala Ala Arg Ile Glu Lys
                565                 570                 575

Glu Lys Phe Tyr Asn Asn Asn Leu His Met Phe Tyr Ser Ser Ser Leu
            580                 585                 590

Leu Glu Lys Val Leu Glu Arg Leu Tyr Ser Ser His His Glu Arg Ala
        595                 600                 605

Ser Gln Val Pro Ser Phe Asn Arg Val Phe Val Arg Lys Asn Phe Pro
    610                 615                 620

Ser Ser Leu Ser Glu Gln Arg Ile Thr Pro Lys Phe Thr Asp Ser Lys
625                 630                 635                 640
```

```
Asp Glu Gln Ile Trp Gln Ser Ala Val Tyr Tyr Leu Cys Lys Glu Ile
               645                 650                 655

Tyr Tyr Asn Asp Phe Leu Gln Ser Lys Glu Ala Tyr Lys Leu Phe Arg
            660                 665                 670

Glu Gly Val Lys Asn Leu Asp Lys Asn Asp Ile Asn Asn Gln Lys Ala
        675                 680                 685

Ala Asp Ser Phe Lys Gln Ala Val Val Tyr Tyr Gly Lys Ala Ile Gly
    690                 695                 700

Asn Ala Thr Leu Ser Gln Val Cys Gln Ala Ile Met Thr Glu Tyr Asn
705                 710                 715                 720

Arg Gln Asn Asn Asp Gly Leu Lys Lys Lys Ser Ala Tyr Ala Glu Lys
               725                 730                 735

Gln Asn Ser Asn Lys Tyr Lys His Tyr Pro Leu Phe Leu Lys Gln Val
            740                 745                 750

Leu Gln Ser Ala Phe Trp Glu Tyr Leu Asp Glu Asn Lys Glu Ile Tyr
        755                 760                 765

Gly Phe Ile Ser Ala Gln Ile His Lys Ser Asn Val Glu Ile Lys Ala
    770                 775                 780

Glu Asp Phe Ile Ala Asn Tyr Ser Ser Gln Gln Tyr Lys Lys Leu Val
785                 790                 795                 800

Asp Lys Val Lys Lys Thr Pro Glu Leu Gln Lys Trp Tyr Thr Leu Gly
               805                 810                 815

Arg Leu Ile Asn Pro Arg Gln Ala Asn Gln Phe Leu Gly Ser Ile Arg
            820                 825                 830

Asn Tyr Val Gln Phe Val Lys Asp Ile Gln Arg Arg Ala Lys Glu Asn
```

```
        835                 840                 845

Gly Asn Pro Ile Arg Asn Tyr Tyr Glu Val Leu Glu Ser Asp Ser Ile
    850                 855                 860

Ile Lys Ile Leu Glu Met Cys Thr Lys Leu Asn Gly Thr Thr Ser Asn
865                 870                 875                 880

Asp Ile His Asp Tyr Phe Arg Asp Glu Asp Glu Tyr Ala Glu Tyr Ile
                885                 890                 895

Ser Gln Phe Val Asn Phe Gly Asp Val His Ser Gly Ala Ala Leu Asn
            900                 905                 910

Ala Phe Cys Asn Ser Glu Ser Glu Gly Lys Lys Asn Gly Ile Tyr Tyr
        915                 920                 925

Asp Gly Ile Asn Pro Ile Val Asn Arg Asn Trp Val Leu Cys Lys Leu
    930                 935                 940

Tyr Gly Ser Pro Asp Leu Ile Ser Lys Ile Ile Ser Arg Val Asn Glu
945                 950                 955                 960

Asn Met Ile His Asp Phe His Lys Gln Glu Asp Leu Ile Arg Glu Tyr
                965                 970                 975

Gln Ile Lys Gly Ile Cys Ser Asn Lys Lys Glu Gln Gln Asp Leu Arg
            980                 985                 990

Thr Phe Gln Val Leu Lys Asn Arg  Val Glu Leu Arg Asp  Ile Val Glu
        995                 1000                1005

Tyr Ser  Glu Ile Ile Asn Glu  Leu Tyr Gly Gln Leu  Ile Lys Trp
    1010                1015                1020

Cys Tyr  Leu Arg Glu Arg Asp  Leu Met Tyr Phe Gln  Leu Gly Phe
    1025                1030                1035
```

```
His Tyr  Leu Cys Leu Asn Asn  Ala Ser Ser Lys Glu  Ala Asp Tyr
    1040                1045                1050

Ile Lys  Ile Asn Val Asp Asp  Arg Asn Ile Ser Gly  Ala Ile Leu
    1055                1060                1065

Tyr Gln  Ile Ala Ala Met Tyr  Ile Asn Gly Leu Pro  Val Tyr Tyr
    1070                1075                1080

Lys Lys  Asp Asp Met Tyr Val  Ala Leu Lys Ser Gly  Lys Lys Ala
    1085                1090                1095

Ser Asp  Glu Leu Asn Ser Asn  Glu Gln Thr Ser Lys  Lys Ile Asn
    1100                1105                1110

Tyr Phe  Leu Lys Tyr Gly Asn  Asn Ile Leu Gly Asp  Lys Lys Asp
    1115                1120                1125

Gln Leu  Tyr Leu Ala Gly Leu  Glu Leu Phe Glu Asn  Val Ala Glu
    1130                1135                1140

His Glu  Asn Ile Ile Ile Phe  Arg Asn Glu Ile Asp  His Phe His
    1145                1150                1155

Tyr Phe  Tyr Asp Arg Asp Arg  Ser Met Leu Asp Leu  Tyr Ser Glu
    1160                1165                1170

Val Phe  Asp Arg Phe Phe Thr  Tyr Asp Met Lys Leu  Arg Lys Asn
    1175                1180                1185

Val Val  Asn Met Leu Tyr Asn  Ile Leu Leu Asp His  Asn Ile Val
    1190                1195                1200

Ser Ser  Phe Val Phe Glu Thr  Gly Glu Lys Lys Val  Gly Arg Gly
    1205                1210                1215

Asp Ser  Glu Val Ile Lys Pro  Ser Ala Lys Ile Arg  Leu Arg Ala
```

```
    1220                1225                1230

Asn Asn  Gly Val Ser Ser Asp  Val Phe Thr Tyr Lys  Val Gly Ser
    1235                1240                1245

Lys Asp  Glu Leu Lys Ile Ala  Thr Leu Pro Ala Lys  Asn Glu Glu
    1250                1255                1260

Phe Leu  Leu Asn Val Ala Arg  Leu Ile Tyr Tyr Pro  Asp Met Glu
    1265                1270                1275

Ala Val  Ser Glu Asn Met Val  Arg Glu Gly Val Val  Lys Val Glu
    1280                1285                1290

Lys Ser  Asn Asp Lys Lys Gly  Lys Ile Ser Arg Gly  Ser Asn Thr
    1295                1300                1305

Arg Ser  Ser Asn Gln Ser Lys  Tyr Asn Asn Lys Ser  Lys Asn Arg
    1310                1315                1320

Met Asn  Tyr Ser Met Gly Ser  Ile Phe Glu Lys Met  Asp Leu Lys
    1325                1330                1335

Phe Asp
    1340


<210>  835
<211>  1437
<212>  PRT
<213>  unknown

<220>
<223>  Synthetic Sequence

<400>  835

Met Lys Ile Ser Lys Val Arg Glu Glu Asn Arg Gly Ala Lys Leu Thr
1               5                   10                  15

Val Asn Ala Lys Thr Ala Val Val Ser Glu Asn Arg Ser Gln Glu Gly
```

```
            20                  25                  30

Ile Leu Tyr Asn Asp Pro Ser Arg Tyr Gly Lys Ser Arg Lys Asn Asp
        35                  40                  45

Glu Asp Arg Asp Arg Tyr Ile Glu Ser Arg Leu Lys Ser Ser Gly Lys
    50                  55                  60

Leu Tyr Arg Ile Phe Asn Glu Asp Lys Asn Lys Arg Glu Thr Asp Glu
65                  70                  75                  80

Leu Gln Trp Phe Leu Ser Glu Ile Val Lys Lys Ile Asn Arg Arg Asn
                85                  90                  95

Gly Leu Val Leu Ser Asp Met Leu Ser Val Asp Asp Arg Ala Phe Glu
            100                 105                 110

Lys Ala Phe Glu Lys Tyr Ala Glu Leu Ser Tyr Thr Asn Arg Arg Asn
        115                 120                 125

Lys Val Ser Gly Ser Pro Ala Phe Glu Thr Cys Gly Val Asp Ala Ala
    130                 135                 140

Thr Ala Glu Arg Leu Lys Gly Ile Ile Ser Glu Thr Asn Phe Ile Asn
145                 150                 155                 160

Arg Ile Lys Asn Asn Ile Asp Asn Lys Val Ser Glu Asp Ile Ile Asp
                165                 170                 175

Arg Ile Ile Ala Lys Tyr Leu Lys Lys Ser Leu Cys Arg Glu Arg Val
            180                 185                 190

Lys Arg Gly Leu Lys Lys Leu Leu Met Asn Ala Phe Asp Leu Pro Tyr
        195                 200                 205

Ser Asp Pro Asp Ile Asp Val Gln Arg Asp Phe Ile Asp Tyr Val Leu
    210                 215                 220
```

```
Glu Asp Phe Tyr His Val Arg Ala Lys Ser Gln Val Ser Arg Ser Ile
225                 230                 235                 240

Lys Asn Met Asn Met Pro Val Gln Pro Glu Gly Asp Gly Lys Phe Ala
                245                 250                 255

Ile Thr Val Ser Lys Gly Gly Thr Glu Ser Gly Asn Lys Arg Ser Ala
            260                 265                 270

Glu Lys Glu Ala Phe Lys Lys Phe Leu Ser Asp Tyr Ala Ser Leu Asp
        275                 280                 285

Glu Arg Val Arg Asp Asp Met Leu Arg Arg Met Arg Arg Leu Val Val
    290                 295                 300

Leu Tyr Phe Tyr Gly Ser Asp Asp Ser Lys Leu Ser Asp Val Asn Glu
305                 310                 315                 320

Lys Phe Asp Val Trp Glu Asp His Ala Ala Arg Arg Val Asp Asn Arg
                325                 330                 335

Glu Phe Ile Lys Leu Pro Leu Glu Asn Lys Leu Ala Asn Gly Lys Thr
            340                 345                 350

Asp Lys Asp Ala Glu Arg Ile Arg Lys Asn Thr Val Lys Glu Leu Tyr
        355                 360                 365

Arg Asn Gln Asn Ile Gly Cys Tyr Arg Gln Ala Val Lys Ala Val Glu
    370                 375                 380

Glu Asp Asn Asn Gly Arg Tyr Phe Asp Asp Lys Met Leu Asn Met Phe
385                 390                 395                 400

Phe Ile His Arg Ile Glu Tyr Gly Val Glu Lys Ile Tyr Ala Asn Leu
                405                 410                 415

Lys Gln Val Thr Glu Phe Lys Ala Arg Thr Gly Tyr Leu Ser Glu Lys
```

```
            420                 425                 430

Ile Trp Lys Asp Leu Ile Asn Tyr Ile Ser Ile Lys Tyr Ile Ala Met
        435                 440                 445

Gly Lys Ala Val Tyr Asn Tyr Ala Met Asp Glu Leu Asn Ala Ser Asp
    450                 455                 460

Lys Lys Glu Ile Glu Leu Gly Lys Ile Ser Glu Glu Tyr Leu Ser Gly
465                 470                 475                 480

Ile Ser Ser Phe Asp Tyr Glu Leu Ile Lys Ala Glu Glu Met Leu Gln
                485                 490                 495

Arg Glu Thr Ala Val Tyr Val Ala Phe Ala Ala Arg His Leu Ser Ser
            500                 505                 510

Gln Thr Val Glu Leu Asp Ser Glu Asn Ser Asp Phe Leu Leu Leu Lys
        515                 520                 525

Pro Lys Gly Thr Met Asp Lys Asn Asp Lys Asn Lys Leu Ala Ser Asn
    530                 535                 540

Asn Ile Leu Asn Phe Leu Lys Asp Lys Glu Thr Leu Arg Asp Thr Ile
545                 550                 555                 560

Leu Gln Tyr Phe Gly Gly His Ser Leu Trp Thr Asp Phe Pro Phe Asp
                565                 570                 575

Lys Tyr Leu Ala Gly Gly Lys Asp Asp Val Asp Phe Leu Thr Asp Leu
            580                 585                 590

Lys Asp Val Ile Tyr Ser Met Arg Asn Asp Ser Phe His Tyr Ala Thr
        595                 600                 605

Glu Asn His Asn Asn Gly Lys Trp Asn Lys Glu Leu Ile Ser Ala Met
    610                 615                 620
```

```
Phe Glu His Glu Thr Glu Arg Met Thr Val Val Met Lys Asp Lys Phe
625                 630                 635                 640

Tyr Ser Asn Asn Leu Pro Met Phe Tyr Lys Asn Asp Asp Leu Lys Lys
                645                 650                 655

Leu Leu Ile Asp Leu Tyr Lys Asp Asn Val Glu Arg Ala Ser Gln Val
            660                 665                 670

Pro Ser Phe Asn Lys Val Phe Val Arg Lys Asn Phe Pro Ala Leu Val
        675                 680                 685

Arg Asp Lys Asp Asn Leu Gly Ile Glu Leu Asp Leu Lys Ala Asp Ala
    690                 695                 700

Asp Lys Gly Glu Asn Glu Leu Lys Phe Tyr Asn Ala Leu Tyr Tyr Met
705                 710                 715                 720

Phe Lys Glu Ile Tyr Tyr Asn Ala Phe Leu Asn Asp Lys Asn Val Arg
                725                 730                 735

Glu Arg Phe Ile Thr Lys Ala Thr Lys Val Ala Asp Asn Tyr Asp Arg
            740                 745                 750

Asn Lys Glu Arg Asn Leu Lys Asp Arg Ile Lys Ser Ala Gly Ser Asp
        755                 760                 765

Glu Lys Lys Lys Leu Arg Glu Gln Leu Gln Asn Tyr Ile Ala Glu Asn
    770                 775                 780

Asp Phe Gly Gln Arg Ile Lys Asn Ile Val Gln Val Asn Pro Asp Tyr
785                 790                 795                 800

Thr Leu Ala Gln Ile Cys Gln Leu Ile Met Thr Glu Tyr Asn Gln Gln
                805                 810                 815

Asn Asn Gly Cys Met Gln Lys Lys Ser Ala Ala Arg Lys Asp Ile Asn
```

```
            820                 825                 830

Lys Asp Ser Tyr Gln His Tyr Lys Met Leu Leu Leu Val Asn Leu Arg
        835                 840                 845

Lys Ala Phe Leu Glu Phe Ile Lys Glu Asn Tyr Ala Phe Val Leu Lys
    850                 855                 860

Pro Tyr Lys His Asp Leu Cys Asp Lys Ala Asp Phe Val Pro Asp Phe
865                 870                 875                 880

Ala Lys Tyr Val Lys Pro Tyr Ala Gly Leu Ile Ser Arg Val Ala Gly
                885                 890                 895

Ser Ser Glu Leu Gln Lys Trp Tyr Ile Val Ser Arg Phe Leu Ser Pro
            900                 905                 910

Ala Gln Ala Asn His Met Leu Gly Phe Leu His Ser Tyr Lys Gln Tyr
        915                 920                 925

Val Trp Asp Ile Tyr Arg Arg Ala Ser Glu Thr Gly Thr Glu Ile Asn
    930                 935                 940

His Ser Ile Ala Glu Asp Lys Ile Ala Gly Val Asp Ile Thr Asp Val
945                 950                 955                 960

Asp Ala Val Ile Asp Leu Ser Val Lys Leu Cys Gly Thr Ile Ser Ser
                965                 970                 975

Glu Ile Ser Asp Tyr Phe Lys Asp Asp Glu Val Tyr Ala Glu Tyr Ile
            980                 985                 990

Ser Ser Tyr Leu Asp Phe Glu Tyr  Asp Gly Gly Asn Tyr  Lys Asp Ser
        995                 1000                1005

Leu Asn  Arg Phe Cys Asn Ser  Asp Ala Val Asn Asp  Gln Lys Val
    1010                1015                1020
```

```
Ala Leu  Tyr Tyr Asp Gly Glu  His Pro Lys Leu Asn  Arg Asn Ile
    1025                1030                1035

Ile Leu  Ser Lys Leu Tyr Gly  Glu Arg Arg Phe Leu  Glu Lys Ile
    1040                1045                1050

Thr Asp  Arg Val Ser Arg Ser  Asp Ile Val Glu Tyr  Tyr Lys Leu
    1055                1060                1065

Lys Lys  Glu Thr Ser Gln Tyr  Gln Thr Lys Gly Ile  Phe Asp Ser
    1070                1075                1080

Glu Asp  Glu Gln Lys Asn Ile  Lys Lys Phe Gln Glu  Met Lys Asn
    1085                1090                1095

Ile Val  Glu Phe Arg Asp Leu  Met Asp Tyr Ser Glu  Ile Ala Asp
    1100                1105                1110

Glu Leu  Gln Gly Gln Leu Ile  Asn Trp Ile Tyr Leu  Arg Glu Arg
    1115                1120                1125

Asp Leu  Met Asn Phe Gln Leu  Gly Tyr His Tyr Ala  Cys Leu Asn
    1130                1135                1140

Asn Asp  Ser Asn Lys Gln Ala  Thr Tyr Val Thr Leu  Asp Tyr Gln
    1145                1150                1155

Gly Lys  Lys Asn Arg Lys Ile  Asn Gly Ala Ile Leu  Tyr Gln Ile
    1160                1165                1170

Cys Ala  Met Tyr Ile Asn Gly  Leu Pro Leu Tyr Tyr  Val Asp Lys
    1175                1180                1185

Asp Ser  Ser Glu Trp Thr Val  Ser Asp Gly Lys Glu  Ser Thr Gly
    1190                1195                1200

Ala Lys  Ile Gly Glu Phe Tyr  Arg Tyr Ala Lys Ser  Phe Glu Asn
```

```
    1205                1210                1215

Thr Ser  Asp Cys Tyr Ala Ser  Gly Leu Glu Ile Phe  Glu Asn Ile
    1220                1225                1230

Ser Glu  His Asp Asn Ile Thr  Glu Leu Arg Asn Tyr  Ile Glu His
    1235                1240                1245

Phe Arg  Tyr Tyr Ser Ser Phe  Asp Arg Ser Phe Leu  Gly Ile Tyr
    1250                1255                1260

Ser Glu  Val Phe Asp Arg Phe  Phe Thr Tyr Asp Leu  Lys Tyr Arg
    1265                1270                1275

Lys Asn  Val Pro Thr Ile Leu  Tyr Asn Ile Leu Leu  Gln His Phe
    1280                1285                1290

Val Asn  Val Arg Phe Glu Phe  Val Ser Gly Lys Lys  Met Ile Gly
    1295                1300                1305

Ile Asp  Lys Lys Asp Arg Lys  Ile Ala Lys Glu Lys  Glu Cys Ala
    1310                1315                1320

Arg Ile  Thr Ile Arg Glu Lys  Asn Gly Val Tyr Ser  Glu Gln Phe
    1325                1330                1335

Thr Tyr  Lys Leu Lys Asn Gly  Thr Val Tyr Val Asp  Ala Arg Asp
    1340                1345                1350

Lys Arg  Tyr Leu Gln Ser Ile  Ile Arg Leu Leu Phe  Tyr Pro Glu
    1355                1360                1365

Lys Val  Asn Met Asp Glu Met  Ile Glu Val Lys Glu  Lys Lys Lys
    1370                1375                1380

Pro Ser  Asp Asn Asn Thr Gly  Lys Gly Tyr Ser Lys  Arg Asp Arg
    1385                1390                1395
```

```
Gln Gln  Asp Arg Lys Glu Tyr  Asp Lys Tyr Lys Glu  Lys Lys Lys
    1400                1405                1410


Lys Glu  Gly Asn Phe Leu Ser  Gly Met Gly Gly Asn  Ile Asn Trp
    1415                1420                1425


Asp Glu  Ile Asn Ala Gln Leu  Lys Asn
    1430                1435
```

<210> 836
<211> 1385
<212> PRT
<213> Clostridium aminophilum

<400> 836

```
Met Lys Phe Ser Lys Val Asp His Thr Arg Ser Ala Val Gly Ile Gln
1               5                   10                  15


Lys Ala Thr Asp Ser Val His Gly Met Leu Tyr Thr Asp Pro Lys Lys
            20                  25                  30


Gln Glu Val Asn Asp Leu Asp Lys Arg Phe Asp Gln Leu Asn Val Lys
        35                  40                  45


Ala Lys Arg Leu Tyr Asn Val Phe Asn Gln Ser Lys Ala Glu Glu Asp
    50                  55                  60


Asp Asp Glu Lys Arg Phe Gly Lys Val Val Lys Lys Leu Asn Arg Glu
65                  70                  75                  80


Leu Lys Asp Leu Leu Phe His Arg Glu Val Ser Arg Tyr Asn Ser Ile
                85                  90                  95


Gly Asn Ala Lys Tyr Asn Tyr Tyr Gly Ile Lys Ser Asn Pro Glu Glu
            100                 105                 110


Ile Val Ser Asn Leu Gly Met Val Glu Ser Leu Lys Gly Glu Arg Asp
        115                 120                 125
```

```
Pro Gln Lys Val Ile Ser Lys Leu Leu Leu Tyr Tyr Leu Arg Lys Gly
    130                 135                 140

Leu Lys Pro Gly Thr Asp Gly Leu Arg Met Ile Leu Glu Ala Ser Cys
145                 150                 155                 160

Gly Leu Arg Lys Leu Ser Gly Asp Glu Lys Glu Leu Lys Val Phe Leu
                165                 170                 175

Gln Thr Leu Asp Glu Asp Phe Glu Lys Lys Thr Phe Lys Lys Asn Leu
            180                 185                 190

Ile Arg Ser Ile Glu Asn Gln Asn Met Ala Val Gln Pro Ser Asn Glu
        195                 200                 205

Gly Asp Pro Ile Ile Gly Ile Thr Gln Gly Arg Phe Asn Ser Gln Lys
    210                 215                 220

Asn Glu Glu Lys Ser Ala Ile Glu Arg Met Met Ser Met Tyr Ala Asp
225                 230                 235                 240

Leu Asn Glu Asp His Arg Glu Asp Val Leu Arg Lys Leu Arg Arg Leu
                245                 250                 255

Asn Val Leu Tyr Phe Asn Val Asp Thr Glu Lys Thr Glu Glu Pro Thr
            260                 265                 270

Leu Pro Gly Glu Val Asp Thr Asn Pro Val Phe Glu Val Trp His Asp
        275                 280                 285

His Glu Lys Gly Lys Glu Asn Asp Arg Gln Phe Ala Thr Phe Ala Lys
    290                 295                 300

Ile Leu Thr Glu Asp Arg Glu Thr Arg Lys Lys Glu Lys Leu Ala Val
305                 310                 315                 320
```

```
Lys Glu Ala Leu Asn Asp Leu Lys Ser Ala Ile Arg Asp His Asn Ile
                325                 330                 335

Met Ala Tyr Arg Cys Ser Ile Lys Val Thr Glu Gln Asp Lys Asp Gly
            340                 345                 350

Leu Phe Phe Glu Asp Gln Arg Ile Asn Arg Phe Trp Ile His His Ile
        355                 360                 365

Glu Ser Ala Val Glu Arg Ile Leu Ala Ser Ile Asn Pro Glu Lys Leu
    370                 375                 380

Tyr Lys Leu Arg Ile Gly Tyr Leu Gly Glu Lys Val Trp Lys Asp Leu
385                 390                 395                 400

Leu Asn Tyr Leu Ser Ile Lys Tyr Ile Ala Val Gly Lys Ala Val Phe
                405                 410                 415

His Phe Ala Met Glu Asp Leu Gly Lys Thr Gly Gln Asp Ile Glu Leu
            420                 425                 430

Gly Lys Leu Ser Asn Ser Val Ser Gly Gly Leu Thr Ser Phe Asp Tyr
        435                 440                 445

Glu Gln Ile Arg Ala Asp Glu Thr Leu Gln Arg Gln Leu Ser Val Glu
    450                 455                 460

Val Ala Phe Ala Ala Asn Asn Leu Phe Arg Ala Val Val Gly Gln Thr
465                 470                 475                 480

Gly Lys Lys Ile Glu Gln Ser Lys Ser Glu Glu Asn Glu Glu Asp Phe
                485                 490                 495

Leu Leu Trp Lys Ala Glu Lys Ile Ala Glu Ser Ile Lys Lys Glu Gly
            500                 505                 510

Glu Gly Asn Thr Leu Lys Ser Ile Leu Gln Phe Phe Gly Gly Ala Ser
        515                 520                 525
```

```
Ser Trp Asp Leu Asn His Phe Cys Ala Ala Tyr Gly Asn Glu Ser Ser
    530                 535                 540

Ala Leu Gly Tyr Glu Thr Lys Phe Ala Asp Asp Leu Arg Lys Ala Ile
545                 550                 555                 560

Tyr Ser Leu Arg Asn Glu Thr Phe His Phe Thr Thr Leu Asn Lys Gly
                565                 570                 575

Ser Phe Asp Trp Asn Ala Lys Leu Ile Gly Asp Met Phe Ser His Glu
            580                 585                 590

Ala Ala Thr Gly Ile Ala Val Glu Arg Thr Arg Phe Tyr Ser Asn Asn
        595                 600                 605

Leu Pro Met Phe Tyr Arg Glu Ser Asp Leu Lys Arg Ile Met Asp His
    610                 615                 620

Leu Tyr Asn Thr Tyr His Pro Arg Ala Ser Gln Val Pro Ser Phe Asn
625                 630                 635                 640

Ser Val Phe Val Arg Lys Asn Phe Arg Leu Phe Leu Ser Asn Thr Leu
                645                 650                 655

Asn Thr Asn Thr Ser Phe Asp Thr Glu Val Tyr Gln Lys Trp Glu Ser
            660                 665                 670

Gly Val Tyr Tyr Leu Phe Lys Glu Ile Tyr Tyr Asn Ser Phe Leu Pro
        675                 680                 685

Ser Gly Asp Ala His His Leu Phe Phe Glu Gly Leu Arg Arg Ile Arg
    690                 695                 700

Lys Glu Ala Asp Asn Leu Pro Ile Val Gly Lys Glu Ala Lys Lys Arg
705                 710                 715                 720
```

```
Asn Ala Val Gln Asp Phe Gly Arg Arg Cys Asp Glu Leu Lys Asn Leu
                725                 730                 735

Ser Leu Ser Ala Ile Cys Gln Met Ile Met Thr Glu Tyr Asn Glu Gln
            740                 745                 750

Asn Asn Gly Asn Arg Lys Val Lys Ser Thr Arg Glu Asp Lys Arg Lys
        755                 760                 765

Pro Asp Ile Phe Gln His Tyr Lys Met Leu Leu Leu Arg Thr Leu Gln
    770                 775                 780

Glu Ala Phe Ala Ile Tyr Ile Arg Arg Glu Glu Phe Lys Phe Ile Phe
785                 790                 795                 800

Asp Leu Pro Lys Thr Leu Tyr Val Met Lys Pro Val Glu Glu Phe Leu
                805                 810                 815

Pro Asn Trp Lys Ser Gly Met Phe Asp Ser Leu Val Glu Arg Val Lys
            820                 825                 830

Gln Ser Pro Asp Leu Gln Arg Trp Tyr Val Leu Cys Lys Phe Leu Asn
        835                 840                 845

Gly Arg Leu Leu Asn Gln Leu Ser Gly Val Ile Arg Ser Tyr Ile Gln
    850                 855                 860

Phe Ala Gly Asp Ile Gln Arg Arg Ala Lys Ala Asn His Asn Arg Leu
865                 870                 875                 880

Tyr Met Asp Asn Thr Gln Arg Val Glu Tyr Tyr Ser Asn Val Leu Glu
                885                 890                 895

Val Val Asp Phe Cys Ile Lys Gly Thr Ser Arg Phe Ser Asn Val Phe
            900                 905                 910

Ser Asp Tyr Phe Arg Asp Glu Asp Ala Tyr Ala Asp Tyr Leu Asp Asn
        915                 920                 925
```

```
Tyr Leu Gln Phe Lys Asp Glu Lys Ile Ala Glu Val Ser Ser Phe Ala
    930                 935                 940

Ala Leu Lys Thr Phe Cys Asn Glu Glu Glu Val Lys Ala Gly Ile Tyr
945                 950                 955                 960

Met Asp Gly Glu Asn Pro Val Met Gln Arg Asn Ile Val Met Ala Lys
                965                 970                 975

Leu Phe Gly Pro Asp Glu Val Leu Lys Asn Val Val Pro Lys Val Thr
            980                 985                 990

Arg Glu Glu Ile Glu Glu Tyr Tyr  Gln Leu Glu Lys Gln  Ile Ala Pro
        995                 1000                1005

Tyr Arg  Gln Asn Gly Tyr Cys  Lys Ser Glu Glu Asp  Gln Lys Lys
    1010                1015                1020

Leu Leu  Arg Phe Gln Arg Ile  Lys Asn Arg Val Glu  Phe Gln Thr
    1025                1030                1035

Ile Thr  Glu Phe Ser Glu Ile  Ile Asn Glu Leu Leu  Gly Gln Leu
    1040                1045                1050

Ile Ser  Trp Ser Phe Leu Arg  Glu Arg Asp Leu Leu  Tyr Phe Gln
    1055                1060                1065

Leu Gly  Phe His Tyr Leu Cys  Leu His Asn Asp Thr  Glu Lys Pro
    1070                1075                1080

Ala Glu  Tyr Lys Glu Ile Ser  Arg Glu Asp Gly Thr  Val Ile Arg
    1085                1090                1095

Asn Ala  Ile Leu His Gln Val  Ala Ala Met Tyr Val  Gly Gly Leu
    1100                1105                1110
```

```
Pro Val  Tyr Thr Leu Ala Asp  Lys Lys Leu Ala Ala  Phe Glu Lys
    1115                1120                1125

Gly Glu  Ala Asp Cys Lys Leu  Ser Ile Ser Lys Asp  Thr Ala Gly
    1130                1135                1140

Ala Gly  Lys Lys Ile Lys Asp  Phe Phe Arg Tyr Ser  Lys Tyr Val
    1145                1150                1155

Leu Ile  Lys Asp Arg Met Leu  Thr Asp Gln Asn Gln  Lys Tyr Thr
    1160                1165                1170

Ile Tyr  Leu Ala Gly Leu Glu  Leu Phe Glu Asn Thr  Asp Glu His
    1175                1180                1185

Asp Asn  Ile Thr Asp Val Arg  Lys Tyr Val Asp His  Phe Lys Tyr
    1190                1195                1200

Tyr Ala  Thr Ser Asp Glu Asn  Ala Met Ser Ile Leu  Asp Leu Tyr
    1205                1210                1215

Ser Glu  Ile His Asp Arg Phe  Phe Thr Tyr Asp Met  Lys Tyr Gln
    1220                1225                1230

Lys Asn  Val Ala Asn Met Leu  Glu Asn Ile Leu Leu  Arg His Phe
    1235                1240                1245

Val Leu  Ile Arg Pro Glu Phe  Phe Thr Gly Ser Lys  Lys Val Gly
    1250                1255                1260

Glu Gly  Lys Lys Ile Thr Cys  Lys Ala Arg Ala Gln  Ile Glu Ile
    1265                1270                1275

Ala Glu  Asn Gly Met Arg Ser  Glu Asp Phe Thr Tyr  Lys Leu Ser
    1280                1285                1290

Asp Gly  Lys Lys Asn Ile Ser  Thr Cys Met Ile Ala  Ala Arg Asp
    1295                1300                1305
```

```
Gln Lys  Tyr Leu Asn Thr Val  Ala Arg Leu Leu Tyr  Tyr Pro His
    1310                1315                1320


Glu Ala  Lys Lys Ser Ile Val  Asp Thr Arg Glu Lys  Lys Asn Asn
    1325                1330                1335


Lys Lys  Thr Asn Arg Gly Asp  Gly Thr Phe Asn Lys  Gln Lys Gly
    1340                1345                1350


Thr Ala  Arg Lys Glu Lys Asp  Asn Gly Pro Arg Glu  Phe Asn Asp
    1355                1360                1365


Thr Gly  Phe Ser Asn Thr Pro  Phe Ala Gly Phe Asp  Pro Phe Arg
    1370                1375                1380


Asn Ser
    1385
```

<210> 837
<211> 1334
<212> PRT
<213> unknown

<220>
<223> Synthetic Sequence

<400> 837

```
Met Lys Ile Ser Lys Val Asp His Thr Arg Met Ala Val Ala Lys Gly
1               5                   10                  15


Asn Gln His Arg Arg Asp Glu Ile Ser Gly Ile Leu Tyr Lys Asp Pro
            20                  25                  30


Thr Lys Thr Gly Ser Ile Asp Phe Asp Glu Arg Phe Lys Lys Leu Asn
        35                  40                  45


Cys Ser Ala Lys Ile Leu Tyr His Val Phe Asn Gly Ile Ala Glu Gly
    50                  55                  60
```

```
Ser Asn Lys Tyr Lys Asn Ile Val Asp Lys Val Asn Asn Asn Leu Asp
65                  70                  75                  80

Arg Val Leu Phe Thr Gly Lys Ser Tyr Asp Arg Lys Ser Ile Ile Asp
                85                  90                  95

Ile Asp Thr Val Leu Arg Asn Val Glu Lys Ile Asn Ala Phe Asp Arg
            100                 105                 110

Ile Ser Thr Glu Glu Arg Glu Gln Ile Ile Asp Asp Leu Leu Glu Ile
        115                 120                 125

Gln Leu Arg Lys Gly Leu Arg Lys Gly Lys Ala Gly Leu Arg Glu Val
    130                 135                 140

Leu Leu Ile Gly Ala Gly Val Ile Val Arg Thr Asp Lys Lys Gln Glu
145                 150                 155                 160

Ile Ala Asp Phe Leu Glu Ile Leu Asp Glu Asp Phe Asn Lys Thr Asn
                165                 170                 175

Gln Ala Lys Asn Ile Lys Leu Ser Ile Glu Asn Gln Gly Leu Val Val
            180                 185                 190

Ser Pro Val Ser Arg Gly Glu Glu Arg Ile Phe Asp Val Ser Gly Ala
        195                 200                 205

Gln Lys Gly Lys Ser Ser Lys Lys Ala Gln Glu Lys Glu Ala Leu Ser
    210                 215                 220

Ala Phe Leu Leu Asp Tyr Ala Asp Leu Asp Lys Asn Val Arg Phe Glu
225                 230                 235                 240

Tyr Leu Arg Lys Ile Arg Arg Leu Ile Asn Leu Tyr Phe Tyr Val Lys
                245                 250                 255
```

```
Asn Asp Asp Val Met Ser Leu Thr Glu Ile Pro Ala Glu Val Asn Leu
            260                 265                 270

Glu Lys Asp Phe Asp Ile Trp Arg Asp His Glu Gln Arg Lys Glu Glu
        275                 280                 285

Asn Gly Asp Phe Val Gly Cys Pro Asp Ile Leu Leu Ala Asp Arg Asp
    290                 295                 300

Val Lys Lys Ser Asn Ser Lys Gln Val Lys Ile Ala Glu Arg Gln Leu
305                 310                 315                 320

Arg Glu Ser Ile Arg Glu Lys Asn Ile Lys Arg Tyr Arg Phe Ser Ile
                325                 330                 335

Lys Thr Ile Glu Lys Asp Asp Gly Thr Tyr Phe Phe Ala Asn Lys Gln
            340                 345                 350

Ile Ser Val Phe Trp Ile His Arg Ile Glu Asn Ala Val Glu Arg Ile
        355                 360                 365

Leu Gly Ser Ile Asn Asp Lys Lys Leu Tyr Arg Leu Arg Leu Gly Tyr
    370                 375                 380

Leu Gly Glu Lys Val Trp Lys Asp Ile Leu Asn Phe Leu Ser Ile Lys
385                 390                 395                 400

Tyr Ile Ala Val Gly Lys Ala Val Phe Asn Phe Ala Met Asp Asp Leu
                405                 410                 415

Gln Glu Lys Asp Arg Asp Ile Glu Pro Gly Lys Ile Ser Glu Asn Ala
            420                 425                 430

Val Asn Gly Leu Thr Ser Phe Asp Tyr Glu Gln Ile Lys Ala Asp Glu
        435                 440                 445

Met Leu Gln Arg Glu Val Ala Val Asn Val Ala Phe Ala Ala Asn Asn
    450                 455                 460
```

```
Leu Ala Arg Val Thr Val Asp Ile Pro Gln Asn Gly Glu Lys Glu Asp
465                 470                 475                 480

Ile Leu Leu Trp Asn Lys Ser Asp Ile Lys Lys Tyr Lys Lys Asn Ser
                485                 490                 495

Lys Lys Gly Ile Leu Lys Ser Ile Leu Gln Phe Phe Gly Gly Ala Ser
            500                 505                 510

Thr Trp Asn Met Lys Met Phe Glu Ile Ala Tyr His Asp Gln Pro Gly
        515                 520                 525

Asp Tyr Glu Glu Asn Tyr Leu Tyr Asp Ile Ile Gln Ile Ile Tyr Ser
    530                 535                 540

Leu Arg Asn Lys Ser Phe His Phe Lys Thr Tyr Asp His Gly Asp Lys
545                 550                 555                 560

Asn Trp Asn Arg Glu Leu Ile Gly Lys Met Ile Glu His Asp Ala Glu
                565                 570                 575

Arg Val Ile Ser Val Glu Arg Glu Lys Phe His Ser Asn Asn Leu Pro
            580                 585                 590

Met Phe Tyr Lys Asp Ala Asp Leu Lys Lys Ile Leu Asp Leu Leu Tyr
        595                 600                 605

Ser Asp Tyr Ala Gly Arg Ala Ser Gln Val Pro Ala Phe Asn Thr Val
    610                 615                 620

Leu Val Arg Lys Asn Phe Pro Glu Phe Leu Arg Lys Asp Met Gly Tyr
625                 630                 635                 640

Lys Val His Phe Asn Asn Pro Glu Val Glu Asn Gln Trp His Ser Ala
                645                 650                 655
```

```
Val Tyr Tyr Leu Tyr Lys Glu Ile Tyr Tyr Asn Leu Phe Leu Arg Asp
            660                 665                 670

Lys Glu Val Lys Asn Leu Phe Tyr Thr Ser Leu Lys Asn Ile Arg Ser
        675                 680                 685

Glu Val Ser Asp Lys Lys Gln Lys Leu Ala Ser Asp Asp Phe Ala Ser
    690                 695                 700

Arg Cys Glu Glu Ile Glu Asp Arg Ser Leu Pro Glu Ile Cys Gln Ile
705                 710                 715                 720

Ile Met Thr Glu Tyr Asn Ala Gln Asn Phe Gly Asn Arg Lys Val Lys
                725                 730                 735

Ser Gln Arg Val Ile Glu Lys Asn Lys Asp Ile Phe Arg His Tyr Lys
            740                 745                 750

Met Leu Leu Ile Lys Thr Leu Ala Gly Ala Phe Ser Leu Tyr Leu Lys
        755                 760                 765

Gln Glu Arg Phe Ala Phe Ile Gly Lys Ala Thr Pro Ile Pro Tyr Glu
    770                 775                 780

Thr Thr Asp Val Lys Asn Phe Leu Pro Glu Trp Lys Ser Gly Met Tyr
785                 790                 795                 800

Ala Ser Phe Val Glu Glu Ile Lys Asn Asn Leu Asp Leu Gln Glu Trp
                805                 810                 815

Tyr Ile Val Gly Arg Phe Leu Asn Gly Arg Met Leu Asn Gln Leu Ala
            820                 825                 830

Gly Ser Leu Arg Ser Tyr Ile Gln Tyr Ala Glu Asp Ile Glu Arg Arg
        835                 840                 845

Ala Ala Glu Asn Arg Asn Lys Leu Phe Ser Lys Pro Asp Glu Lys Ile
    850                 855                 860
```

```
Glu Ala Cys Lys Lys Ala Val Arg Val Leu Asp Leu Cys Ile Lys Ile
865                 870                 875                 880


Ser Thr Arg Ile Ser Ala Glu Phe Thr Asp Tyr Phe Asp Ser Glu Asp
                885                 890                 895


Asp Tyr Ala Asp Tyr Leu Glu Lys Tyr Leu Lys Tyr Gln Asp Asp Ala
            900                 905                 910


Ile Lys Glu Leu Ser Gly Ser Ser Tyr Ala Ala Leu Asp His Phe Cys
        915                 920                 925


Asn Lys Asp Asp Leu Lys Phe Asp Ile Tyr Val Asn Ala Gly Gln Lys
    930                 935                 940


Pro Ile Leu Gln Arg Asn Ile Val Met Ala Lys Leu Phe Gly Pro Asp
945                 950                 955                 960


Asn Ile Leu Ser Glu Val Met Glu Lys Val Thr Glu Ser Ala Ile Arg
                965                 970                 975


Glu Tyr Tyr Asp Tyr Leu Lys Lys Val Ser Gly Tyr Arg Val Arg Gly
            980                 985                 990


Lys Cys Ser Thr Glu Lys Glu Gln  Glu Asp Leu Leu Lys  Phe Gln Arg
        995                 1000                1005


Leu Lys  Asn Ala Val Glu Phe  Arg Asp Val Thr Glu  Tyr Ala Glu
    1010                1015                1020


Val Ile  Asn Glu Leu Leu Gly  Gln Leu Ile Ser Trp  Ser Tyr Leu
    1025                1030                1035


Arg Glu  Arg Asp Leu Leu Tyr  Phe Gln Leu Gly Phe  His Tyr Met
    1040                1045                1050
```

```
Cys Leu  Lys Asn Lys Ser Phe  Lys Pro Ala Glu Tyr  Val Asp Ile
    1055                1060                1065

Arg Arg  Asn Asn Gly Thr Ile  Ile His Asn Ala Ile  Leu Tyr Gln
    1070                1075                1080

Ile Val  Ser Met Tyr Ile Asn  Gly Leu Asp Phe Tyr  Ser Cys Asp
    1085                1090                1095

Lys Glu  Gly Lys Thr Leu Lys  Pro Ile Glu Thr Gly  Lys Gly Val
    1100                1105                1110

Gly Ser  Lys Ile Gly Gln Phe  Ile Lys Tyr Ser Gln  Tyr Leu Tyr
    1115                1120                1125

Asn Asp  Pro Ser Tyr Lys Leu  Glu Ile Tyr Asn Ala  Gly Leu Glu
    1130                1135                1140

Val Phe  Glu Asn Ile Asp Glu  His Asp Asn Ile Thr  Asp Leu Arg
    1145                1150                1155

Lys Tyr  Val Asp His Phe Lys  Tyr Tyr Ala Tyr Gly  Asn Lys Met
    1160                1165                1170

Ser Leu  Leu Asp Leu Tyr Ser  Glu Phe Phe Asp Arg  Phe Phe Thr
    1175                1180                1185

Tyr Asp  Met Lys Tyr Gln Lys  Asn Val Val Asn Val  Leu Glu Asn
    1190                1195                1200

Ile Leu  Leu Arg His Phe Val  Ile Phe Tyr Pro Lys  Phe Gly Ser
    1205                1210                1215

Gly Lys  Lys Asp Val Gly Ile  Arg Asp Cys Lys Lys  Glu Arg Ala
    1220                1225                1230

Gln Ile  Glu Ile Ser Glu Gln  Ser Leu Thr Ser Glu  Asp Phe Met
    1235                1240                1245
```

```
Phe Lys  Leu Asp Asp Lys Ala  Gly Glu Glu Ala Lys  Lys Phe Pro
    1250                1255                1260


Ala Arg  Asp Glu Arg Tyr Leu  Gln Thr Ile Ala Lys  Leu Leu Tyr
    1265                1270                1275


Tyr Pro  Asn Glu Ile Glu Asp  Met Asn Arg Phe Met  Lys Lys Gly
    1280                1285                1290


Glu Thr  Ile Asn Lys Lys Val  Gln Phe Asn Arg Lys  Lys Lys Ile
    1295                1300                1305


Thr Arg  Lys Gln Lys Asn Asn  Ser Ser Asn Glu Val  Leu Ser Ser
    1310                1315                1320


Thr Met  Gly Tyr Leu Phe Lys  Asn Ile Lys Leu
    1325                1330
```

<210> 838
<211> 1175
<212> PRT
<213> Carnobacterium gallinarum

<400> 838

```
Met Arg Ile Thr Lys Val Lys Ile Lys Leu Asp Asn Lys Leu Tyr Gln
1               5                   10                  15


Val Thr Met Gln Lys Glu Glu Lys Tyr Gly Thr Leu Lys Leu Asn Glu
            20                  25                  30


Glu Ser Arg Lys Ser Thr Ala Glu Ile Leu Arg Leu Lys Lys Ala Ser
        35                  40                  45


Phe Asn Lys Ser Phe His Ser Lys Thr Ile Asn Ser Gln Lys Glu Asn
    50                  55                  60


Lys Asn Ala Thr Ile Lys Lys Asn Gly Asp Tyr Ile Ser Gln Ile Phe
```

```
65                  70                  75                  80

Glu Lys Leu Val Gly Val Asp Thr Asn Lys Asn Ile Arg Lys Pro Lys
                85                  90                  95

Met Ser Leu Thr Asp Leu Lys Asp Leu Pro Lys Lys Asp Leu Ala Leu
            100                 105                 110

Phe Ile Lys Arg Lys Phe Lys Asn Asp Asp Ile Val Glu Ile Lys Asn
        115                 120                 125

Leu Asp Leu Ile Ser Leu Phe Tyr Asn Ala Leu Gln Lys Val Pro Gly
    130                 135                 140

Glu His Phe Thr Asp Glu Ser Trp Ala Asp Phe Cys Gln Glu Met Met
145                 150                 155                 160

Pro Tyr Arg Glu Tyr Lys Asn Lys Phe Ile Glu Arg Lys Ile Ile Leu
                165                 170                 175

Leu Ala Asn Ser Ile Glu Gln Asn Lys Gly Phe Ser Ile Asn Pro Glu
            180                 185                 190

Thr Phe Ser Lys Arg Lys Arg Val Leu His Gln Trp Ala Ile Glu Val
        195                 200                 205

Gln Glu Arg Gly Asp Phe Ser Ile Leu Asp Glu Lys Leu Ser Lys Leu
    210                 215                 220

Ala Glu Ile Tyr Asn Phe Lys Lys Met Cys Lys Arg Val Gln Asp Glu
225                 230                 235                 240

Leu Asn Asp Leu Glu Lys Ser Met Lys Lys Gly Lys Asn Pro Glu Lys
                245                 250                 255

Glu Lys Glu Ala Tyr Lys Lys Gln Lys Asn Phe Lys Ile Lys Thr Ile
            260                 265                 270
```

```
Trp Lys Asp Tyr Pro Tyr Lys Thr His Ile Gly Leu Ile Glu Lys Ile
        275                 280                 285

Lys Glu Asn Glu Glu Leu Asn Gln Phe Asn Ile Glu Ile Gly Lys Tyr
    290                 295                 300

Phe Glu His Tyr Phe Pro Ile Lys Lys Glu Arg Cys Thr Glu Asp Glu
305                 310                 315                 320

Pro Tyr Tyr Leu Asn Ser Glu Thr Ile Ala Thr Thr Val Asn Tyr Gln
                325                 330                 335

Leu Lys Asn Ala Leu Ile Ser Tyr Leu Met Gln Ile Gly Lys Tyr Lys
            340                 345                 350

Gln Phe Gly Leu Glu Asn Gln Val Leu Asp Ser Lys Lys Leu Gln Glu
        355                 360                 365

Ile Gly Ile Tyr Glu Gly Phe Gln Thr Lys Phe Met Asp Ala Cys Val
    370                 375                 380

Phe Ala Thr Ser Ser Leu Lys Asn Ile Ile Glu Pro Met Arg Ser Gly
385                 390                 395                 400

Asp Ile Leu Gly Lys Arg Glu Phe Lys Glu Ala Ile Ala Thr Ser Ser
                405                 410                 415

Phe Val Asn Tyr His His Phe Phe Pro Tyr Phe Pro Phe Glu Leu Lys
            420                 425                 430

Gly Met Lys Asp Arg Glu Ser Glu Leu Ile Pro Phe Gly Glu Gln Thr
        435                 440                 445

Glu Ala Lys Gln Met Gln Asn Ile Trp Ala Leu Arg Gly Ser Val Gln
    450                 455                 460

Gln Ile Arg Asn Glu Ile Phe His Ser Phe Asp Lys Asn Gln Lys Phe
```

```
465                 470                 475                 480

Asn Leu Pro Gln Leu Asp Lys Ser Asn Phe Glu Phe Asp Ala Ser Glu
                485                 490                 495

Asn Ser Thr Gly Lys Ser Gln Ser Tyr Ile Glu Thr Asp Tyr Lys Phe
            500                 505                 510

Leu Phe Glu Ala Glu Lys Asn Gln Leu Glu Gln Phe Phe Ile Glu Arg
        515                 520                 525

Ile Lys Ser Ser Gly Ala Leu Glu Tyr Tyr Pro Leu Lys Ser Leu Glu
    530                 535                 540

Lys Leu Phe Ala Lys Lys Glu Met Lys Phe Ser Leu Gly Ser Gln Val
545                 550                 555                 560

Val Ala Phe Ala Pro Ser Tyr Lys Lys Leu Val Lys Lys Gly His Ser
                565                 570                 575

Tyr Gln Thr Ala Thr Glu Gly Thr Ala Asn Tyr Leu Gly Leu Ser Tyr
            580                 585                 590

Tyr Asn Arg Tyr Glu Leu Lys Glu Glu Ser Phe Gln Ala Gln Tyr Tyr
        595                 600                 605

Leu Leu Lys Leu Ile Tyr Gln Tyr Val Phe Leu Pro Asn Phe Ser Gln
    610                 615                 620

Gly Asn Ser Pro Ala Phe Arg Glu Thr Val Lys Ala Ile Leu Arg Ile
625                 630                 635                 640

Asn Lys Asp Glu Ala Arg Lys Lys Met Lys Lys Asn Lys Lys Phe Leu
                645                 650                 655

Arg Lys Tyr Ala Phe Glu Gln Val Arg Glu Met Glu Phe Lys Glu Thr
            660                 665                 670
```

```
Pro Asp Gln Tyr Met Ser Tyr Leu Gln Ser Glu Met Arg Glu Glu Lys
        675                 680                 685

Val Arg Lys Ala Glu Lys Asn Asp Lys Gly Phe Glu Lys Asn Ile Thr
    690                 695                 700

Met Asn Phe Glu Lys Leu Leu Met Gln Ile Phe Val Lys Gly Phe Asp
705                 710                 715                 720

Val Phe Leu Thr Thr Phe Ala Gly Lys Glu Leu Leu Leu Ser Ser Glu
                725                 730                 735

Glu Lys Val Ile Lys Glu Thr Glu Ile Ser Leu Ser Lys Lys Ile Asn
            740                 745                 750

Glu Arg Glu Lys Thr Leu Lys Ala Ser Ile Gln Val Glu His Gln Leu
        755                 760                 765

Val Ala Thr Asn Ser Ala Ile Ser Tyr Trp Leu Phe Cys Lys Leu Leu
    770                 775                 780

Asp Ser Arg His Leu Asn Glu Leu Arg Asn Glu Met Ile Lys Phe Lys
785                 790                 795                 800

Gln Ser Arg Ile Lys Phe Asn His Thr Gln His Ala Glu Leu Ile Gln
                805                 810                 815

Asn Leu Leu Pro Ile Val Glu Leu Thr Ile Leu Ser Asn Asp Tyr Asp
            820                 825                 830

Glu Lys Asn Asp Ser Gln Asn Val Asp Val Ser Ala Tyr Phe Glu Asp
        835                 840                 845

Lys Ser Leu Tyr Glu Thr Ala Pro Tyr Val Gln Thr Asp Asp Arg Thr
    850                 855                 860

Arg Val Ser Phe Arg Pro Ile Leu Lys Leu Glu Lys Tyr His Thr Lys
```

```
865                 870                 875                 880

Ser Leu Ile Glu Ala Leu Leu Lys Asp Asn Pro Gln Phe Arg Val Ala
                885                 890                 895

Ala Thr Asp Ile Gln Glu Trp Met His Lys Arg Glu Glu Ile Gly Glu
            900                 905                 910

Leu Val Glu Lys Arg Lys Asn Leu His Thr Glu Trp Ala Glu Gly Gln
        915                 920                 925

Gln Thr Leu Gly Ala Glu Lys Arg Glu Glu Tyr Arg Asp Tyr Cys Lys
    930                 935                 940

Lys Ile Asp Arg Phe Asn Trp Lys Ala Asn Lys Val Thr Leu Thr Tyr
945                 950                 955                 960

Leu Ser Gln Leu His Tyr Leu Ile Thr Asp Leu Leu Gly Arg Met Val
                965                 970                 975

Gly Phe Ser Ala Leu Phe Glu Arg Asp Leu Val Tyr Phe Ser Arg Ser
            980                 985                 990

Phe Ser Glu Leu Gly Gly Glu Thr  Tyr His Ile Ser Asp  Tyr Lys Asn
        995                 1000                1005

Leu Ser  Gly Val Leu Arg Leu  Asn Ala Glu Val Lys  Pro Ile Lys
    1010                1015                1020

Ile Lys  Asn Ile Lys Val Ile  Asp Asn Glu Glu Asn  Pro Tyr Lys
    1025                1030                1035

Gly Asn  Glu Pro Glu Val Lys  Pro Phe Leu Asp Arg  Leu His Ala
    1040                1045                1050

Tyr Leu  Glu Asn Val Ile Gly  Ile Lys Ala Val His  Gly Lys Ile
    1055                1060                1065
```

```
Arg Asn  Gln Thr Ala His Leu  Ser Val Leu Gln Leu  Glu Leu Ser
    1070                1075                1080


Met Ile  Glu Ser Met Asn Asn  Leu Arg Asp Leu Met  Ala Tyr Asp
    1085                1090                1095


Arg Lys  Leu Lys Asn Ala Val  Thr Lys Ser Met Ile  Lys Ile Leu
    1100                1105                1110


Asp Lys  His Gly Met Ile Leu  Lys Leu Lys Ile Asp  Glu Asn His
    1115                1120                1125


Lys Asn  Phe Glu Ile Glu Ser  Leu Ile Pro Lys Glu  Ile Ile His
    1130                1135                1140


Leu Lys  Asp Lys Ala Ile Lys  Thr Asn Gln Val Ser  Glu Glu Tyr
    1145                1150                1155


Cys Gln  Leu Val Leu Ala Leu  Leu Thr Thr Asn Pro  Gly Asn Gln
    1160                1165                1170


Leu Asn
    1175
```

<210> 839
<211> 1154
<212> PRT
<213> Paludibacter propionicigenes

<400> 839

```
Met Arg Val Ser Lys Val Lys Val Lys Asp Gly Gly Lys Asp Lys Met
1               5                   10                  15


Val Leu Val His Arg Lys Thr Thr Gly Ala Gln Leu Val Tyr Ser Gly
            20                  25                  30


Gln Pro Val Ser Asn Glu Thr Ser Asn Ile Leu Pro Glu Lys Lys Arg
        35                  40                  45
```

```
Gln Ser Phe Asp Leu Ser Thr Leu Asn Lys Thr Ile Ile Lys Phe Asp
    50                  55                  60

Thr Ala Lys Lys Gln Lys Leu Asn Val Asp Gln Tyr Lys Ile Val Glu
65                  70                  75                  80

Lys Ile Phe Lys Tyr Pro Lys Gln Glu Leu Pro Lys Gln Ile Lys Ala
                85                  90                  95

Glu Glu Ile Leu Pro Phe Leu Asn His Lys Phe Gln Glu Pro Val Lys
            100                 105                 110

Tyr Trp Lys Asn Gly Lys Glu Glu Ser Phe Asn Leu Thr Leu Leu Ile
        115                 120                 125

Val Glu Ala Val Gln Ala Gln Asp Lys Arg Lys Leu Gln Pro Tyr Tyr
    130                 135                 140

Asp Trp Lys Thr Trp Tyr Ile Gln Thr Lys Ser Asp Leu Leu Lys Lys
145                 150                 155                 160

Ser Ile Glu Asn Asn Arg Ile Asp Leu Thr Glu Asn Leu Ser Lys Arg
                165                 170                 175

Lys Lys Ala Leu Leu Ala Trp Glu Thr Glu Phe Thr Ala Ser Gly Ser
            180                 185                 190

Ile Asp Leu Thr His Tyr His Lys Val Tyr Met Thr Asp Val Leu Cys
        195                 200                 205

Lys Met Leu Gln Asp Val Lys Pro Leu Thr Asp Asp Lys Gly Lys Ile
    210                 215                 220

Asn Thr Asn Ala Tyr His Arg Gly Leu Lys Lys Ala Leu Gln Asn His
225                 230                 235                 240
```

```
Gln Pro Ala Ile Phe Gly Thr Arg Glu Val Pro Asn Glu Ala Asn Arg
                245                 250                 255

Ala Asp Asn Gln Leu Ser Ile Tyr His Leu Glu Val Val Lys Tyr Leu
            260                 265                 270

Glu His Tyr Phe Pro Ile Lys Thr Ser Lys Arg Arg Asn Thr Ala Asp
        275                 280                 285

Asp Ile Ala His Tyr Leu Lys Ala Gln Thr Leu Lys Thr Thr Ile Glu
    290                 295                 300

Lys Gln Leu Val Asn Ala Ile Arg Ala Asn Ile Ile Gln Gln Gly Lys
305                 310                 315                 320

Thr Asn His His Glu Leu Lys Ala Asp Thr Thr Ser Asn Asp Leu Ile
                325                 330                 335

Arg Ile Lys Thr Asn Glu Ala Phe Val Leu Asn Leu Thr Gly Thr Cys
            340                 345                 350

Ala Phe Ala Ala Asn Asn Ile Arg Asn Met Val Asp Asn Glu Gln Thr
        355                 360                 365

Asn Asp Ile Leu Gly Lys Gly Asp Phe Ile Lys Ser Leu Leu Lys Asp
    370                 375                 380

Asn Thr Asn Ser Gln Leu Tyr Ser Phe Phe Phe Gly Glu Gly Leu Ser
385                 390                 395                 400

Thr Asn Lys Ala Glu Lys Glu Thr Gln Leu Trp Gly Ile Arg Gly Ala
                405                 410                 415

Val Gln Gln Ile Arg Asn Asn Val Asn His Tyr Lys Lys Asp Ala Leu
            420                 425                 430

Lys Thr Val Phe Asn Ile Ser Asn Phe Glu Asn Pro Thr Ile Thr Asp
        435                 440                 445
```

```
Pro Lys Gln Gln Thr Asn Tyr Ala Asp Thr Ile Tyr Lys Ala Arg Phe
    450                 455                 460

Ile Asn Glu Leu Glu Lys Ile Pro Glu Ala Phe Ala Gln Gln Leu Lys
465                 470                 475                 480

Thr Gly Gly Ala Val Ser Tyr Tyr Thr Ile Glu Asn Leu Lys Ser Leu
                485                 490                 495

Leu Thr Thr Phe Gln Phe Ser Leu Cys Arg Ser Thr Ile Pro Phe Ala
            500                 505                 510

Pro Gly Phe Lys Lys Val Phe Asn Gly Gly Ile Asn Tyr Gln Asn Ala
        515                 520                 525

Lys Gln Asp Glu Ser Phe Tyr Glu Leu Met Leu Glu Gln Tyr Leu Arg
    530                 535                 540

Lys Glu Asn Phe Ala Glu Glu Ser Tyr Asn Ala Arg Tyr Phe Met Leu
545                 550                 555                 560

Lys Leu Ile Tyr Asn Asn Leu Phe Leu Pro Gly Phe Thr Thr Asp Arg
                565                 570                 575

Lys Ala Phe Ala Asp Ser Val Gly Phe Val Gln Met Gln Asn Lys Lys
            580                 585                 590

Gln Ala Glu Lys Val Asn Pro Arg Lys Lys Glu Ala Tyr Ala Phe Glu
        595                 600                 605

Ala Val Arg Pro Met Thr Ala Ala Asp Ser Ile Ala Asp Tyr Met Ala
    610                 615                 620

Tyr Val Gln Ser Glu Leu Met Gln Glu Gln Asn Lys Lys Glu Glu Lys
625                 630                 635                 640
```

```
Val Ala Glu Glu Thr Arg Ile Asn Phe Glu Lys Phe Val Leu Gln Val
                645                 650                 655

Phe Ile Lys Gly Phe Asp Ser Phe Leu Arg Ala Lys Glu Phe Asp Phe
            660                 665                 670

Val Gln Met Pro Gln Pro Gln Leu Thr Ala Thr Ala Ser Asn Gln Gln
        675                 680                 685

Lys Ala Asp Lys Leu Asn Gln Leu Glu Ala Ser Ile Thr Ala Asp Cys
    690                 695                 700

Lys Leu Thr Pro Gln Tyr Ala Lys Ala Asp Asp Ala Thr His Ile Ala
705                 710                 715                 720

Phe Tyr Val Phe Cys Lys Leu Leu Asp Ala Ala His Leu Ser Asn Leu
                725                 730                 735

Arg Asn Glu Leu Ile Lys Phe Arg Glu Ser Val Asn Glu Phe Lys Phe
            740                 745                 750

His His Leu Leu Glu Ile Ile Glu Ile Cys Leu Leu Ser Ala Asp Val
        755                 760                 765

Val Pro Thr Asp Tyr Arg Asp Leu Tyr Ser Ser Glu Ala Asp Cys Leu
    770                 775                 780

Ala Arg Leu Arg Pro Phe Ile Glu Gln Gly Ala Asp Ile Thr Asn Trp
785                 790                 795                 800

Ser Asp Leu Phe Val Gln Ser Asp Lys His Ser Pro Val Ile His Ala
                805                 810                 815

Asn Ile Glu Leu Ser Val Lys Tyr Gly Thr Thr Lys Leu Leu Glu Gln
            820                 825                 830

Ile Ile Asn Lys Asp Thr Gln Phe Lys Thr Thr Glu Ala Asn Phe Thr
        835                 840                 845
```

```
Ala Trp Asn Thr Ala Gln Lys Ser Ile Glu Gln Leu Ile Lys Gln Arg
    850                 855                 860

Glu Asp His His Glu Gln Trp Val Lys Ala Lys Asn Ala Asp Asp Lys
865                 870                 875                 880

Glu Lys Gln Glu Arg Lys Arg Glu Lys Ser Asn Phe Ala Gln Lys Phe
                885                 890                 895

Ile Glu Lys His Gly Asp Asp Tyr Leu Asp Ile Cys Asp Tyr Ile Asn
            900                 905                 910

Thr Tyr Asn Trp Leu Asp Asn Lys Met His Phe Val His Leu Asn Arg
        915                 920                 925

Leu His Gly Leu Thr Ile Glu Leu Leu Gly Arg Met Ala Gly Phe Val
    930                 935                 940

Ala Leu Phe Asp Arg Asp Phe Gln Phe Phe Asp Glu Gln Gln Ile Ala
945                 950                 955                 960

Asp Glu Phe Lys Leu His Gly Phe Val Asn Leu His Ser Ile Asp Lys
                965                 970                 975

Lys Leu Asn Glu Val Pro Thr Lys Lys Ile Lys Glu Ile Tyr Asp Ile
            980                 985                 990

Arg Asn Lys Ile Ile Gln Ile Asn  Gly Asn Lys Ile Asn  Glu Ser Val
        995                 1000                1005

Arg Ala  Asn Leu Ile Gln Phe  Ile Ser Ser Lys Arg  Asn Tyr Tyr
    1010                1015                1020

Asn Asn  Ala Phe Leu His Val  Ser Asn Asp Glu Ile  Lys Glu Lys
    1025                1030                1035
```

```
Gln Met  Tyr Asp Ile Arg Asn  His Ile Ala His Phe  Asn Tyr Leu
    1040                1045                1050

Thr Lys  Asp Ala Ala Asp Phe  Ser Leu Ile Asp Leu  Ile Asn Glu
    1055                1060                1065

Leu Arg  Glu Leu Leu His Tyr  Asp Arg Lys Leu Lys  Asn Ala Val
    1070                1075                1080

Ser Lys  Ala Phe Ile Asp Leu  Phe Asp Lys His Gly  Met Ile Leu
    1085                1090                1095

Lys Leu  Lys Leu Asn Ala Asp  His Lys Leu Lys Val  Glu Ser Leu
    1100                1105                1110

Glu Pro  Lys Lys Ile Tyr His  Leu Gly Ser Ser Ala  Lys Asp Lys
    1115                1120                1125

Pro Glu  Tyr Gln Tyr Cys Thr  Asn Gln Val Met Met  Ala Tyr Cys
    1130                1135                1140

Asn Met  Cys Arg Ser Leu Leu  Glu Met Lys Lys
    1145                1150
```

<210> 840
<211> 1120
<212> PRT
<213> Listeria seeligeri

<400> 840

```
Met Trp Ile Ser Ile Lys Thr Leu Ile His His Leu Gly Val Leu Phe
1               5                  10                  15

Phe Cys Asp Tyr Met Tyr Asn Arg Arg Glu Lys Lys Ile Ile Glu Val
            20                  25                  30

Lys Thr Met Arg Ile Thr Lys Val Glu Val Asp Arg Lys Lys Val Leu
        35                  40                  45
```

```
Ile Ser Arg Asp Lys Asn Gly Gly Lys Leu Val Tyr Glu Asn Glu Met
    50                  55                  60

Gln Asp Asn Thr Glu Gln Ile Met His His Lys Lys Ser Ser Phe Tyr
65                  70                  75                  80

Lys Ser Val Val Asn Lys Thr Ile Cys Arg Pro Glu Gln Lys Gln Met
                85                  90                  95

Lys Lys Leu Val His Gly Leu Leu Gln Glu Asn Ser Gln Glu Lys Ile
            100                 105                 110

Lys Val Ser Asp Val Thr Lys Leu Asn Ile Ser Asn Phe Leu Asn His
        115                 120                 125

Arg Phe Lys Lys Ser Leu Tyr Tyr Phe Pro Glu Asn Ser Pro Asp Lys
    130                 135                 140

Ser Glu Glu Tyr Arg Ile Glu Ile Asn Leu Ser Gln Leu Leu Glu Asp
145                 150                 155                 160

Ser Leu Lys Lys Gln Gln Gly Thr Phe Ile Cys Trp Glu Ser Phe Ser
                165                 170                 175

Lys Asp Met Glu Leu Tyr Ile Asn Trp Ala Glu Asn Tyr Ile Ser Ser
            180                 185                 190

Lys Thr Lys Leu Ile Lys Lys Ser Ile Arg Asn Asn Arg Ile Gln Ser
        195                 200                 205

Thr Glu Ser Arg Ser Gly Gln Leu Met Asp Arg Tyr Met Lys Asp Ile
    210                 215                 220

Leu Asn Lys Asn Lys Pro Phe Asp Ile Gln Ser Val Ser Glu Lys Tyr
225                 230                 235                 240

Gln Leu Glu Lys Leu Thr Ser Ala Leu Lys Ala Thr Phe Lys Glu Ala
```

```
                245                 250                 255

Lys Lys Asn Asp Lys Glu Ile Asn Tyr Lys Leu Lys Ser Thr Leu Gln
            260                 265                 270

Asn His Glu Arg Gln Ile Ile Glu Glu Leu Lys Glu Asn Ser Glu Leu
        275                 280                 285

Asn Gln Phe Asn Ile Glu Ile Arg Lys His Leu Glu Thr Tyr Phe Pro
    290                 295                 300

Ile Lys Lys Thr Asn Arg Lys Val Gly Asp Ile Arg Asn Leu Glu Ile
305                 310                 315                 320

Gly Glu Ile Gln Lys Ile Val Asn His Arg Leu Lys Asn Lys Ile Val
                325                 330                 335

Gln Arg Ile Leu Gln Glu Gly Lys Leu Ala Ser Tyr Glu Ile Glu Ser
            340                 345                 350

Thr Val Asn Ser Asn Ser Leu Gln Lys Ile Lys Ile Glu Glu Ala Phe
        355                 360                 365

Ala Leu Lys Phe Ile Asn Ala Cys Leu Phe Ala Ser Asn Asn Leu Arg
    370                 375                 380

Asn Met Val Tyr Pro Val Cys Lys Lys Asp Ile Leu Met Ile Gly Glu
385                 390                 395                 400

Phe Lys Asn Ser Phe Lys Glu Ile Lys His Lys Lys Phe Ile Arg Gln
                405                 410                 415

Trp Ser Gln Phe Phe Ser Gln Glu Ile Thr Val Asp Asp Ile Glu Leu
            420                 425                 430

Ala Ser Trp Gly Leu Arg Gly Ala Ile Ala Pro Ile Arg Asn Glu Ile
        435                 440                 445
```

```
Ile His Leu Lys Lys His Ser Trp Lys Lys Phe Phe Asn Asn Pro Thr
    450                 455                 460

Phe Lys Val Lys Lys Ser Lys Ile Ile Asn Gly Lys Thr Lys Asp Val
465                 470                 475                 480

Thr Ser Glu Phe Leu Tyr Lys Glu Thr Leu Phe Lys Asp Tyr Phe Tyr
                485                 490                 495

Ser Glu Leu Asp Ser Val Pro Glu Leu Ile Ile Asn Lys Met Glu Ser
            500                 505                 510

Ser Lys Ile Leu Asp Tyr Tyr Ser Ser Asp Gln Leu Asn Gln Val Phe
        515                 520                 525

Thr Ile Pro Asn Phe Glu Leu Ser Leu Leu Thr Ser Ala Val Pro Phe
    530                 535                 540

Ala Pro Ser Phe Lys Arg Val Tyr Leu Lys Gly Phe Asp Tyr Gln Asn
545                 550                 555                 560

Gln Asp Glu Ala Gln Pro Asp Tyr Asn Leu Lys Leu Asn Ile Tyr Asn
                565                 570                 575

Glu Lys Ala Phe Asn Ser Glu Ala Phe Gln Ala Gln Tyr Ser Leu Phe
            580                 585                 590

Lys Met Val Tyr Tyr Gln Val Phe Leu Pro Gln Phe Thr Thr Asn Asn
        595                 600                 605

Asp Leu Phe Lys Ser Ser Val Asp Phe Ile Leu Thr Leu Asn Lys Glu
    610                 615                 620

Arg Lys Gly Tyr Ala Lys Ala Phe Gln Asp Ile Arg Lys Met Asn Lys
625                 630                 635                 640

Asp Glu Lys Pro Ser Glu Tyr Met Ser Tyr Ile Gln Ser Gln Leu Met
```

```
                645                 650                 655

Leu Tyr Gln Lys Lys Gln Glu Glu Lys Glu Lys Ile Asn His Phe Glu
            660                 665                 670

Lys Phe Ile Asn Gln Val Phe Ile Lys Gly Phe Asn Ser Phe Ile Glu
        675                 680                 685

Lys Asn Arg Leu Thr Tyr Ile Cys His Pro Thr Lys Asn Thr Val Pro
    690                 695                 700

Glu Asn Asp Asn Ile Glu Ile Pro Phe His Thr Asp Met Asp Asp Ser
705                 710                 715                 720

Asn Ile Ala Phe Trp Leu Met Cys Lys Leu Leu Asp Ala Lys Gln Leu
                725                 730                 735

Ser Glu Leu Arg Asn Glu Met Ile Lys Phe Ser Cys Ser Leu Gln Ser
            740                 745                 750

Thr Glu Glu Ile Ser Thr Phe Thr Lys Ala Arg Glu Val Ile Gly Leu
        755                 760                 765

Ala Leu Leu Asn Gly Glu Lys Gly Cys Asn Asp Trp Lys Glu Leu Phe
    770                 775                 780

Asp Asp Lys Glu Ala Trp Lys Lys Asn Met Ser Leu Tyr Val Ser Glu
785                 790                 795                 800

Glu Leu Leu Gln Ser Leu Pro Tyr Thr Gln Glu Asp Gly Gln Thr Pro
                805                 810                 815

Val Ile Asn Arg Ser Ile Asp Leu Val Lys Lys Tyr Gly Thr Glu Thr
            820                 825                 830

Ile Leu Glu Lys Leu Phe Ser Ser Ser Asp Asp Tyr Lys Val Ser Ala
        835                 840                 845
```

```
Lys Asp Ile Ala Lys Leu His Glu Tyr Asp Val Thr Glu Lys Ile Ala
    850                 855                 860

Gln Gln Glu Ser Leu His Lys Gln Trp Ile Glu Lys Pro Gly Leu Ala
865                 870                 875                 880

Arg Asp Ser Ala Trp Thr Lys Lys Tyr Gln Asn Val Ile Asn Asp Ile
                885                 890                 895

Ser Asn Tyr Gln Trp Ala Lys Thr Lys Val Glu Leu Thr Gln Val Arg
            900                 905                 910

His Leu His Gln Leu Thr Ile Asp Leu Leu Ser Arg Leu Ala Gly Tyr
        915                 920                 925

Met Ser Ile Ala Asp Arg Asp Phe Gln Phe Ser Ser Asn Tyr Ile Leu
    930                 935                 940

Glu Arg Glu Asn Ser Glu Tyr Arg Val Thr Ser Trp Ile Leu Leu Ser
945                 950                 955                 960

Glu Asn Lys Asn Lys Asn Lys Tyr Asn Asp Tyr Glu Leu Tyr Asn Leu
                965                 970                 975

Lys Asn Ala Ser Ile Lys Val Ser Ser Lys Asn Asp Pro Gln Leu Lys
            980                 985                 990

Val Asp Leu Lys Gln Leu Arg Leu  Thr Leu Glu Tyr Leu  Glu Leu Phe
        995                 1000                1005

Asp Asn  Arg Leu Lys Glu Lys  Arg Asn Asn Ile Ser  His Phe Asn
    1010                1015                1020

Tyr Leu  Asn Gly Gln Leu Gly  Asn Ser Ile Leu Glu  Leu Phe Asp
    1025                1030                1035

Asp Ala  Arg Asp Val Leu Ser  Tyr Asp Arg Lys Leu  Lys Asn Ala
```

```
    1040                1045                1050

Val Ser  Lys Ser Leu Lys Glu  Ile Leu Ser Ser His  Gly Met Glu
    1055                1060                1065

Val Thr  Phe Lys Pro Leu Tyr  Gln Thr Asn His His  Leu Lys Ile
    1070                1075                1080

Asp Lys  Leu Gln Pro Lys Lys  Ile His His Leu Gly  Glu Lys Ser
    1085                1090                1095

Thr Val  Ser Ser Asn Gln Val  Ser Asn Glu Tyr Cys  Gln Leu Val
    1100                1105                1110

Arg Thr  Leu Leu Thr Met Lys
    1115                1120
```

<210> 841
<211> 1051
<212> PRT
<213> Listeria newyorkensis

<400> 841

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Met Lys Ile Thr Lys Met Arg Val Asp Gly Arg Thr Ile Val Met Glu
1               5                   10                  15

Arg Thr Ser Lys Glu Gly Gln Leu Gly Tyr Glu Gly Ile Asp Gly Asn
            20                  25                  30

Lys Thr Thr Glu Ile Ile Phe Asp Lys Lys Lys Glu Ser Phe Tyr Lys
        35                  40                  45

Ser Ile Leu Asn Lys Thr Val Arg Lys Pro Asp Glu Lys Glu Lys Asn
    50                  55                  60

Arg Arg Lys Gln Ala Ile Asn Lys Ala Ile Asn Lys Glu Ile Thr Glu
65                  70                  75                  80
```

```
Leu Met Leu Ala Val Leu His Gln Glu Val Pro Ser Gln Lys Leu His
                85                  90                  95

Asn Leu Lys Ser Leu Asn Thr Glu Ser Leu Thr Lys Leu Phe Lys Pro
            100                 105                 110

Lys Phe Gln Asn Met Ile Ser Tyr Pro Pro Ser Lys Gly Ala Glu His
        115                 120                 125

Val Gln Phe Cys Leu Thr Asp Ile Ala Val Pro Ala Ile Arg Asp Leu
    130                 135                 140

Asp Glu Ile Lys Pro Asp Trp Gly Ile Phe Phe Glu Lys Leu Lys Pro
145                 150                 155                 160

Tyr Thr Asp Trp Ala Glu Ser Tyr Ile His Tyr Lys Gln Thr Thr Ile
                165                 170                 175

Gln Lys Ser Ile Glu Gln Asn Lys Ile Gln Ser Pro Asp Ser Pro Arg
            180                 185                 190

Lys Leu Val Leu Gln Lys Tyr Val Thr Ala Phe Leu Asn Gly Glu Pro
        195                 200                 205

Leu Gly Leu Asp Leu Val Ala Lys Lys Tyr Lys Leu Ala Asp Leu Ala
    210                 215                 220

Glu Ser Phe Lys Leu Val Asp Leu Asn Glu Asp Lys Ser Ala Asn Tyr
225                 230                 235                 240

Lys Ile Lys Ala Cys Leu Gln Gln His Gln Arg Asn Ile Leu Asp Glu
                245                 250                 255

Leu Lys Glu Asp Pro Glu Leu Asn Gln Tyr Gly Ile Glu Val Lys Lys
            260                 265                 270

Tyr Ile Gln Arg Tyr Phe Pro Ile Lys Arg Ala Pro Asn Arg Ser Lys
        275                 280                 285
```

```
His Ala Arg Ala Asp Phe Leu Lys Lys Glu Leu Ile Glu Ser Thr Val
    290                 295                 300

Glu Gln Gln Phe Lys Asn Ala Val Tyr His Tyr Val Leu Glu Gln Gly
305                 310                 315                 320

Lys Met Glu Ala Tyr Glu Leu Thr Asp Pro Lys Thr Lys Asp Leu Gln
                325                 330                 335

Asp Ile Arg Ser Gly Glu Ala Phe Ser Phe Lys Phe Ile Asn Ala Cys
            340                 345                 350

Ala Phe Ala Ser Asn Asn Leu Lys Met Ile Leu Asn Pro Glu Cys Glu
        355                 360                 365

Lys Asp Ile Leu Gly Lys Gly Asn Phe Lys Lys Asn Leu Pro Asn Ser
    370                 375                 380

Thr Thr Arg Ser Asp Val Val Lys Lys Met Ile Pro Phe Phe Ser Asp
385                 390                 395                 400

Glu Leu Gln Asn Val Asn Phe Asp Glu Ala Ile Trp Ala Ile Arg Gly
                405                 410                 415

Ser Ile Gln Gln Ile Arg Asn Glu Val Tyr His Cys Lys Lys His Ser
            420                 425                 430

Trp Lys Ser Ile Leu Lys Ile Lys Gly Phe Glu Phe Glu Pro Asn Asn
        435                 440                 445

Met Lys Tyr Ala Asp Ser Asp Met Gln Lys Leu Met Asp Lys Asp Ile
    450                 455                 460

Ala Lys Ile Pro Glu Phe Ile Glu Glu Lys Leu Lys Ser Ser Gly Val
465                 470                 475                 480
```

```
Val Arg Phe Tyr Arg His Asp Glu Leu Gln Ser Ile Trp Glu Met Lys
                485                 490                 495

Gln Gly Phe Ser Leu Leu Thr Thr Asn Ala Pro Phe Val Pro Ser Phe
            500                 505                 510

Lys Arg Val Tyr Ala Lys Gly His Asp Tyr Gln Thr Ser Lys Asn Arg
        515                 520                 525

Tyr Tyr Asn Leu Asp Leu Thr Thr Phe Asp Ile Leu Glu Tyr Gly Glu
    530                 535                 540

Glu Asp Phe Arg Ala Arg Tyr Phe Leu Thr Lys Leu Val Tyr Tyr Gln
545                 550                 555                 560

Gln Phe Met Pro Trp Phe Thr Ala Asp Asn Asn Ala Phe Arg Asp Ala
                565                 570                 575

Ala Asn Phe Val Leu Arg Leu Asn Lys Asn Arg Gln Gln Asp Ala Lys
            580                 585                 590

Ala Phe Ile Asn Ile Arg Glu Val Glu Glu Gly Glu Met Pro Arg Asp
        595                 600                 605

Tyr Met Gly Tyr Val Gln Gly Gln Ile Ala Ile His Glu Asp Ser Ile
    610                 615                 620

Glu Asp Thr Pro Asn His Phe Glu Lys Phe Ile Ser Gln Val Phe Ile
625                 630                 635                 640

Lys Gly Phe Asp Arg His Met Arg Ser Ala Asn Leu Lys Phe Ile Lys
                645                 650                 655

Asn Pro Arg Asn Gln Gly Leu Glu Gln Ser Glu Ile Glu Glu Met Ser
            660                 665                 670

Phe Asp Ile Lys Val Glu Pro Ser Phe Leu Lys Asn Lys Asp Asp Tyr
        675                 680                 685
```

```
Ile Ala Phe Trp Ile Phe Cys Lys Met Leu Asp Ala Arg His Leu Ser
    690                 695                 700

Glu Leu Arg Asn Glu Met Ile Lys Tyr Asp Gly His Leu Thr Gly Glu
705                 710                 715                 720

Gln Glu Ile Ile Gly Leu Ala Leu Leu Gly Val Asp Ser Arg Glu Asn
                725                 730                 735

Asp Trp Lys Gln Phe Phe Ser Ser Glu Arg Glu Tyr Glu Lys Ile Met
            740                 745                 750

Lys Gly Tyr Val Val Glu Glu Leu Tyr Gln Arg Glu Pro Tyr Arg Gln
        755                 760                 765

Ser Asp Gly Lys Thr Pro Ile Leu Phe Arg Gly Val Glu Gln Ala Arg
    770                 775                 780

Lys Tyr Gly Thr Glu Thr Val Ile Gln Arg Leu Phe Asp Ala Asn Pro
785                 790                 795                 800

Glu Phe Lys Val Ser Lys Cys Asn Leu Ala Glu Trp Glu Arg Gln Lys
                805                 810                 815

Glu Thr Ile Glu Glu Thr Ile Lys Arg Arg Lys Glu Leu His Asn Glu
            820                 825                 830

Trp Ala Lys Asn Pro Lys Lys Pro Gln Asn Asn Ala Phe Phe Lys Glu
        835                 840                 845

Tyr Lys Glu Cys Cys Asp Ala Ile Asp Ala Tyr Asn Trp His Lys Asn
    850                 855                 860

Lys Thr Thr Leu Ala Tyr Val Asn Glu Leu His His Leu Leu Ile Glu
865                 870                 875                 880
```

```
Ile Leu Gly Arg Tyr Val Gly Tyr Val Ala Ile Ala Asp Arg Asp Phe
                885                 890                 895


Gln Cys Met Ala Asn Gln Tyr Phe Lys His Ser Gly Ile Thr Glu Arg
            900                 905                 910


Val Glu Tyr Trp Gly Asp Asn Arg Leu Lys Ser Ile Lys Lys Leu Asp
        915                 920                 925


Thr Phe Leu Lys Lys Glu Gly Leu Phe Val Ser Glu Lys Asn Ala Arg
    930                 935                 940


Asn His Ile Ala His Leu Asn Tyr Leu Ser Leu Lys Ser Glu Cys Thr
945                 950                 955                 960


Leu Leu Tyr Leu Ser Glu Arg Leu Arg Glu Ile Phe Lys Tyr Asp Arg
                965                 970                 975


Lys Leu Lys Asn Ala Val Ser Lys Ser Leu Ile Asp Ile Leu Asp Arg
            980                 985                 990


His Gly Met Ser Val Val Phe Ala  Asn Leu Lys Glu Asn  Lys His Arg
        995                 1000                1005


Leu Val  Ile Lys Ser Leu Glu  Pro Lys Lys Leu Arg  His Leu Gly
    1010                1015                1020


Gly Lys  Lys Ile Asp Gly Gly  Tyr Ile Glu Thr Asn  Gln Val Ser
    1025                1030                1035


Glu Glu  Tyr Cys Gly Ile Val  Lys Arg Leu Leu Glu  Met
    1040                1045                1050


<210>  842
<211>  1182
<212>  PRT
<213>  Leptotrichia wadei

<400>  842
```

```
Met Tyr Met Lys Ile Thr Lys Ile Asp Gly Val Ser His Tyr Lys Lys
1               5                  10                  15

Gln Asp Lys Gly Ile Leu Lys Lys Lys Trp Lys Asp Leu Asp Glu Arg
            20                  25                  30

Lys Gln Arg Glu Lys Ile Glu Ala Arg Tyr Asn Lys Gln Ile Glu Ser
        35                  40                  45

Lys Ile Tyr Lys Glu Phe Phe Arg Leu Lys Asn Lys Lys Arg Ile Glu
    50                  55                  60

Lys Glu Glu Asp Gln Asn Ile Lys Ser Leu Tyr Phe Phe Ile Lys Glu
65                  70                  75                  80

Leu Tyr Leu Asn Glu Lys Asn Glu Glu Trp Glu Leu Lys Asn Ile Asn
                85                  90                  95

Leu Glu Ile Leu Asp Asp Lys Glu Arg Val Ile Lys Gly Tyr Lys Phe
            100                 105                 110

Lys Glu Asp Val Tyr Phe Phe Lys Glu Gly Tyr Lys Glu Tyr Tyr Leu
        115                 120                 125

Arg Ile Leu Phe Asn Asn Leu Ile Glu Lys Val Gln Asn Glu Asn Arg
    130                 135                 140

Glu Lys Val Arg Lys Asn Lys Glu Phe Leu Asp Leu Lys Glu Ile Phe
145                 150                 155                 160

Lys Lys Tyr Lys Asn Arg Lys Ile Asp Leu Leu Leu Lys Ser Ile Asn
                165                 170                 175

Asn Asn Lys Ile Asn Leu Glu Tyr Lys Lys Glu Asn Val Asn Glu Glu
            180                 185                 190

Ile Tyr Gly Ile Asn Pro Thr Asn Asp Arg Glu Met Thr Phe Tyr Glu
```

```
        195                 200                 205

Leu Leu Lys Glu Ile Ile Glu Lys Lys Asp Glu Gln Lys Ser Ile Leu
    210                 215                 220

Glu Glu Lys Leu Asp Asn Phe Asp Ile Thr Asn Phe Leu Glu Asn Ile
225                 230                 235                 240

Glu Lys Ile Phe Asn Glu Glu Thr Glu Ile Asn Ile Ile Lys Gly Lys
                245                 250                 255

Val Leu Asn Glu Leu Arg Glu Tyr Ile Lys Glu Lys Glu Glu Asn Asn
            260                 265                 270

Ser Asp Asn Lys Leu Lys Gln Ile Tyr Asn Leu Glu Leu Lys Lys Tyr
        275                 280                 285

Ile Glu Asn Asn Phe Ser Tyr Lys Lys Gln Lys Ser Lys Ser Lys Asn
    290                 295                 300

Gly Lys Asn Asp Tyr Leu Tyr Leu Asn Phe Leu Lys Lys Ile Met Phe
305                 310                 315                 320

Ile Glu Glu Val Asp Glu Lys Lys Glu Ile Asn Lys Glu Lys Phe Lys
                325                 330                 335

Asn Lys Ile Asn Ser Asn Phe Lys Asn Leu Phe Val Gln His Ile Leu
            340                 345                 350

Asp Tyr Gly Lys Leu Leu Tyr Tyr Lys Glu Asn Asp Glu Tyr Ile Lys
        355                 360                 365

Asn Thr Gly Gln Leu Glu Thr Lys Asp Leu Glu Tyr Ile Lys Thr Lys
    370                 375                 380

Glu Thr Leu Ile Arg Lys Met Ala Val Leu Val Ser Phe Ala Ala Asn
385                 390                 395                 400
```

```
Ser Tyr Tyr Asn Leu Phe Gly Arg Val Ser Gly Asp Ile Leu Gly Thr
                405                 410                 415

Glu Val Val Lys Ser Ser Lys Thr Asn Val Ile Lys Val Gly Ser His
            420                 425                 430

Ile Phe Lys Glu Lys Met Leu Asn Tyr Phe Phe Asp Phe Glu Ile Phe
        435                 440                 445

Asp Ala Asn Lys Ile Val Glu Ile Leu Glu Ser Ile Ser Tyr Ser Ile
    450                 455                 460

Tyr Asn Val Arg Asn Gly Val Gly His Phe Asn Lys Leu Ile Leu Gly
465                 470                 475                 480

Lys Tyr Lys Lys Lys Asp Ile Asn Thr Asn Lys Arg Ile Glu Glu Asp
                485                 490                 495

Leu Asn Asn Asn Glu Glu Ile Lys Gly Tyr Phe Ile Lys Lys Arg Gly
            500                 505                 510

Glu Ile Glu Arg Lys Val Lys Glu Lys Phe Leu Ser Asn Asn Leu Gln
        515                 520                 525

Tyr Tyr Tyr Ser Lys Glu Lys Ile Glu Asn Tyr Phe Glu Val Tyr Glu
    530                 535                 540

Phe Glu Ile Leu Lys Arg Lys Ile Pro Phe Ala Pro Asn Phe Lys Arg
545                 550                 555                 560

Ile Ile Lys Lys Gly Glu Asp Leu Phe Asn Asn Lys Asn Asn Lys Lys
                565                 570                 575

Tyr Glu Tyr Phe Lys Asn Phe Asp Lys Asn Ser Ala Glu Glu Lys Lys
            580                 585                 590

Glu Phe Leu Lys Thr Arg Asn Phe Leu Leu Lys Glu Leu Tyr Tyr Asn
```

```
        595                 600                 605

Asn Phe Tyr Lys Glu Phe Leu Ser Lys Lys Glu Glu Phe Glu Lys Ile
    610                 615                 620

Val Leu Glu Val Lys Glu Glu Lys Lys Ser Arg Gly Asn Ile Asn Asn
625                 630                 635                 640

Lys Lys Ser Gly Val Ser Phe Gln Ser Ile Asp Asp Tyr Asp Thr Lys
                645                 650                 655

Ile Asn Ile Ser Asp Tyr Ile Ala Ser Ile His Lys Lys Glu Met Glu
            660                 665                 670

Arg Val Glu Lys Tyr Asn Glu Glu Lys Gln Lys Asp Thr Ala Lys Tyr
        675                 680                 685

Ile Arg Asp Phe Val Glu Glu Ile Phe Leu Thr Gly Phe Ile Asn Tyr
    690                 695                 700

Leu Glu Lys Asp Lys Arg Leu His Phe Leu Lys Glu Glu Phe Ser Ile
705                 710                 715                 720

Leu Cys Asn Asn Asn Asn Asn Val Val Asp Phe Asn Ile Asn Ile Asn
                725                 730                 735

Glu Glu Lys Ile Lys Glu Phe Leu Lys Glu Asn Asp Ser Lys Thr Leu
            740                 745                 750

Asn Leu Tyr Leu Phe Phe Asn Met Ile Asp Ser Lys Arg Ile Ser Glu
        755                 760                 765

Phe Arg Asn Glu Leu Val Lys Tyr Lys Gln Phe Thr Lys Lys Arg Leu
    770                 775                 780

Asp Glu Glu Lys Glu Phe Leu Gly Ile Lys Ile Glu Leu Tyr Glu Thr
785                 790                 795                 800
```

```
Leu Ile Glu Phe Val Ile Leu Thr Arg Glu Lys Leu Asp Thr Lys Lys
                805                 810                 815

Ser Glu Glu Ile Asp Ala Trp Leu Val Asp Lys Leu Tyr Val Lys Asp
            820                 825                 830

Ser Asn Glu Tyr Lys Glu Tyr Glu Glu Ile Leu Lys Leu Phe Val Asp
        835                 840                 845

Glu Lys Ile Leu Ser Ser Lys Glu Ala Pro Tyr Tyr Ala Thr Asp Asn
    850                 855                 860

Lys Thr Pro Ile Leu Leu Ser Asn Phe Glu Lys Thr Arg Lys Tyr Gly
865                 870                 875                 880

Thr Gln Ser Phe Leu Ser Glu Ile Gln Ser Asn Tyr Lys Tyr Ser Lys
                885                 890                 895

Val Glu Lys Glu Asn Ile Glu Asp Tyr Asn Lys Lys Glu Glu Ile Glu
            900                 905                 910

Gln Lys Lys Lys Ser Asn Ile Glu Lys Leu Gln Asp Leu Lys Val Glu
        915                 920                 925

Leu His Lys Lys Trp Glu Gln Asn Lys Ile Thr Glu Lys Glu Ile Glu
    930                 935                 940

Lys Tyr Asn Asn Thr Thr Arg Lys Ile Asn Glu Tyr Asn Tyr Leu Lys
945                 950                 955                 960

Asn Lys Glu Glu Leu Gln Asn Val Tyr Leu Leu His Glu Met Leu Ser
                965                 970                 975

Asp Leu Leu Ala Arg Asn Val Ala Phe Phe Asn Lys Trp Glu Arg Asp
            980                 985                 990

Phe Lys Phe Ile Val Ile Ala Ile  Lys Gln Phe Leu Arg  Glu Asn Asp
```

995 1000 1005

Lys Glu Lys Val Asn Glu Phe Leu Asn Pro Pro Asp Asn Ser Lys
1010 1015 1020

Gly Lys Lys Val Tyr Phe Ser Val Ser Lys Tyr Lys Asn Thr Val
1025 1030 1035

Glu Asn Ile Asp Gly Ile His Lys Asn Phe Met Asn Leu Ile Phe
1040 1045 1050

Leu Asn Asn Lys Phe Met Asn Arg Lys Ile Asp Lys Met Asn Cys
1055 1060 1065

Ala Ile Trp Val Tyr Phe Arg Asn Tyr Ile Ala His Phe Leu His
1070 1075 1080

Leu His Thr Lys Asn Glu Lys Ile Ser Leu Ile Ser Gln Met Asn
1085 1090 1095

Leu Leu Ile Lys Leu Phe Ser Tyr Asp Lys Lys Val Gln Asn His
1100 1105 1110

Ile Leu Lys Ser Thr Lys Thr Leu Leu Glu Lys Tyr Asn Ile Gln
1115 1120 1125

Ile Asn Phe Glu Ile Ser Asn Asp Lys Asn Glu Val Phe Lys Tyr
1130 1135 1140

Lys Ile Lys Asn Arg Leu Tyr Ser Lys Lys Gly Lys Met Leu Gly
1145 1150 1155

Lys Asn Asn Lys Phe Glu Ile Leu Glu Asn Glu Phe Leu Glu Asn
1160 1165 1170

Val Lys Ala Met Leu Glu Tyr Ser Glu
1175 1180

<210> 843
<211> 1285
<212> PRT
<213> Rhodobacter capsulatus

<400> 843

```
Met Gln Ile Gly Lys Val Gln Gly Arg Thr Ile Ser Glu Phe Gly Asp
1               5                  10                  15


Pro Ala Gly Gly Leu Lys Arg Lys Ile Ser Thr Asp Gly Lys Asn Arg
            20                  25                  30


Lys Glu Leu Pro Ala His Leu Ser Ser Asp Pro Lys Ala Leu Ile Gly
        35                  40                  45


Gln Trp Ile Ser Gly Ile Asp Lys Ile Tyr Arg Lys Pro Asp Ser Arg
    50                  55                  60


Lys Ser Asp Gly Lys Ala Ile His Ser Pro Thr Pro Ser Lys Met Gln
65                  70                  75                  80


Phe Asp Ala Arg Asp Asp Leu Gly Glu Ala Phe Trp Lys Leu Val Ser
                85                  90                  95


Glu Ala Gly Leu Ala Gln Asp Ser Asp Tyr Asp Gln Phe Lys Arg Arg
            100                 105                 110


Leu His Pro Tyr Gly Asp Lys Phe Gln Pro Ala Asp Ser Gly Ala Lys
        115                 120                 125


Leu Lys Phe Glu Ala Asp Pro Pro Glu Pro Gln Ala Phe His Gly Arg
    130                 135                 140


Trp Tyr Gly Ala Met Ser Lys Arg Gly Asn Asp Ala Lys Glu Leu Ala
145                 150                 155                 160


Ala Ala Leu Tyr Glu His Leu His Val Asp Glu Lys Arg Ile Asp Gly
                165                 170                 175
```

```
Gln Pro Lys Arg Asn Pro Lys Thr Asp Lys Phe Ala Pro Gly Leu Val
            180                 185                 190

Val Ala Arg Ala Leu Gly Ile Glu Ser Ser Val Leu Pro Arg Gly Met
        195                 200                 205

Ala Arg Leu Ala Arg Asn Trp Gly Glu Glu Glu Ile Gln Thr Tyr Phe
    210                 215                 220

Val Val Asp Val Ala Ala Ser Val Lys Glu Val Ala Lys Ala Ala Val
225                 230                 235                 240

Ser Ala Ala Gln Ala Phe Asp Pro Pro Arg Gln Val Ser Gly Arg Ser
                245                 250                 255

Leu Ser Pro Lys Val Gly Phe Ala Leu Ala Glu His Leu Glu Arg Val
            260                 265                 270

Thr Gly Ser Lys Arg Cys Ser Phe Asp Pro Ala Ala Gly Pro Ser Val
        275                 280                 285

Leu Ala Leu His Asp Glu Val Lys Lys Thr Tyr Lys Arg Leu Cys Ala
    290                 295                 300

Arg Gly Lys Asn Ala Ala Arg Ala Phe Pro Ala Asp Lys Thr Glu Leu
305                 310                 315                 320

Leu Ala Leu Met Arg His Thr His Glu Asn Arg Val Arg Asn Gln Met
                325                 330                 335

Val Arg Met Gly Arg Val Ser Glu Tyr Arg Gly Gln Gln Ala Gly Asp
            340                 345                 350

Leu Ala Gln Ser His Tyr Trp Thr Ser Ala Gly Gln Thr Glu Ile Lys
        355                 360                 365
```

```
Glu Ser Glu Ile Phe Val Arg Leu Trp Val Gly Ala Phe Ala Leu Ala
    370                 375                 380

Gly Arg Ser Met Lys Ala Trp Ile Asp Pro Met Gly Lys Ile Val Asn
385                 390                 395                 400

Thr Glu Lys Asn Asp Arg Asp Leu Thr Ala Ala Val Asn Ile Arg Gln
                405                 410                 415

Val Ile Ser Asn Lys Glu Met Val Ala Glu Ala Met Ala Arg Arg Gly
            420                 425                 430

Ile Tyr Phe Gly Glu Thr Pro Glu Leu Asp Arg Leu Gly Ala Glu Gly
        435                 440                 445

Asn Glu Gly Phe Val Phe Ala Leu Leu Arg Tyr Leu Arg Gly Cys Arg
    450                 455                 460

Asn Gln Thr Phe His Leu Gly Ala Arg Ala Gly Phe Leu Lys Glu Ile
465                 470                 475                 480

Arg Lys Glu Leu Glu Lys Thr Arg Trp Gly Lys Ala Lys Glu Ala Glu
                485                 490                 495

His Val Val Leu Thr Asp Lys Thr Val Ala Ala Ile Arg Ala Ile Ile
            500                 505                 510

Asp Asn Asp Ala Lys Ala Leu Gly Ala Arg Leu Leu Ala Asp Leu Ser
        515                 520                 525

Gly Ala Phe Val Ala His Tyr Ala Ser Lys Glu His Phe Ser Thr Leu
    530                 535                 540

Tyr Ser Glu Ile Val Lys Ala Val Lys Asp Ala Pro Glu Val Ser Ser
545                 550                 555                 560

Gly Leu Pro Arg Leu Lys Leu Leu Leu Lys Arg Ala Asp Gly Val Arg
                565                 570                 575
```

```
Gly Tyr Val His Gly Leu Arg Asp Thr Arg Lys His Ala Phe Ala Thr
            580                 585                 590

Lys Leu Pro Pro Pro Pro Ala Pro Arg Glu Leu Asp Asp Pro Ala Thr
        595                 600                 605

Lys Ala Arg Tyr Ile Ala Leu Leu Arg Leu Tyr Asp Gly Pro Phe Arg
    610                 615                 620

Ala Tyr Ala Ser Gly Ile Thr Gly Thr Ala Leu Ala Gly Pro Ala Ala
625                 630                 635                 640

Arg Ala Lys Glu Ala Ala Thr Ala Leu Ala Gln Ser Val Asn Val Thr
                645                 650                 655

Lys Ala Tyr Ser Asp Val Met Glu Gly Arg Ser Ser Arg Leu Arg Pro
            660                 665                 670

Pro Asn Asp Gly Glu Thr Leu Arg Glu Tyr Leu Ser Ala Leu Thr Gly
        675                 680                 685

Glu Thr Ala Thr Glu Phe Arg Val Gln Ile Gly Tyr Glu Ser Asp Ser
    690                 695                 700

Glu Asn Ala Arg Lys Gln Ala Glu Phe Ile Glu Asn Tyr Arg Arg Asp
705                 710                 715                 720

Met Leu Ala Phe Met Phe Glu Asp Tyr Ile Arg Ala Lys Gly Phe Asp
                725                 730                 735

Trp Ile Leu Lys Ile Glu Pro Gly Ala Thr Ala Met Thr Arg Ala Pro
            740                 745                 750

Val Leu Pro Glu Pro Ile Asp Thr Arg Gly Gln Tyr Glu His Trp Gln
        755                 760                 765
```

```
Ala Ala Leu Tyr Leu Val Met His Phe Val Pro Ala Ser Asp Val Ser
    770                 775                 780

Asn Leu Leu His Gln Leu Arg Lys Trp Glu Ala Leu Gln Gly Lys Tyr
785                 790                 795                 800

Glu Leu Val Gln Asp Gly Asp Ala Thr Asp Gln Ala Asp Ala Arg Arg
                805                 810                 815

Glu Ala Leu Asp Leu Val Lys Arg Phe Arg Asp Val Leu Val Leu Phe
            820                 825                 830

Leu Lys Thr Gly Glu Ala Arg Phe Glu Gly Arg Ala Ala Pro Phe Asp
        835                 840                 845

Leu Lys Pro Phe Arg Ala Leu Phe Ala Asn Pro Ala Thr Phe Asp Arg
    850                 855                 860

Leu Phe Met Ala Thr Pro Thr Thr Ala Arg Pro Ala Glu Asp Asp Pro
865                 870                 875                 880

Glu Gly Asp Gly Ala Ser Glu Pro Glu Leu Arg Val Ala Arg Thr Leu
                885                 890                 895

Arg Gly Leu Arg Gln Ile Ala Arg Tyr Asn His Met Ala Val Leu Ser
            900                 905                 910

Asp Leu Phe Ala Lys His Lys Val Arg Asp Glu Glu Val Ala Arg Leu
        915                 920                 925

Ala Glu Ile Glu Asp Glu Thr Gln Glu Lys Ser Gln Ile Val Ala Ala
    930                 935                 940

Gln Glu Leu Arg Thr Asp Leu His Asp Lys Val Met Lys Cys His Pro
945                 950                 955                 960

Lys Thr Ile Ser Pro Glu Glu Arg Gln Ser Tyr Ala Ala Ala Ile Lys
                965                 970                 975
```

```
Thr Ile Glu Glu His Arg Phe Leu Val Gly Arg Val Tyr Leu Gly Asp
            980                 985                 990

His Leu Arg Leu His Arg Leu Met  Met Asp Val Ile Gly  Arg Leu Ile
        995                 1000                1005

Asp Tyr  Ala Gly Ala Tyr Glu  Arg Asp Thr Gly Thr  Phe Leu Ile
    1010                1015                1020

Asn Ala  Ser Lys Gln Leu Gly  Ala Gly Ala Asp Trp  Ala Val Thr
    1025                1030                1035

Ile Ala  Gly Ala Ala Asn Thr  Asp Ala Arg Thr Gln  Thr Arg Lys
    1040                1045                1050

Asp Leu  Ala His Phe Asn Val  Leu Asp Arg Ala Asp  Gly Thr Pro
    1055                1060                1065

Asp Leu  Thr Ala Leu Val Asn  Arg Ala Arg Glu Met  Met Ala Tyr
    1070                1075                1080

Asp Arg  Lys Arg Lys Asn Ala  Val Pro Arg Ser Ile  Leu Asp Met
    1085                1090                1095

Leu Ala  Arg Leu Gly Leu Thr  Leu Lys Trp Gln Met  Lys Asp His
    1100                1105                1110

Leu Leu  Gln Asp Ala Thr Ile  Thr Gln Ala Ala Ile  Lys His Leu
    1115                1120                1125

Asp Lys  Val Arg Leu Thr Val  Gly Gly Pro Ala Ala  Val Thr Glu
    1130                1135                1140

Ala Arg  Phe Ser Gln Asp Tyr  Leu Gln Met Val Ala  Ala Val Phe
    1145                1150                1155
```

```
Asn Gly  Ser Val Gln Asn Pro  Lys Pro Arg Arg Arg  Asp Asp Gly
    1160                 1165                 1170


Asp Ala  Trp His Lys Pro Pro  Lys Pro Ala Thr Ala  Gln Ser Gln
    1175                 1180                 1185


Pro Asp  Gln Lys Pro Pro Asn  Lys Ala Pro Ser Ala  Gly Ser Arg
    1190                 1195                 1200


Leu Pro  Pro Pro Gln Val Gly  Glu Val Tyr Glu Gly  Val Val Val
    1205                 1210                 1215


Lys Val  Ile Asp Thr Gly Ser  Leu Gly Phe Leu Ala  Val Glu Gly
    1220                 1225                 1230


Val Ala  Gly Asn Ile Gly Leu  His Ile Ser Arg Leu  Arg Arg Ile
    1235                 1240                 1245


Arg Glu  Asp Ala Ile Ile Val  Gly Arg Arg Tyr Arg  Phe Arg Val
    1250                 1255                 1260


Glu Ile  Tyr Val Pro Pro Lys  Ser Asn Thr Ser Lys  Leu Asn Ala
    1265                 1270                 1275


Ala Asp  Leu Val Arg Ile Asp
    1280                 1285


<210>  844
<211>  1159
<212>  PRT
<213>  Leptotrichia buccalis

<400>  844

Met Lys Val Thr Lys Val Gly Gly Ile Ser His Lys Lys Tyr Thr Ser
1               5                  10                  15


Glu Gly Arg Leu Val Lys Ser Glu Ser Glu Glu Asn Arg Thr Asp Glu
            20                  25                  30
```

```
Arg Leu Ser Ala Leu Leu Asn Met Arg Leu Asp Met Tyr Ile Lys Asn
        35                  40                  45

Pro Ser Ser Thr Glu Thr Lys Glu Asn Gln Lys Arg Ile Gly Lys Leu
    50                  55                  60

Lys Lys Phe Phe Ser Asn Lys Met Val Tyr Leu Lys Asp Asn Thr Leu
65                  70                  75                  80

Ser Leu Lys Asn Gly Lys Lys Glu Asn Ile Asp Arg Glu Tyr Ser Glu
                85                  90                  95

Thr Asp Ile Leu Glu Ser Asp Val Arg Asp Lys Lys Asn Phe Ala Val
            100                 105                 110

Leu Lys Lys Ile Tyr Leu Asn Glu Asn Val Asn Ser Glu Glu Leu Glu
        115                 120                 125

Val Phe Arg Asn Asp Ile Lys Lys Lys Leu Asn Lys Ile Asn Ser Leu
    130                 135                 140

Lys Tyr Ser Phe Glu Lys Asn Lys Ala Asn Tyr Gln Lys Ile Asn Glu
145                 150                 155                 160

Asn Asn Ile Glu Lys Val Glu Gly Lys Ser Lys Arg Asn Ile Ile Tyr
                165                 170                 175

Asp Tyr Tyr Arg Glu Ser Ala Lys Arg Asp Ala Tyr Val Ser Asn Val
            180                 185                 190

Lys Glu Ala Phe Asp Lys Leu Tyr Lys Glu Glu Asp Ile Ala Lys Leu
        195                 200                 205

Val Leu Glu Ile Glu Asn Leu Thr Lys Leu Glu Lys Tyr Lys Ile Arg
    210                 215                 220

Glu Phe Tyr His Glu Ile Ile Gly Arg Lys Asn Asp Lys Glu Asn Phe
```

```
225                 230                 235                 240

Ala Lys Ile Ile Tyr Glu Glu Ile Gln Asn Val Asn Asn Met Lys Glu
                245                 250                 255

Leu Ile Glu Lys Val Pro Asp Met Ser Glu Leu Lys Lys Ser Gln Val
            260                 265                 270

Phe Tyr Lys Tyr Tyr Leu Asp Lys Glu Glu Leu Asn Asp Lys Asn Ile
        275                 280                 285

Lys Tyr Ala Phe Cys His Phe Val Glu Ile Glu Met Ser Gln Leu Leu
    290                 295                 300

Lys Asn Tyr Val Tyr Lys Arg Leu Ser Asn Ile Ser Asn Asp Lys Ile
305                 310                 315                 320

Lys Arg Ile Phe Glu Tyr Gln Asn Leu Lys Lys Leu Ile Glu Asn Lys
                325                 330                 335

Leu Leu Asn Lys Leu Asp Thr Tyr Val Arg Asn Cys Gly Lys Tyr Asn
            340                 345                 350

Tyr Tyr Leu Gln Asp Gly Glu Ile Ala Thr Ser Asp Phe Ile Ala Arg
        355                 360                 365

Asn Arg Gln Asn Glu Ala Phe Leu Arg Asn Ile Ile Gly Val Ser Ser
    370                 375                 380

Val Ala Tyr Phe Ser Leu Arg Asn Ile Leu Glu Thr Glu Asn Glu Asn
385                 390                 395                 400

Asp Ile Thr Gly Arg Met Arg Gly Lys Thr Val Lys Asn Asn Lys Gly
                405                 410                 415

Glu Glu Lys Tyr Val Ser Gly Glu Val Asp Lys Ile Tyr Asn Glu Asn
            420                 425                 430
```

```
Lys Lys Asn Glu Val Lys Glu Asn Leu Lys Met Phe Tyr Ser Tyr Asp
        435                 440                 445

Phe Asn Met Asp Asn Lys Asn Glu Ile Glu Asp Phe Phe Ala Asn Ile
    450                 455                 460

Asp Glu Ala Ile Ser Ser Ile Arg His Gly Ile Val His Phe Asn Leu
465                 470                 475                 480

Glu Leu Glu Gly Lys Asp Ile Phe Ala Phe Lys Asn Ile Ala Pro Ser
                485                 490                 495

Glu Ile Ser Lys Lys Met Phe Gln Asn Glu Ile Asn Glu Lys Lys Leu
            500                 505                 510

Lys Leu Lys Ile Phe Arg Gln Leu Asn Ser Ala Asn Val Phe Arg Tyr
        515                 520                 525

Leu Glu Lys Tyr Lys Ile Leu Asn Tyr Leu Lys Arg Thr Arg Phe Glu
    530                 535                 540

Phe Val Asn Lys Asn Ile Pro Phe Val Pro Ser Phe Thr Lys Leu Tyr
545                 550                 555                 560

Ser Arg Ile Asp Asp Leu Lys Asn Ser Leu Gly Ile Tyr Trp Lys Thr
                565                 570                 575

Pro Lys Thr Asn Asp Asp Asn Lys Thr Lys Glu Ile Ile Asp Ala Gln
            580                 585                 590

Ile Tyr Leu Leu Lys Asn Ile Tyr Tyr Gly Glu Phe Leu Asn Tyr Phe
        595                 600                 605

Met Ser Asn Asn Gly Asn Phe Phe Glu Ile Ser Lys Glu Ile Ile Glu
    610                 615                 620

Leu Asn Lys Asn Asp Lys Arg Asn Leu Lys Thr Gly Phe Tyr Lys Leu
```

625 630 635 640

Gln Lys Phe Glu Asp Ile Gln Glu Lys Ile Pro Lys Glu Tyr Leu Ala
645 650 655

Asn Ile Gln Ser Leu Tyr Met Ile Asn Ala Gly Asn Gln Asp Glu Glu
660 665 670

Glu Lys Asp Thr Tyr Ile Asp Phe Ile Gln Lys Ile Phe Leu Lys Gly
675 680 685

Phe Met Thr Tyr Leu Ala Asn Asn Gly Arg Leu Ser Leu Ile Tyr Ile
690 695 700

Gly Ser Asp Glu Glu Thr Asn Thr Ser Leu Ala Glu Lys Lys Gln Glu
705 710 715 720

Phe Asp Lys Phe Leu Lys Lys Tyr Glu Gln Asn Asn Asn Ile Lys Ile
725 730 735

Pro Tyr Glu Ile Asn Glu Phe Leu Arg Glu Ile Lys Leu Gly Asn Ile
740 745 750

Leu Lys Tyr Thr Glu Arg Leu Asn Met Phe Tyr Leu Ile Leu Lys Leu
755 760 765

Leu Asn His Lys Glu Leu Thr Asn Leu Lys Gly Ser Leu Glu Lys Tyr
770 775 780

Gln Ser Ala Asn Lys Glu Glu Ala Phe Ser Asp Gln Leu Glu Leu Ile
785 790 795 800

Asn Leu Leu Asn Leu Asp Asn Asn Arg Val Thr Glu Asp Phe Glu Leu
805 810 815

Glu Ala Asp Glu Ile Gly Lys Phe Leu Asp Phe Asn Gly Asn Lys Val
820 825 830

```
Lys Asp Asn Lys Glu Leu Lys Lys Phe Asp Thr Asn Lys Ile Tyr Phe
        835                 840                 845

Asp Gly Glu Asn Ile Ile Lys His Arg Ala Phe Tyr Asn Ile Lys Lys
    850                 855                 860

Tyr Gly Met Leu Asn Leu Leu Glu Lys Ile Ala Asp Lys Ala Gly Tyr
865                 870                 875                 880

Lys Ile Ser Ile Glu Glu Leu Lys Lys Tyr Ser Asn Lys Lys Asn Glu
                885                 890                 895

Ile Glu Lys Asn His Lys Met Gln Glu Asn Leu His Arg Lys Tyr Ala
            900                 905                 910

Arg Pro Arg Lys Asp Glu Lys Phe Thr Asp Glu Asp Tyr Glu Ser Tyr
        915                 920                 925

Lys Gln Ala Ile Glu Asn Ile Glu Glu Tyr Thr His Leu Lys Asn Lys
    930                 935                 940

Val Glu Phe Asn Glu Leu Asn Leu Leu Gln Gly Leu Leu Leu Arg Ile
945                 950                 955                 960

Leu His Arg Leu Val Gly Tyr Thr Ser Ile Trp Glu Arg Asp Leu Arg
                965                 970                 975

Phe Arg Leu Lys Gly Glu Phe Pro Glu Asn Gln Tyr Ile Glu Glu Ile
            980                 985                 990

Phe Asn Phe Glu Asn Lys Lys Asn  Val Lys Tyr Lys Gly  Gly Gln Ile
        995                 1000                1005

Val Glu  Lys Tyr Ile Lys Phe  Tyr Lys Glu Leu His  Gln Asn Asp
    1010                1015                1020

Glu Val  Lys Ile Asn Lys Tyr  Ser Ser Ala Asn Ile  Lys Val Leu
```

```
    1025                1030                1035

Lys Gln  Glu Lys Lys Asp Leu  Tyr Ile Arg Asn Tyr  Ile Ala His
    1040                1045                1050

Phe Asn  Tyr Ile Pro His Ala  Glu Ile Ser Leu Leu  Glu Val Leu
    1055                1060                1065

Glu Asn  Leu Arg Lys Leu Leu  Ser Tyr Asp Arg Lys  Leu Lys Asn
    1070                1075                1080

Ala Val  Met Lys Ser Val Val  Asp Ile Leu Lys Glu  Tyr Gly Phe
    1085                1090                1095

Val Ala  Thr Phe Lys Ile Gly  Ala Asp Lys Lys Ile  Gly Ile Gln
    1100                1105                1110

Thr Leu  Glu Ser Glu Lys Ile  Val His Leu Lys Asn  Leu Lys Lys
    1115                1120                1125

Lys Lys  Leu Met Thr Asp Arg  Asn Ser Glu Glu Leu  Cys Lys Leu
    1130                1135                1140

Val Lys  Ile Met Phe Glu Tyr  Lys Met Glu Glu Lys  Lys Ser Glu
    1145                1150                1155

Asn
```

<210> 845
<211> 1389
<212> PRT
<213> Leptotrichia shahii

<400> 845

```
Met Gly Asn Leu Phe Gly His Lys Arg Trp Tyr Glu Val Arg Asp Lys
1               5                   10                  15
```

```
Lys Asp Phe Lys Ile Lys Arg Lys Val Lys Val Lys Arg Asn Tyr Asp
            20                  25                  30

Gly Asn Lys Tyr Ile Leu Asn Ile Asn Glu Asn Asn Asn Lys Glu Lys
        35                  40                  45

Ile Asp Asn Asn Lys Phe Ile Arg Lys Tyr Ile Asn Tyr Lys Lys Asn
    50                  55                  60

Asp Asn Ile Leu Lys Glu Phe Thr Arg Lys Phe His Ala Gly Asn Ile
65                  70                  75                  80

Leu Phe Lys Leu Lys Gly Lys Glu Gly Ile Ile Arg Ile Glu Asn Asn
                85                  90                  95

Asp Asp Phe Leu Glu Thr Glu Glu Val Val Leu Tyr Ile Glu Ala Tyr
            100                 105                 110

Gly Lys Ser Glu Lys Leu Lys Ala Leu Gly Ile Thr Lys Lys Lys Ile
        115                 120                 125

Ile Asp Glu Ala Ile Arg Gln Gly Ile Thr Lys Asp Asp Lys Lys Ile
    130                 135                 140

Glu Ile Lys Arg Gln Glu Asn Glu Glu Glu Ile Glu Ile Asp Ile Arg
145                 150                 155                 160

Asp Glu Tyr Thr Asn Lys Thr Leu Asn Asp Cys Ser Ile Ile Leu Arg
                165                 170                 175

Ile Ile Glu Asn Asp Glu Leu Glu Thr Lys Lys Ser Ile Tyr Glu Ile
            180                 185                 190

Phe Lys Asn Ile Asn Met Ser Leu Tyr Lys Ile Ile Glu Lys Ile Ile
        195                 200                 205

Glu Asn Glu Thr Glu Lys Val Phe Glu Asn Arg Tyr Tyr Glu Glu His
    210                 215                 220
```

```
Leu Arg Glu Lys Leu Leu Lys Asp Asp Lys Ile Asp Val Ile Leu Thr
225                 230                 235                 240

Asn Phe Met Glu Ile Arg Glu Lys Ile Lys Ser Asn Leu Glu Ile Leu
                245                 250                 255

Gly Phe Val Lys Phe Tyr Leu Asn Val Gly Gly Asp Lys Lys Lys Ser
            260                 265                 270

Lys Asn Lys Lys Met Leu Val Glu Lys Ile Leu Asn Ile Asn Val Asp
        275                 280                 285

Leu Thr Val Glu Asp Ile Ala Asp Phe Val Ile Lys Glu Leu Glu Phe
    290                 295                 300

Trp Asn Ile Thr Lys Arg Ile Glu Lys Val Lys Lys Val Asn Asn Glu
305                 310                 315                 320

Phe Leu Glu Lys Arg Arg Asn Arg Thr Tyr Ile Lys Ser Tyr Val Leu
                325                 330                 335

Leu Asp Lys His Glu Lys Phe Lys Ile Glu Arg Glu Asn Lys Lys Asp
            340                 345                 350

Lys Ile Val Lys Phe Phe Val Glu Asn Ile Lys Asn Asn Ser Ile Lys
        355                 360                 365

Glu Lys Ile Glu Lys Ile Leu Ala Glu Phe Lys Ile Asp Glu Leu Ile
    370                 375                 380

Lys Lys Leu Glu Lys Glu Leu Lys Lys Gly Asn Cys Asp Thr Glu Ile
385                 390                 395                 400

Phe Gly Ile Phe Lys Lys His Tyr Lys Val Asn Phe Asp Ser Lys Lys
                405                 410                 415
```

```
Phe Ser Lys Lys Ser Asp Glu Glu Lys Glu Leu Tyr Lys Ile Ile Tyr
            420                 425                 430

Arg Tyr Leu Lys Gly Arg Ile Glu Lys Ile Leu Val Asn Glu Gln Lys
        435                 440                 445

Val Arg Leu Lys Lys Met Glu Lys Ile Glu Ile Glu Lys Ile Leu Asn
    450                 455                 460

Glu Ser Ile Leu Ser Glu Lys Ile Leu Lys Arg Val Lys Gln Tyr Thr
465                 470                 475                 480

Leu Glu His Ile Met Tyr Leu Gly Lys Leu Arg His Asn Asp Ile Asp
                485                 490                 495

Met Thr Thr Val Asn Thr Asp Asp Phe Ser Arg Leu His Ala Lys Glu
            500                 505                 510

Glu Leu Asp Leu Glu Leu Ile Thr Phe Phe Ala Ser Thr Asn Met Glu
        515                 520                 525

Leu Asn Lys Ile Phe Ser Arg Glu Asn Ile Asn Asn Asp Glu Asn Ile
    530                 535                 540

Asp Phe Phe Gly Gly Asp Arg Glu Lys Asn Tyr Val Leu Asp Lys Lys
545                 550                 555                 560

Ile Leu Asn Ser Lys Ile Lys Ile Ile Arg Asp Leu Asp Phe Ile Asp
                565                 570                 575

Asn Lys Asn Asn Ile Thr Asn Asn Phe Ile Arg Lys Phe Thr Lys Ile
            580                 585                 590

Gly Thr Asn Glu Arg Asn Arg Ile Leu His Ala Ile Ser Lys Glu Arg
        595                 600                 605

Asp Leu Gln Gly Thr Gln Asp Asp Tyr Asn Lys Val Ile Asn Ile Ile
    610                 615                 620
```

```
Gln Asn Leu Lys Ile Ser Asp Glu Glu Val Ser Lys Ala Leu Asn Leu
625                 630                 635                 640

Asp Val Val Phe Lys Asp Lys Lys Asn Ile Ile Thr Lys Ile Asn Asp
                645                 650                 655

Ile Lys Ile Ser Glu Glu Asn Asn Asn Asp Ile Lys Tyr Leu Pro Ser
            660                 665                 670

Phe Ser Lys Val Leu Pro Glu Ile Leu Asn Leu Tyr Arg Asn Asn Pro
        675                 680                 685

Lys Asn Glu Pro Phe Asp Thr Ile Glu Thr Glu Lys Ile Val Leu Asn
    690                 695                 700

Ala Leu Ile Tyr Val Asn Lys Glu Leu Tyr Lys Lys Leu Ile Leu Glu
705                 710                 715                 720

Asp Asp Leu Glu Glu Asn Glu Ser Lys Asn Ile Phe Leu Gln Glu Leu
                725                 730                 735

Lys Lys Thr Leu Gly Asn Ile Asp Glu Ile Asp Glu Asn Ile Ile Glu
            740                 745                 750

Asn Tyr Tyr Lys Asn Ala Gln Ile Ser Ala Ser Lys Gly Asn Asn Lys
        755                 760                 765

Ala Ile Lys Lys Tyr Gln Lys Lys Val Ile Glu Cys Tyr Ile Gly Tyr
    770                 775                 780

Leu Arg Lys Asn Tyr Glu Glu Leu Phe Asp Phe Ser Asp Phe Lys Met
785                 790                 795                 800

Asn Ile Gln Glu Ile Lys Lys Gln Ile Lys Asp Ile Asn Asp Asn Lys
                805                 810                 815
```

```
Thr Tyr Glu Arg Ile Thr Val Lys Thr Ser Asp Lys Thr Ile Val Ile
            820                 825                 830

Asn Asp Asp Phe Glu Tyr Ile Ile Ser Ile Phe Ala Leu Leu Asn Ser
        835                 840                 845

Asn Ala Val Ile Asn Lys Ile Arg Asn Arg Phe Phe Ala Thr Ser Val
    850                 855                 860

Trp Leu Asn Thr Ser Glu Tyr Gln Asn Ile Ile Asp Ile Leu Asp Glu
865                 870                 875                 880

Ile Met Gln Leu Asn Thr Leu Arg Asn Glu Cys Ile Thr Glu Asn Trp
                885                 890                 895

Asn Leu Asn Leu Glu Glu Phe Ile Gln Lys Met Lys Glu Ile Glu Lys
            900                 905                 910

Asp Phe Asp Asp Phe Lys Ile Gln Thr Lys Lys Glu Ile Phe Asn Asn
        915                 920                 925

Tyr Tyr Glu Asp Ile Lys Asn Asn Ile Leu Thr Glu Phe Lys Asp Asp
    930                 935                 940

Ile Asn Gly Cys Asp Val Leu Glu Lys Lys Leu Glu Lys Ile Val Ile
945                 950                 955                 960

Phe Asp Asp Glu Thr Lys Phe Glu Ile Asp Lys Lys Ser Asn Ile Leu
                965                 970                 975

Gln Asp Glu Gln Arg Lys Leu Ser Asn Ile Asn Lys Lys Asp Leu Lys
            980                 985                 990

Lys Lys Val Asp Gln Tyr Ile Lys  Asp Lys Asp Gln Glu  Ile Lys Ser
        995                 1000                1005

Lys Ile  Leu Cys Arg Ile Ile  Phe Asn Ser Asp Phe  Leu Lys Lys
    1010                1015                1020
```

```
Tyr Lys  Lys Glu Ile Asp Asn  Leu Ile Glu Asp Met  Glu Ser Glu
    1025                1030                1035

Asn Glu  Asn Lys Phe Gln Glu  Ile Tyr Tyr Pro Lys  Glu Arg Lys
    1040                1045                1050

Asn Glu  Leu Tyr Ile Tyr Lys  Lys Asn Leu Phe Leu  Asn Ile Gly
    1055                1060                1065

Asn Pro  Asn Phe Asp Lys Ile  Tyr Gly Leu Ile Ser  Asn Asp Ile
    1070                1075                1080

Lys Met  Ala Asp Ala Lys Phe  Leu Phe Asn Ile Asp  Gly Lys Asn
    1085                1090                1095

Ile Arg  Lys Asn Lys Ile Ser  Glu Ile Asp Ala Ile  Leu Lys Asn
    1100                1105                1110

Leu Asn  Asp Lys Leu Asn Gly  Tyr Ser Lys Glu Tyr  Lys Glu Lys
    1115                1120                1125

Tyr Ile  Lys Lys Leu Lys Glu  Asn Asp Asp Phe Phe  Ala Lys Asn
    1130                1135                1140

Ile Gln  Asn Lys Asn Tyr Lys  Ser Phe Glu Lys Asp  Tyr Asn Arg
    1145                1150                1155

Val Ser  Glu Tyr Lys Lys Ile  Arg Asp Leu Val Glu  Phe Asn Tyr
    1160                1165                1170

Leu Asn  Lys Ile Glu Ser Tyr  Leu Ile Asp Ile Asn  Trp Lys Leu
    1175                1180                1185

Ala Ile  Gln Met Ala Arg Phe  Glu Arg Asp Met His  Tyr Ile Val
    1190                1195                1200
```

```
Asn Gly  Leu Arg Glu Leu Gly  Ile Ile Lys Leu Ser  Gly Tyr Asn
    1205                 1210                 1215

Thr Gly  Ile Ser Arg Ala Tyr  Pro Lys Arg Asn Gly  Ser Asp Gly
    1220                 1225                 1230

Phe Tyr  Thr Thr Thr Ala Tyr  Tyr Lys Phe Phe Asp  Glu Glu Ser
    1235                 1240                 1245

Tyr Lys  Lys Phe Glu Lys Ile  Cys Tyr Gly Phe Gly  Ile Asp Leu
    1250                 1255                 1260

Ser Glu  Asn Ser Glu Ile Asn  Lys Pro Glu Asn Glu  Ser Ile Arg
    1265                 1270                 1275

Asn Tyr  Ile Ser His Phe Tyr  Ile Val Arg Asn Pro  Phe Ala Asp
    1280                 1285                 1290

Tyr Ser  Ile Ala Glu Gln Ile  Asp Arg Val Ser Asn  Leu Leu Ser
    1295                 1300                 1305

Tyr Ser  Thr Arg Tyr Asn Asn  Ser Thr Tyr Ala Ser  Val Phe Glu
    1310                 1315                 1320

Val Phe  Lys Lys Asp Val Asn  Leu Asp Tyr Asp Glu  Leu Lys Lys
    1325                 1330                 1335

Lys Phe  Lys Leu Ile Gly Asn  Asn Asp Ile Leu Glu  Arg Leu Met
    1340                 1345                 1350

Lys Pro  Lys Lys Val Ser Val  Leu Glu Leu Glu Ser  Tyr Asn Ser
    1355                 1360                 1365

Asp Tyr  Ile Lys Asn Leu Ile  Ile Glu Leu Leu Thr  Lys Ile Glu
    1370                 1375                 1380

Asn Thr  Asn Asp Thr Leu
    1385
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<210> 846
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<212> PRT
<213> Artificial sequence

<220>
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<220>
<221> misc_feature
<222> (2)..(3)
<223> Xaa can be any naturally occurring amino acid

<220>
<221> MISC_FEATURE
<222> (4)..(4)
<223> Xaa at position 4 is a hydrophobic residue.

<220>
<221> MISC_FEATURE
<222> (5)..(5)
<223> Xaa at position 5 is Ser or Thr.

<220>
<221> misc_feature
<222> (6)..(6)
<223> Xaa can be any naturally occurring amino acid

<400> 846

Pro Xaa Xaa Xaa Xaa Xaa
1 5

<210> 847
<211> 6
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<220>
<221> MISC_FEATURE
<222> (2)..(2)
<223> Xaa at position 2 is Leu or Gln.

<400> 847

Pro Xaa Gly Met Thr Ser
1 5

<210> 848
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<220>
<221> MISC_FEATURE
<222> (2)..(2)
<223> Xaa at position 2 is Leu or Gln.

<400> 848

Pro Xaa Gly Met Thr
1 5

<210> 849
<211> 7
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 849

Glu Asn Leu Tyr Thr Gln Ser
1 5

<210> 850
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 850

Asp Asp Asp Asp Lys
1 5

<210> 851
<211> 4
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 851

Leu Val Pro Arg
1

<210> 852
<211> 8
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 852

Leu Glu Val Leu Phe Gln Gly Pro
1 5

<210> 853
<211> 10
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 853

Cys Gly Leu Val Pro Ala Gly Ser Gly Pro
1 5 10

<210> 854
<211> 12
<212> PRT

<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 854

Ser Leu Leu Lys Ser Arg Met Val Pro Asn Phe Asn
1   5   10

<210> 855
<211> 12
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 855

Ser Leu Leu Ile Ala Arg Arg Met Pro Asn Phe Asn
1   5   10

<210> 856
<211> 12
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 856

Ser Lys Leu Val Gln Ala Ser Ala Ser Gly Val Asn
1   5   10

<210> 857
<211> 12
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 857

Ser Ser Tyr Leu Lys Ala Ser Asp Ala Pro Asp Asn

1 5 10

<210> 858
<211> 12
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 858

Arg Pro Lys Pro Gln Gln Phe Phe Gly Leu Met Asn
1 5 10

<210> 859
<211> 12
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 859

Ser Leu Arg Pro Leu Ala Leu Trp Arg Ser Phe Asn
1 5 10

<210> 860
<211> 12
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 860

Ser Pro Gln Gly Ile Ala Gly Gln Arg Asn Phe Asn
1 5 10

<210> 861
<211> 14
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 861

Asp Val Asp Glu Arg Asp Val Arg Gly Phe Ala Ser Phe Leu
1   5   10

<210> 862
<211> 12
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 862

Ser Leu Pro Leu Gly Leu Trp Ala Pro Asn Phe Asn
1   5   10

<210> 863
<211> 12
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 863

Ser Leu Leu Ile Phe Arg Ser Trp Ala Asn Phe Asn
1   5   10

<210> 864
<211> 12
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 864

Ser Gly Val Val Ile Ala Thr Val Ile Val Ile Thr
1   5   10

<210> 865
<211> 12
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 865

Ser Leu Gly Pro Gln Gly Ile Trp Gly Gln Phe Asn
1 5 10

<210> 866
<211> 12
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 866

Lys Lys Ser Pro Gly Arg Val Val Gly Gly Ser Val
1 5 10

<210> 867
<211> 12
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 867

Pro Gln Gly Leu Leu Gly Ala Pro Gly Ile Leu Gly
1 5 10

<210> 868
<211> 31
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 868

His Gly Pro Glu Gly Leu Arg Val Gly Phe Tyr Glu Ser Asp Val Met
1 5 10 15

Gly Arg Gly His Ala Arg Leu Val His Val Glu Glu Pro His Thr
20 25 30

<210> 869
<211> 12
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 869

Gly Pro Gln Gly Leu Ala Gly Gln Arg Gly Ile Val
1 5 10

<210> 870
<211> 12
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 870

Gly Gly Ser Gly Gln Arg Gly Arg Lys Ala Leu Glu
1 5 10

<210> 871
<211> 12
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 871

Ser Leu Ser Ala Leu Leu Ser Ser Asp Ile Phe Asn

1 5 10

<210> 872
<211> 12
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 872

Ser Leu Pro Arg Phe Lys Ile Ile Gly Gly Phe Asn
1 5 10

<210> 873
<211> 12
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 873

Ser Leu Leu Gly Ile Ala Val Pro Gly Asn Phe Asn
1 5 10

<210> 874
<211> 12
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 874

Phe Phe Lys Asn Ile Val Thr Pro Arg Thr Pro Pro
1 5 10

<210> 875
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 875

His His His His His
1   5

<210> 876
<211> 6
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 876

His His His His His His
1   5

<210> 877
<211> 10
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 877

Glu Gln Lys Leu Ile Ser Glu Glu Asp Leu
1   5   10

<210> 878
<211> 8
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 878

Asp Tyr Lys Asp Asp Asp Asp Lys
1   5

<210> 879
<211> 8
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 879

Trp Ser His Pro Gln Phe Glu Lys
1   5

<210> 880
<211> 9
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 880

Tyr Pro Tyr Asp Val Pro Asp Tyr Ala
1   5

<210> 881
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 881

Arg Tyr Ile Arg Ser
1   5

<210> 882
<211> 4
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 882

Phe His His Thr
1

<210> 883
<211> 17
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 883

Trp Glu Ala Ala Ala Arg Glu Ala Cys Cys Arg Glu Cys Cys Ala Arg
1   5   10   15

Ala

<210> 884
<211> 108
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 884

Met Gly Val Gln Val Glu Thr Ile Ser Pro Gly Asp Gly Arg Thr Phe
1   5   10   15

Pro Lys Arg Gly Gln Thr Cys Val Val His Tyr Thr Gly Met Leu Glu
            20   25   30

Asp Gly Lys Lys Phe Asp Ser Ser Arg Asp Arg Asn Lys Pro Phe Lys
        35   40   45

Phe Met Leu Gly Lys Gln Glu Val Ile Arg Gly Trp Glu Glu Gly Val
    50   55   60

```
Ala Gln Met Ser Val Gly Gln Arg Ala Lys Leu Thr Ile Ser Pro Asp
65                  70                  75                  80


Tyr Ala Tyr Gly Ala Thr Gly His Pro Gly Ile Ile Pro Pro His Ala
                85                  90                  95


Thr Leu Val Phe Asp Val Glu Leu Leu Lys Leu Glu
            100                 105


<210>  885
<211>  196
<212>  PRT
<213>  Artificial sequence

<220>
<223>  synthetic sequence

<400>  885

Gln Leu Val Lys Ser Glu Leu Glu Glu Lys Lys Ser Glu Leu Arg His
1               5                   10                  15


Lys Leu Lys Tyr Val Pro His Glu Tyr Ile Glu Leu Ile Glu Ile Ala
            20                  25                  30


Arg Asn Ser Thr Gln Asp Arg Ile Leu Glu Met Lys Val Met Glu Phe
        35                  40                  45


Phe Met Lys Val Tyr Gly Tyr Arg Gly Lys His Leu Gly Gly Ser Arg
    50                  55                  60


Lys Pro Asp Gly Ala Ile Tyr Thr Val Gly Ser Pro Ile Asp Tyr Gly
65                  70                  75                  80


Val Ile Val Asp Thr Lys Ala Tyr Ser Gly Gly Tyr Asn Leu Pro Ile
                85                  90                  95


Gly Gln Ala Asp Glu Met Gln Arg Tyr Val Glu Glu Asn Gln Thr Arg
            100                 105                 110
```

```
Asn Lys His Ile Asn Pro Asn Glu Trp Trp Lys Val Tyr Pro Ser Ser
        115                 120                 125


Val Thr Glu Phe Lys Phe Leu Phe Val Ser Gly His Phe Lys Gly Asn
    130                 135                 140


Tyr Lys Ala Gln Leu Thr Arg Leu Asn His Ile Thr Asn Cys Asn Gly
145                 150                 155                 160


Ala Val Leu Ser Val Glu Glu Leu Leu Ile Gly Gly Glu Met Ile Lys
                165                 170                 175


Ala Gly Thr Leu Thr Leu Glu Glu Val Arg Arg Lys Phe Asn Asn Gly
            180                 185                 190


Glu Ile Asn Phe
        195


<210>  886
<211>  167
<212>  PRT
<213>  Artificial sequence

<220>
<223>  synthetic sequence

<400>  886

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                   10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60
```

```
Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95


Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
            100                 105                 110


Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125


Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140


Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160


Lys Ala Gln Ser Ser Thr Asp
                165
```

<210> 887
<211> 178
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 887

```
Met Arg Arg Ala Phe Ile Thr Gly Val Phe Phe Leu Ser Glu Val Glu
1               5                   10                  15


Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg
            20                  25                  30


Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val Leu Val His Asn
        35                  40                  45
```

```
Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile Gly Arg His Asp
    50                  55                  60

Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val
65                  70                  75                  80

Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr Val Thr Leu Glu
                85                  90                  95

Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg
            100                 105                 110

Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly Ala Ala Gly Ser Leu
        115                 120                 125

Met Asp Val Leu His His Pro Gly Met Asn His Arg Val Glu Ile Thr
    130                 135                 140

Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu Ser Asp Phe Phe
145                 150                 155                 160

Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys Lys Ala Gln Ser Ser
                165                 170                 175

Thr Asp
```

<210> 888
<211> 150
<212> PRT
<213> Staphylococcus aureus

<400> 888

```
Met Gly Ser His Met Thr Asn Asp Ile Tyr Phe Met Thr Leu Ala Ile
1               5                   10                  15

Glu Glu Ala Lys Lys Ala Ala Gln Leu Gly Glu Val Pro Ile Gly Ala
            20                  25                  30
```

```
Ile Ile Thr Lys Asp Asp Glu Val Ile Ala Arg Ala His Asn Leu Arg
        35                  40                  45

Glu Thr Leu Gln Gln Pro Thr Ala His Ala Glu His Ile Ala Ile Glu
    50                  55                  60

Arg Ala Ala Lys Val Leu Gly Ser Trp Arg Leu Glu Gly Cys Thr Leu
65                  70                  75                  80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Thr Ile Val Met
                85                  90                  95

Ser Arg Ile Pro Arg Val Val Tyr Gly Ala Asp Asp Pro Lys Gly Gly
            100                 105                 110

Cys Ser Gly Ser Leu Met Asn Leu Leu Gln Gln Ser Asn Phe Asn His
        115                 120                 125

Arg Ala Ile Val Asp Lys Gly Val Leu Lys Glu Ala Cys Ser Thr Leu
    130                 135                 140

Leu Thr Thr Phe Phe Lys
145                 150
```

<210> 889
<211> 161
<212> PRT
<213> Bacillus subtilis

<400> 889

```
Met Thr Gln Asp Glu Leu Tyr Met Lys Glu Ala Ile Lys Glu Ala Lys
1               5                   10                  15

Lys Ala Glu Glu Lys Gly Glu Val Pro Ile Gly Ala Val Leu Val Ile
            20                  25                  30

Asn Gly Glu Ile Ile Ala Arg Ala His Asn Leu Arg Glu Thr Glu Gln
```

```
        35                  40                  45

Arg Ser Ile Ala His Ala Glu Met Leu Val Ile Asp Glu Ala Cys Lys
    50                  55                  60

Ala Leu Gly Thr Trp Arg Leu Glu Gly Ala Thr Leu Tyr Val Thr Leu
65                  70                  75                  80

Glu Pro Cys Pro Met Cys Ala Gly Ala Val Val Leu Ser Arg Val Glu
                85                  90                  95

Lys Val Val Phe Gly Ala Phe Asp Pro Lys Gly Gly Cys Ser Gly Thr
            100                 105                 110

Leu Met Asn Leu Leu Gln Glu Glu Arg Phe Asn His Gln Ala Glu Val
        115                 120                 125

Val Ser Gly Val Leu Glu Glu Glu Cys Gly Gly Met Leu Ser Ala Phe
    130                 135                 140

Phe Arg Glu Leu Arg Lys Lys Lys Lys Ala Ala Arg Lys Asn Leu Ser
145                 150                 155                 160

Glu
```

<210> 890
<211> 183
<212> PRT
<213> Salmonella typhimurium

<400> 890

```
Met Pro Pro Ala Phe Ile Thr Gly Val Thr Ser Leu Ser Asp Val Glu
1               5                   10                  15

Leu Asp His Glu Tyr Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg
            20                  25                  30
```

```
Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val Leu Val His Asn
        35                  40                  45

His Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile Gly Arg His Asp
    50                  55                  60

Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val
65                  70                  75                  80

Leu Gln Asn Tyr Arg Leu Leu Asp Thr Thr Leu Tyr Val Thr Leu Glu
                85                  90                  95

Pro Cys Val Met Cys Ala Gly Ala Met Val His Ser Arg Ile Gly Arg
            100                 105                 110

Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly Ala Ala Gly Ser Leu
        115                 120                 125

Ile Asp Val Leu His His Pro Gly Met Asn His Arg Val Glu Ile Ile
    130                 135                 140

Glu Gly Val Leu Arg Asp Glu Cys Ala Thr Leu Leu Ser Asp Phe Phe
145                 150                 155                 160

Arg Met Arg Arg Gln Glu Ile Lys Ala Leu Lys Lys Ala Asp Arg Ala
                165                 170                 175

Glu Gly Ala Gly Pro Ala Val
            180
```

<210> 891
<211> 164
<212> PRT
<213> Shewanella putrefaciens

<400> 891

```
Met Asp Glu Tyr Trp Met Gln Val Ala Met Gln Met Ala Glu Lys Ala
1               5                   10                  15
```

```
Glu Ala Ala Gly Glu Val Pro Val Gly Ala Val Leu Val Lys Asp Gly
            20                  25                  30

Gln Gln Ile Ala Thr Gly Tyr Asn Leu Ser Ile Ser Gln His Asp Pro
        35                  40                  45

Thr Ala His Ala Glu Ile Leu Cys Leu Arg Ser Ala Gly Lys Lys Leu
    50                  55                  60

Glu Asn Tyr Arg Leu Leu Asp Ala Thr Leu Tyr Ile Thr Leu Glu Pro
65                  70                  75                  80

Cys Ala Met Cys Ala Gly Ala Met Val His Ser Arg Ile Ala Arg Val
                85                  90                  95

Val Tyr Gly Ala Arg Asp Glu Lys Thr Gly Ala Ala Gly Thr Val Val
            100                 105                 110

Asn Leu Leu Gln His Pro Ala Phe Asn His Gln Val Glu Val Thr Ser
        115                 120                 125

Gly Val Leu Ala Glu Ala Cys Ser Ala Gln Leu Ser Arg Phe Phe Lys
    130                 135                 140

Arg Arg Arg Asp Glu Lys Lys Ala Leu Lys Leu Ala Gln Arg Ala Gln
145                 150                 155                 160

Gln Gly Ile Glu
```

<210> 892
<211> 173
<212> PRT
<213> Haemophilus influenzae

<400> 892

```
Met Asp Ala Ala Lys Val Arg Ser Glu Phe Asp Glu Lys Met Met Arg
1               5                   10                  15
```

```
Tyr Ala Leu Glu Leu Ala Asp Lys Ala Glu Ala Leu Gly Glu Ile Pro
            20                  25                  30

Val Gly Ala Val Leu Val Asp Asp Ala Arg Asn Ile Ile Gly Glu Gly
        35                  40                  45

Trp Asn Leu Ser Ile Val Gln Ser Asp Pro Thr Ala His Ala Glu Ile
    50                  55                  60

Ile Ala Leu Arg Asn Gly Ala Lys Asn Ile Gln Asn Tyr Arg Leu Leu
65                  70                  75                  80

Asn Ser Thr Leu Tyr Val Thr Leu Glu Pro Cys Thr Met Cys Ala Gly
                85                  90                  95

Ala Ile Leu His Ser Arg Ile Lys Arg Leu Val Phe Gly Ala Ser Asp
            100                 105                 110

Tyr Lys Thr Gly Ala Ile Gly Ser Arg Phe His Phe Phe Asp Asp Tyr
        115                 120                 125

Lys Met Asn His Thr Leu Glu Ile Thr Ser Gly Val Leu Ala Glu Glu
    130                 135                 140

Cys Ser Gln Lys Leu Ser Thr Phe Phe Gln Lys Arg Arg Glu Glu Lys
145                 150                 155                 160

Lys Ile Glu Lys Ala Leu Leu Lys Ser Leu Ser Asp Lys
                165                 170
```

<210> 893
<211> 161
<212> PRT
<213> Caulobacter crescentus

<400> 893

```
Met Arg Thr Asp Glu Ser Glu Asp Gln Asp His Arg Met Met Arg Leu
```

```
1               5                   10                  15

Ala Leu Asp Ala Ala Arg Ala Ala Ala Glu Ala Gly Glu Thr Pro Val
            20                  25                  30

Gly Ala Val Ile Leu Asp Pro Ser Thr Gly Glu Val Ile Ala Thr Ala
        35                  40                  45

Gly Asn Gly Pro Ile Ala Ala His Asp Pro Thr Ala His Ala Glu Ile
    50                  55                  60

Ala Ala Met Arg Ala Ala Ala Ala Lys Leu Gly Asn Tyr Arg Leu Thr
65                  70                  75                  80

Asp Leu Thr Leu Val Val Thr Leu Glu Pro Cys Ala Met Cys Ala Gly
                85                  90                  95

Ala Ile Ser His Ala Arg Ile Gly Arg Val Val Phe Gly Ala Asp Asp
            100                 105                 110

Pro Lys Gly Gly Ala Val Val His Gly Pro Lys Phe Phe Ala Gln Pro
        115                 120                 125

Thr Cys His Trp Arg Pro Glu Val Thr Gly Gly Val Leu Ala Asp Glu
    130                 135                 140

Ser Ala Asp Leu Leu Arg Gly Phe Phe Arg Ala Arg Arg Lys Ala Lys
145                 150                 155                 160

Ile
```

<210> 894
<211> 179
<212> PRT
<213> Geobacter sulfurreducens

<400> 894

```
Met Ser Ser Leu Lys Lys Thr Pro Ile Arg Asp Asp Ala Tyr Trp Met
1               5                  10                  15

Gly Lys Ala Ile Arg Glu Ala Ala Lys Ala Ala Ala Arg Asp Glu Val
            20                  25                  30

Pro Ile Gly Ala Val Ile Val Arg Asp Gly Ala Val Ile Gly Arg Gly
        35                  40                  45

His Asn Leu Arg Glu Gly Ser Asn Asp Pro Ser Ala His Ala Glu Met
    50                  55                  60

Ile Ala Ile Arg Gln Ala Ala Arg Arg Ser Ala Asn Trp Arg Leu Thr
65                  70                  75                  80

Gly Ala Thr Leu Tyr Val Thr Leu Glu Pro Cys Leu Met Cys Met Gly
                85                  90                  95

Ala Ile Ile Leu Ala Arg Leu Glu Arg Val Val Phe Gly Cys Tyr Asp
            100                 105                 110

Pro Lys Gly Gly Ala Ala Gly Ser Leu Tyr Asp Leu Ser Ala Asp Pro
        115                 120                 125

Arg Leu Asn His Gln Val Arg Leu Ser Pro Gly Val Cys Gln Glu Glu
    130                 135                 140

Cys Gly Thr Met Leu Ser Asp Phe Phe Arg Asp Leu Arg Arg Arg Lys
145                 150                 155                 160

Lys Ala Lys Ala Thr Pro Ala Leu Phe Ile Asp Glu Arg Lys Val Pro
                165                 170                 175

Pro Glu Pro
```

<210> 895
<211> 198

<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 895

Met Asp Ser Leu Leu Met Asn Arg Arg Lys Phe Leu Tyr Gln Phe Lys
1 5 10 15

Asn Val Arg Trp Ala Lys Gly Arg Arg Glu Thr Tyr Leu Cys Tyr Val
20 25 30

Val Lys Arg Arg Asp Ser Ala Thr Ser Phe Ser Leu Asp Phe Gly Tyr
35 40 45

Leu Arg Asn Lys Asn Gly Cys His Val Glu Leu Leu Phe Leu Arg Tyr
50 55 60

Ile Ser Asp Trp Asp Leu Asp Pro Gly Arg Cys Tyr Arg Val Thr Trp
65 70 75 80

Phe Thr Ser Trp Ser Pro Cys Tyr Asp Cys Ala Arg His Val Ala Asp
85 90 95

Phe Leu Arg Gly Asn Pro Asn Leu Ser Leu Arg Ile Phe Thr Ala Arg
100 105 110

Leu Tyr Phe Cys Glu Asp Arg Lys Ala Glu Pro Glu Gly Leu Arg Arg
115 120 125

Leu His Arg Ala Gly Val Gln Ile Ala Ile Met Thr Phe Lys Asp Tyr
130 135 140

Phe Tyr Cys Trp Asn Thr Phe Val Glu Asn His Glu Arg Thr Phe Lys
145 150 155 160

Ala Trp Glu Gly Leu His Glu Asn Ser Val Arg Leu Ser Arg Gln Leu
165 170 175

Arg Arg Ile Leu Leu Pro Leu Tyr Glu Val Asp Asp Leu Arg Asp Ala
180 185 190

Phe Arg Thr Leu Gly Leu
195

<210> 896
<211> 188
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 896

Met Asp Ser Leu Leu Met Asn Arg Arg Lys Phe Leu Tyr Gln Phe Lys
1 5 10 15

Asn Val Arg Trp Ala Lys Gly Arg Arg Glu Thr Tyr Leu Cys Tyr Val
20 25 30

Val Lys Arg Arg Asp Ser Ala Thr Ser Phe Ser Leu Asp Phe Gly Tyr
35 40 45

Leu Arg Asn Lys Asn Gly Cys His Val Glu Leu Leu Phe Leu Arg Tyr
50 55 60

Ile Ser Asp Trp Asp Leu Asp Pro Gly Arg Cys Tyr Arg Val Thr Trp
65 70 75 80

Phe Thr Ser Trp Ser Pro Cys Tyr Asp Cys Ala Arg His Val Ala Asp
85 90 95

Phe Leu Arg Gly Asn Pro Asn Leu Ser Leu Arg Ile Phe Thr Ala Arg
100 105 110

Leu Tyr Phe Cys Glu Asp Arg Lys Ala Glu Pro Glu Gly Leu Arg Arg
115 120 125

```
Leu His Arg Ala Gly Val Gln Ile Ala Ile Met Thr Phe Lys Glu Asn
    130                 135                 140

His Glu Arg Thr Phe Lys Ala Trp Glu Gly Leu His Glu Asn Ser Val
145                 150                 155                 160

Arg Leu Ser Arg Gln Leu Arg Arg Ile Leu Leu Pro Leu Tyr Glu Val
                165                 170                 175

Asp Asp Leu Arg Asp Ala Phe Arg Thr Leu Gly Leu
            180                 185
```

<210> 897
<211> 198
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 897

```
Met Asp Ser Leu Leu Met Asn Arg Arg Lys Phe Leu Tyr Gln Phe Lys
1               5                   10                  15

Asn Val Arg Trp Ala Lys Gly Arg Arg Glu Thr Tyr Leu Cys Tyr Val
            20                  25                  30

Val Lys Arg Arg Asp Ser Ala Thr Ser Phe Ser Leu Asp Phe Gly Tyr
        35                  40                  45

Leu Arg Asn Lys Asn Gly Cys His Val Glu Leu Leu Phe Leu Arg Tyr
    50                  55                  60

Ile Ser Asp Trp Asp Leu Asp Pro Gly Arg Cys Tyr Arg Val Thr Trp
65                  70                  75                  80

Phe Thr Ser Trp Ser Pro Cys Tyr Asp Cys Ala Arg His Val Ala Asp
                85                  90                  95
```

```
Phe Leu Arg Gly Asn Pro Asn Leu Ser Leu Arg Ile Phe Thr Ala Arg
            100                 105                 110


Leu Tyr Phe Cys Glu Asp Arg Lys Ala Glu Pro Glu Gly Leu Arg Arg
        115                 120                 125


Leu His Arg Ala Gly Val Gln Ile Ala Ile Met Thr Phe Lys Asp Tyr
    130                 135                 140


Phe Tyr Cys Trp Asn Thr Phe Val Glu Asn His Glu Arg Thr Phe Lys
145                 150                 155                 160


Ala Trp Glu Gly Leu His Glu Asn Ser Val Arg Leu Ser Arg Gln Leu
                165                 170                 175


Arg Arg Ile Leu Leu Pro Leu Tyr Glu Val Asp Asp Leu Arg Asp Ala
            180                 185                 190


Phe Arg Thr Leu Gly Leu
        195


<210>  898
<211>  1367
<212>  PRT
<213>  Artificial sequence

<220>
<223>  synthetic sequence

<400>  898

Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly
1               5                   10                  15


Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys
            20                  25                  30


Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly
        35                  40                  45
```

```
Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys
    50                  55                  60

Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr
65                  70                  75                  80

Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe
                85                  90                  95

Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His
            100                 105                 110

Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His
        115                 120                 125

Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser
    130                 135                 140

Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met
145                 150                 155                 160

Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp
                165                 170                 175

Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn
            180                 185                 190

Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240
```

```
Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445
```

```
Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Ala
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640
```

```
Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Ala Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe Ala
        675                 680                 685

Asn Arg Asn Phe Met Ala Leu Ile His Asp Asp Ser Leu Thr Phe Lys
    690                 695                 700

Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His
705                 710                 715                 720

Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg
            740                 745                 750

His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
        755                 760                 765

Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu
    770                 775                 780

Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val
785                 790                 795                 800

Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln
                805                 810                 815

Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu
            820                 825                 830

Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp
        835                 840                 845
```

```
Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly
    850                 855                 860

Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn
865                 870                 875                 880

Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe
                885                 890                 895

Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys
            900                 905                 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Ala Ile Thr Lys
        915                 920                 925

His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu
    930                 935                 940

Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys
945                 950                 955                 960

Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu
                965                 970                 975

Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val
            980                 985                 990

Gly Thr Ala Leu Ile Lys Lys Tyr  Pro Lys Leu Glu Ser  Glu Phe Val
        995                 1000                1005

Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg Lys Met  Ile Ala Lys
    1010                1015                1020

Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala Lys Tyr  Phe Phe Tyr
    1025                1030                1035
```

```
Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu Ile Thr  Leu Ala Asn
    1040                1045                1050

Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu Thr Asn  Gly Glu Thr
    1055                1060                1065

Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp Phe Ala  Thr Val Arg
    1070                1075                1080

Lys Val  Leu Ser Met Pro Gln  Val Asn Ile Val Lys  Lys Thr Glu
    1085                1090                1095

Val Gln  Thr Gly Gly Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Arg
    1100                1105                1110

Asn Ser  Asp Lys Leu Ile Ala  Arg Lys Lys Asp Trp  Asp Pro Lys
    1115                1120                1125

Lys Tyr  Gly Gly Phe Asp Ser  Pro Thr Val Ala Tyr  Ser Val Leu
    1130                1135                1140

Val Val  Ala Lys Val Glu Lys  Gly Lys Ser Lys Lys  Leu Lys Ser
    1145                1150                1155

Val Lys  Glu Leu Leu Gly Ile  Thr Ile Met Glu Arg  Ser Ser Phe
    1160                1165                1170

Glu Lys  Asn Pro Ile Asp Phe  Leu Glu Ala Lys Gly  Tyr Lys Glu
    1175                1180                1185

Val Lys  Lys Asp Leu Ile Ile  Lys Leu Pro Lys Tyr  Ser Leu Phe
    1190                1195                1200

Glu Leu  Glu Asn Gly Arg Lys  Arg Met Leu Ala Ser  Ala Gly Glu
    1205                1210                1215

Leu Gln  Lys Gly Asn Glu Leu  Ala Leu Pro Ser Lys  Tyr Val Asn
    1220                1225                1230
```

```
Phe Leu  Tyr Leu Ala Ser His  Tyr Glu Lys Leu Lys  Gly Ser Pro
    1235                1240                1245


Glu Asp  Asn Glu Gln Lys Gln  Leu Phe Val Glu Gln  His Lys His
    1250                1255                1260


Tyr Leu  Asp Glu Ile Ile Glu  Gln Ile Ser Glu Phe  Ser Lys Arg
    1265                1270                1275


Val Ile  Leu Ala Asp Ala Asn  Leu Asp Lys Val Leu  Ser Ala Tyr
    1280                1285                1290


Asn Lys  His Arg Asp Lys Pro  Ile Arg Glu Gln Ala  Glu Asn Ile
    1295                1300                1305


Ile His  Leu Phe Thr Leu Thr  Asn Leu Gly Ala Pro  Ala Ala Phe
    1310                1315                1320


Lys Tyr  Phe Asp Thr Thr Ile  Asp Arg Lys Arg Tyr  Thr Ser Thr
    1325                1330                1335


Lys Glu  Val Leu Asp Ala Thr  Leu Ile His Gln Ser  Ile Thr Gly
    1340                1345                1350


Leu Tyr  Glu Thr Arg Ile Asp  Leu Ser Gln Leu Gly  Gly Asp
    1355                1360                1365


<210>  899
<211>  196
<212>  PRT
<213>  Artificial sequence

<220>
<223>  synthetic sequence

<400>  899

Gln Leu Val Lys Ser Glu Leu Glu Glu Lys Lys Ser Glu Leu Arg His
1               5                  10                  15
```

```
Lys Leu Lys Tyr Val Pro His Glu Tyr Ile Glu Leu Ile Glu Ile Ala
            20                  25                  30

Arg Asn Ser Thr Gln Asp Arg Ile Leu Glu Met Lys Val Met Glu Phe
        35                  40                  45

Phe Met Lys Val Tyr Gly Tyr Arg Gly Lys His Leu Gly Gly Ser Arg
    50                  55                  60

Lys Pro Asp Gly Ala Ile Tyr Thr Val Gly Ser Pro Ile Asp Tyr Gly
65                  70                  75                  80

Val Ile Val Asp Thr Lys Ala Tyr Ser Gly Gly Tyr Asn Leu Pro Ile
                85                  90                  95

Gly Gln Ala Asp Glu Met Gln Arg Tyr Val Glu Glu Asn Gln Thr Arg
            100                 105                 110

Asn Lys His Ile Asn Pro Asn Glu Trp Trp Lys Val Tyr Pro Ser Ser
        115                 120                 125

Val Thr Glu Phe Lys Phe Leu Phe Val Ser Gly His Phe Lys Gly Asn
    130                 135                 140

Tyr Lys Ala Gln Leu Thr Arg Leu Asn His Ile Thr Asn Cys Asn Gly
145                 150                 155                 160

Ala Val Leu Ser Val Glu Glu Leu Leu Ile Gly Gly Glu Met Ile Lys
                165                 170                 175

Ala Gly Thr Leu Thr Leu Glu Glu Val Arg Arg Lys Phe Asn Asn Gly
            180                 185                 190

Glu Ile Asn Phe
        195
```

<210> 900
<211> 196
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 900

```
Gln Leu Val Lys Ser Glu Leu Glu Glu Lys Lys Ser Glu Leu Arg His
1               5                  10                  15


Lys Leu Lys Tyr Val Pro His Glu Tyr Ile Glu Leu Ile Glu Ile Ala
            20                  25                  30


Arg Asn Ser Thr Gln Asp Arg Ile Leu Glu Met Lys Val Met Glu Phe
        35                  40                  45


Phe Met Lys Val Tyr Gly Tyr Arg Gly Lys His Leu Gly Gly Ser Arg
    50                  55                  60


Lys Pro Asp Gly Ala Ile Tyr Thr Val Gly Ser Pro Ile Asp Tyr Gly
65                  70                  75                  80


Val Ile Val Asp Thr Lys Ala Tyr Ser Gly Gly Tyr Asn Leu Pro Ile
                85                  90                  95


Gly Gln Ala Asp Glu Met Gln Arg Tyr Val Glu Glu Asn Gln Thr Arg
            100                 105                 110


Asn Lys His Ile Asn Pro Asn Glu Trp Trp Lys Val Tyr Pro Ser Ser
        115                 120                 125


Val Thr Glu Phe Lys Phe Leu Phe Val Ser Gly His Phe Lys Gly Asn
    130                 135                 140


Tyr Lys Ala Gln Leu Thr Arg Leu Asn His Ile Thr Asn Cys Asn Gly
145                 150                 155                 160
```

Ala Val Leu Ser Val Glu Glu Leu Leu Ile Gly Gly Glu Met Ile Lys
165 170 175

Ala Gly Thr Leu Thr Leu Glu Glu Val Arg Arg Lys Phe Asn Asn Gly
180 185 190

Glu Ile Asn Phe
195

<210> 901
<211> 167
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 901

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1 5 10 15

Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
20 25 30

Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
35 40 45

Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
50 55 60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65 70 75 80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
85 90 95

Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
100 105 110

```
Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125


Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140


Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160


Lys Ala Gln Ser Ser Thr Asp
                165


<210>  902
<211>  178
<212>  PRT
<213>  Artificial sequence

<220>
<223>  synthetic sequence

<400>  902

Met Arg Arg Ala Phe Ile Thr Gly Val Phe Phe Leu Ser Glu Val Glu
1               5                   10                  15


Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg
            20                  25                  30


Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val Leu Val His Asn
        35                  40                  45


Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile Gly Arg His Asp
    50                  55                  60


Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val
65                  70                  75                  80


Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr Val Thr Leu Glu
                85                  90                  95
```

```
Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg
            100                 105                 110

Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly Ala Ala Gly Ser Leu
        115                 120                 125

Met Asp Val Leu His His Pro Gly Met Asn His Arg Val Glu Ile Thr
    130                 135                 140

Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu Ser Asp Phe Phe
145                 150                 155                 160

Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys Lys Ala Gln Ser Ser
                165                 170                 175

Thr Asp
```

<210> 903
<211> 160
<212> PRT
<213> Staphylococcus aureus

<400> 903

```
Met Gly Ser His Met Thr Asn Asp Ile Tyr Phe Met Thr Leu Ala Ile
1               5                   10                  15

Glu Glu Ala Lys Lys Ala Ala Gln Leu Gly Glu Val Pro Ile Gly Ala
            20                  25                  30

Ile Ile Thr Lys Asp Asp Glu Val Ile Ala Arg Ala His Asn Leu Arg
        35                  40                  45

Glu Thr Leu Gln Gln Pro Thr Ala His Ala Glu His Ile Ala Ile Glu
    50                  55                  60

Arg Ala Ala Lys Val Leu Gly Ser Trp Arg Leu Glu Gly Cys Thr Leu
65                  70                  75                  80
```

```
Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Thr Ile Val Met
                85                  90                  95


Ser Arg Ile Pro Arg Val Val Tyr Gly Ala Asp Asp Pro Lys Gly Gly
            100                 105                 110


Cys Ser Gly Ser Leu Met Asn Leu Leu Gln Gln Ser Asn Phe Asn His
        115                 120                 125


Arg Ala Ile Val Asp Lys Gly Val Leu Lys Glu Ala Cys Ser Thr Leu
    130                 135                 140


Leu Thr Thr Phe Phe Lys Asn Leu Arg Ala Asn Lys Lys Ser Thr Asn
145                 150                 155                 160


<210>  904
<211>  161
<212>  PRT
<213>  Bacillus subtilis

<400>  904

Met Thr Gln Asp Glu Leu Tyr Met Lys Glu Ala Ile Lys Glu Ala Lys
1               5                   10                  15


Lys Ala Glu Glu Lys Gly Glu Val Pro Ile Gly Ala Val Leu Val Ile
            20                  25                  30


Asn Gly Glu Ile Ile Ala Arg Ala His Asn Leu Arg Glu Thr Glu Gln
        35                  40                  45


Arg Ser Ile Ala His Ala Glu Met Leu Val Ile Asp Glu Ala Cys Lys
    50                  55                  60


Ala Leu Gly Thr Trp Arg Leu Glu Gly Ala Thr Leu Tyr Val Thr Leu
65                  70                  75                  80


Glu Pro Cys Pro Met Cys Ala Gly Ala Val Val Leu Ser Arg Val Glu
                85                  90                  95
```

```
Lys Val Val Phe Gly Ala Phe Asp Pro Lys Gly Gly Cys Ser Gly Thr
            100                 105                 110

Leu Met Asn Leu Leu Gln Glu Glu Arg Phe Asn His Gln Ala Glu Val
        115                 120                 125

Val Ser Gly Val Leu Glu Glu Glu Cys Gly Gly Met Leu Ser Ala Phe
    130                 135                 140

Phe Arg Glu Leu Arg Lys Lys Lys Lys Ala Ala Arg Lys Asn Leu Ser
145                 150                 155                 160

Glu
```

<210> 905
<211> 183
<212> PRT
<213> Salmonella typhimurium

<400> 905

```
Met Pro Pro Ala Phe Ile Thr Gly Val Thr Ser Leu Ser Asp Val Glu
1               5                   10                  15

Leu Asp His Glu Tyr Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg
            20                  25                  30

Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val Leu Val His Asn
        35                  40                  45

His Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile Gly Arg His Asp
    50                  55                  60

Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val
65                  70                  75                  80

Leu Gln Asn Tyr Arg Leu Leu Asp Thr Thr Leu Tyr Val Thr Leu Glu
```

```
                85                  90                  95

Pro Cys Val Met Cys Ala Gly Ala Met Val His Ser Arg Ile Gly Arg
            100                 105                 110

Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly Ala Ala Gly Ser Leu
        115                 120                 125

Ile Asp Val Leu His His Pro Gly Met Asn His Arg Val Glu Ile Ile
    130                 135                 140

Glu Gly Val Leu Arg Asp Glu Cys Ala Thr Leu Leu Ser Asp Phe Phe
145                 150                 155                 160

Arg Met Arg Arg Gln Glu Ile Lys Ala Leu Lys Lys Ala Asp Arg Ala
                165                 170                 175

Glu Gly Ala Gly Pro Ala Val
            180


<210>  906
<211>  164
<212>  PRT
<213>  Shewanella putrefaciens

<400>  906

Met Asp Glu Tyr Trp Met Gln Val Ala Met Gln Met Ala Glu Lys Ala
1               5                   10                  15

Glu Ala Ala Gly Glu Val Pro Val Gly Ala Val Leu Val Lys Asp Gly
            20                  25                  30

Gln Gln Ile Ala Thr Gly Tyr Asn Leu Ser Ile Ser Gln His Asp Pro
        35                  40                  45

Thr Ala His Ala Glu Ile Leu Cys Leu Arg Ser Ala Gly Lys Lys Leu
    50                  55                  60
```

```
Glu Asn Tyr Arg Leu Leu Asp Ala Thr Leu Tyr Ile Thr Leu Glu Pro
65                  70                  75                  80

Cys Ala Met Cys Ala Gly Ala Met Val His Ser Arg Ile Ala Arg Val
                85                  90                  95

Val Tyr Gly Ala Arg Asp Glu Lys Thr Gly Ala Ala Gly Thr Val Val
            100                 105                 110

Asn Leu Leu Gln His Pro Ala Phe Asn His Gln Val Glu Val Thr Ser
        115                 120                 125

Gly Val Leu Ala Glu Ala Cys Ser Ala Gln Leu Ser Arg Phe Phe Lys
    130                 135                 140

Arg Arg Arg Asp Glu Lys Lys Ala Leu Lys Leu Ala Gln Arg Ala Gln
145                 150                 155                 160

Gln Gly Ile Glu
```

<210> 907
<211> 173
<212> PRT
<213> Haemophilus influenzae

<400> 907

```
Met Asp Ala Ala Lys Val Arg Ser Glu Phe Asp Glu Lys Met Met Arg
1               5                   10                  15

Tyr Ala Leu Glu Leu Ala Asp Lys Ala Glu Ala Leu Gly Glu Ile Pro
            20                  25                  30

Val Gly Ala Val Leu Val Asp Asp Ala Arg Asn Ile Ile Gly Glu Gly
        35                  40                  45

Trp Asn Leu Ser Ile Val Gln Ser Asp Pro Thr Ala His Ala Glu Ile
    50                  55                  60
```

```
Ile Ala Leu Arg Asn Gly Ala Lys Asn Ile Gln Asn Tyr Arg Leu Leu
65                  70                  75                  80


Asn Ser Thr Leu Tyr Val Thr Leu Glu Pro Cys Thr Met Cys Ala Gly
                85                  90                  95


Ala Ile Leu His Ser Arg Ile Lys Arg Leu Val Phe Gly Ala Ser Asp
            100                 105                 110


Tyr Lys Thr Gly Ala Ile Gly Ser Arg Phe His Phe Phe Asp Asp Tyr
        115                 120                 125


Lys Met Asn His Thr Leu Glu Ile Thr Ser Gly Val Leu Ala Glu Glu
    130                 135                 140


Cys Ser Gln Lys Leu Ser Thr Phe Phe Gln Lys Arg Arg Glu Glu Lys
145                 150                 155                 160


Lys Ile Glu Lys Ala Leu Leu Lys Ser Leu Ser Asp Lys
                165                 170


<210>  908
<211>  161
<212>  PRT
<213>  Caulobacter crescentus

<400>  908

Met Arg Thr Asp Glu Ser Glu Asp Gln Asp His Arg Met Met Arg Leu
1               5                   10                  15


Ala Leu Asp Ala Ala Arg Ala Ala Ala Glu Ala Gly Glu Thr Pro Val
            20                  25                  30


Gly Ala Val Ile Leu Asp Pro Ser Thr Gly Glu Val Ile Ala Thr Ala
        35                  40                  45


Gly Asn Gly Pro Ile Ala Ala His Asp Pro Thr Ala His Ala Glu Ile
    50                  55                  60
```

```
Ala Ala Met Arg Ala Ala Ala Ala Lys Leu Gly Asn Tyr Arg Leu Thr
65                  70                  75                  80

Asp Leu Thr Leu Val Val Thr Leu Glu Pro Cys Ala Met Cys Ala Gly
                85                  90                  95

Ala Ile Ser His Ala Arg Ile Gly Arg Val Val Phe Gly Ala Asp Asp
            100                 105                 110

Pro Lys Gly Gly Ala Val Val His Gly Pro Lys Phe Phe Ala Gln Pro
        115                 120                 125

Thr Cys His Trp Arg Pro Glu Val Thr Gly Gly Val Leu Ala Asp Glu
    130                 135                 140

Ser Ala Asp Leu Leu Arg Gly Phe Phe Arg Ala Arg Arg Lys Ala Lys
145                 150                 155                 160

Ile
```

<210> 909
<211> 179
<212> PRT
<213> Geobacter sulfurreducens

<400> 909

```
Met Ser Ser Leu Lys Lys Thr Pro Ile Arg Asp Asp Ala Tyr Trp Met
1               5                   10                  15

Gly Lys Ala Ile Arg Glu Ala Ala Lys Ala Ala Ala Arg Asp Glu Val
            20                  25                  30

Pro Ile Gly Ala Val Ile Val Arg Asp Gly Ala Val Ile Gly Arg Gly
        35                  40                  45

His Asn Leu Arg Glu Gly Ser Asn Asp Pro Ser Ala His Ala Glu Met
```

```
    50                  55                  60

Ile Ala Ile Arg Gln Ala Ala Arg Arg Ser Ala Asn Trp Arg Leu Thr
65                  70                  75                  80

Gly Ala Thr Leu Tyr Val Thr Leu Glu Pro Cys Leu Met Cys Met Gly
                85                  90                  95

Ala Ile Ile Leu Ala Arg Leu Glu Arg Val Val Phe Gly Cys Tyr Asp
            100                 105                 110

Pro Lys Gly Gly Ala Ala Gly Ser Leu Tyr Asp Leu Ser Ala Asp Pro
        115                 120                 125

Arg Leu Asn His Gln Val Arg Leu Ser Pro Gly Val Cys Gln Glu Glu
    130                 135                 140

Cys Gly Thr Met Leu Ser Asp Phe Phe Arg Asp Leu Arg Arg Arg Lys
145                 150                 155                 160

Lys Ala Lys Ala Thr Pro Ala Leu Phe Ile Asp Glu Arg Lys Val Pro
                165                 170                 175

Pro Glu Pro
```

<210> 910
<211> 198
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 910

```
Met Asp Ser Leu Leu Met Asn Arg Arg Lys Phe Leu Tyr Gln Phe Lys
1               5                   10                  15

Asn Val Arg Trp Ala Lys Gly Arg Arg Glu Thr Tyr Leu Cys Tyr Val
```

```
            20                  25                  30

Val Lys Arg Arg Asp Ser Ala Thr Ser Phe Ser Leu Asp Phe Gly Tyr
        35                  40                  45

Leu Arg Asn Lys Asn Gly Cys His Val Glu Leu Leu Phe Leu Arg Tyr
    50                  55                  60

Ile Ser Asp Trp Asp Leu Asp Pro Gly Arg Cys Tyr Arg Val Thr Trp
65                  70                  75                  80

Phe Thr Ser Trp Ser Pro Cys Tyr Asp Cys Ala Arg His Val Ala Asp
                85                  90                  95

Phe Leu Arg Gly Asn Pro Asn Leu Ser Leu Arg Ile Phe Thr Ala Arg
            100                 105                 110

Leu Tyr Phe Cys Glu Asp Arg Lys Ala Glu Pro Glu Gly Leu Arg Arg
        115                 120                 125

Leu His Arg Ala Gly Val Gln Ile Ala Ile Met Thr Phe Lys Asp Tyr
    130                 135                 140

Phe Tyr Cys Trp Asn Thr Phe Val Glu Asn His Glu Arg Thr Phe Lys
145                 150                 155                 160

Ala Trp Glu Gly Leu His Glu Asn Ser Val Arg Leu Ser Arg Gln Leu
                165                 170                 175

Arg Arg Ile Leu Leu Pro Leu Tyr Glu Val Asp Asp Leu Arg Asp Ala
            180                 185                 190

Phe Arg Thr Leu Gly Leu
        195


<210>  911
<211>  188
<212>  PRT
```

<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 911

```
Met Asp Ser Leu Leu Met Asn Arg Arg Lys Phe Leu Tyr Gln Phe Lys
1               5                  10                  15


Asn Val Arg Trp Ala Lys Gly Arg Arg Glu Thr Tyr Leu Cys Tyr Val
            20                  25                  30


Val Lys Arg Arg Asp Ser Ala Thr Ser Phe Ser Leu Asp Phe Gly Tyr
        35                  40                  45


Leu Arg Asn Lys Asn Gly Cys His Val Glu Leu Leu Phe Leu Arg Tyr
    50                  55                  60


Ile Ser Asp Trp Asp Leu Asp Pro Gly Arg Cys Tyr Arg Val Thr Trp
65                  70                  75                  80


Phe Thr Ser Trp Ser Pro Cys Tyr Asp Cys Ala Arg His Val Ala Asp
                85                  90                  95


Phe Leu Arg Gly Asn Pro Asn Leu Ser Leu Arg Ile Phe Thr Ala Arg
            100                 105                 110


Leu Tyr Phe Cys Glu Asp Arg Lys Ala Glu Pro Glu Gly Leu Arg Arg
        115                 120                 125


Leu His Arg Ala Gly Val Gln Ile Ala Ile Met Thr Phe Lys Glu Asn
    130                 135                 140


His Glu Arg Thr Phe Lys Ala Trp Glu Gly Leu His Glu Asn Ser Val
145                 150                 155                 160


Arg Leu Ser Arg Gln Leu Arg Arg Ile Leu Leu Pro Leu Tyr Glu Val
                165                 170                 175
```

Asp Asp Leu Arg Asp Ala Phe Arg Thr Leu Gly Leu
            180   185

<210> 912
<211> 198
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 912

Met Asp Ser Leu Leu Met Asn Arg Arg Lys Phe Leu Tyr Gln Phe Lys
1   5   10   15

Asn Val Arg Trp Ala Lys Gly Arg Arg Glu Thr Tyr Leu Cys Tyr Val
            20   25   30

Val Lys Arg Arg Asp Ser Ala Thr Ser Phe Ser Leu Asp Phe Gly Tyr
        35   40   45

Leu Arg Asn Lys Asn Gly Cys His Val Glu Leu Leu Phe Leu Arg Tyr
    50   55   60

Ile Ser Asp Trp Asp Leu Asp Pro Gly Arg Cys Tyr Arg Val Thr Trp
65   70   75   80

Phe Thr Ser Trp Ser Pro Cys Tyr Asp Cys Ala Arg His Val Ala Asp
                85   90   95

Phe Leu Arg Gly Asn Pro Asn Leu Ser Leu Arg Ile Phe Thr Ala Arg
            100   105   110

Leu Tyr Phe Cys Glu Asp Arg Lys Ala Glu Pro Glu Gly Leu Arg Arg
        115   120   125

Leu His Arg Ala Gly Val Gln Ile Ala Ile Met Thr Phe Lys Asp Tyr
    130   135   140

```
Phe Tyr Cys Trp Asn Thr Phe Val Glu Asn His Glu Arg Thr Phe Lys
145                 150                 155                 160


Ala Trp Glu Gly Leu His Glu Asn Ser Val Arg Leu Ser Arg Gln Leu
                165                 170                 175


Arg Arg Ile Leu Leu Pro Leu Tyr Glu Val Asp Asp Leu Arg Asp Ala
            180                 185                 190


Phe Arg Thr Leu Gly Leu
        195


<210>  913
<211>  7
<212>  PRT
<213>  Artificial sequence

<220>
<223>  synthetic sequence

<400>  913

Pro Lys Lys Lys Arg Lys Val
1               5


<210>  914
<211>  16
<212>  PRT
<213>  Artificial sequence

<220>
<223>  synthetic sequence

<400>  914

Lys Arg Pro Ala Ala Thr Lys Lys Ala Gly Gln Ala Lys Lys Lys Lys
1               5                   10                  15


<210>  915
<211>  9
<212>  PRT
<213>  Artificial sequence
```

<220>
<223> synthetic sequence

<400> 915

Pro Ala Ala Lys Arg Val Lys Leu Asp
1   5

<210> 916
<211> 11
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 916

Arg Gln Arg Arg Asn Glu Leu Lys Arg Ser Pro
1   5   10

<210> 917
<211> 38
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 917

Asn Gln Ser Ser Asn Phe Gly Pro Met Lys Gly Gly Asn Phe Gly Gly
1   5   10   15

Arg Ser Ser Gly Pro Tyr Gly Gly Gly Gly Gln Tyr Phe Ala Lys Pro
            20   25   30

Arg Asn Gln Gly Gly Tyr
        35

<210> 918
<211> 42
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 918

Arg Met Arg Ile Glx Phe Lys Asn Lys Gly Lys Asp Thr Ala Glu Leu
1   5   10   15

Arg Arg Arg Arg Val Glu Val Ser Val Glu Leu Arg Lys Ala Lys Lys
            20   25   30

Asp Glu Gln Ile Leu Lys Arg Arg Asn Val
        35   40

<210> 919
<211> 8
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 919

Val Ser Arg Lys Arg Pro Arg Pro
1   5

<210> 920
<211> 8
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 920

Pro Pro Lys Lys Ala Arg Glu Asp
1   5

<210> 921
<211> 8
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 921

Pro Gln Pro Lys Lys Lys Pro Leu
1   5

<210> 922
<211> 12
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 922

Ser Ala Leu Ile Lys Lys Lys Lys Lys Met Ala Pro
1   5   10

<210> 923
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 923

Asp Arg Leu Arg Arg
1   5

<210> 924
<211> 7
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 924

Pro Lys Gln Lys Lys Arg Lys
1   5

<210> 925
<211> 10
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 925

Arg Lys Leu Lys Lys Lys Ile Lys Lys Leu
1 5 10

<210> 926
<211> 10
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 926

Arg Glu Lys Lys Lys Phe Leu Lys Arg Arg
1 5 10

<210> 927
<211> 20
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 927

Lys Arg Lys Gly Asp Glu Val Asp Gly Val Asp Glu Val Ala Lys Lys
1 5 10 15

Lys Ser Lys Lys
20

<210> 928
<211> 17
<212> PRT

<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 928

Arg Lys Cys Leu Gln Ala Gly Met Asn Leu Glu Ala Arg Lys Thr Lys
1 5 10 15

Lys

<210> 929
<211> 30
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 929

Met Asp Ser Leu Leu Met Asn Arg Arg Lys Phe Leu Tyr Gln Phe Lys
1 5 10 15

Asn Val Arg Trp Ala Lys Gly Arg Arg Glu Thr Tyr Leu Cys
20 25 30

<210> 930
<211> 11
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 930

Tyr Gly Arg Lys Lys Arg Arg Gln Arg Arg Arg
1 5 10

<210> 931
<211> 12
<212> PRT

<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 931

Arg Arg Gln Arg Arg Thr Ser Lys Leu Met Lys Arg
1 5 10

<210> 932
<211> 27
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 932

Gly Trp Thr Leu Asn Ser Ala Gly Tyr Leu Leu Gly Lys Ile Asn Leu
1 5 10 15

Lys Ala Leu Ala Ala Leu Ala Lys Lys Ile Leu
20 25

<210> 933
<211> 33
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 933

Lys Ala Leu Ala Trp Glu Ala Lys Leu Ala Lys Ala Leu Ala Lys Ala
1 5 10 15

Leu Ala Lys His Leu Ala Lys Ala Leu Ala Lys Ala Leu Lys Cys Glu
20 25 30

Ala

<210> 934
<211> 16
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 934

Arg Gln Ile Lys Ile Trp Phe Gln Asn Arg Arg Met Lys Trp Lys Lys
1 5 10 15

<210> 935
<211> 11
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 935

Tyr Gly Arg Lys Lys Arg Arg Gln Arg Arg Arg
1 5 10

<210> 936
<211> 9
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 936

Arg Lys Lys Arg Arg Gln Arg Arg Arg
1 5

<210> 937
<211> 11
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 937

Tyr Gly Arg Lys Lys Arg Arg Gln Arg Arg Arg
1 5 10

<210> 938
<211> 8
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 938

Arg Lys Lys Arg Arg Gln Arg Arg
1 5

<210> 939
<211> 11
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 939

Tyr Ala Arg Ala Ala Ala Arg Gln Ala Arg Ala
1 5 10

<210> 940
<211> 11
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 940

Thr His Arg Leu Pro Arg Arg Arg Arg Arg Arg
1 5 10

<210> 941

<211> 11
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 941

Gly Gly Arg Arg Ala Arg Arg Arg Arg Arg Arg
1 5 10

<210> 942
<211> 19
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<220>
<221> MISC_FEATURE
<222> (1)..(1)
<223> The amino acid at position 1 may be attached to an acyl group.

<400> 942

Tyr Gly Pro Lys Lys Lys Arg Lys Val Gly Gly Ser Pro Lys Lys Lys
1 5 10 15

Arg Lys Val

<210> 943
<211> 16
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 943

Gly Tyr Ala Cys Gly Glu Met Gly Trp Val Arg Cys Gly Gly Ser Lys
1 5 10 15

<210> 944
<211> 10
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 944

Tyr Gly Arg Arg Arg Arg Arg Arg Arg Arg
1 5 10

<210> 945
<211> 14
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 945

Tyr Gly Arg Lys Lys Arg Arg Gln Arg Arg Arg Pro Pro Gln
1 5 10

<210> 946
<211> 13
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 946

Gly Gly Gly Gly Ser Gly Gly Gly Gly Ser Gly Gly Tyr
1 5 10

<210> 947
<211> 7
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 947

Ser Ser Gly Gly Gly Gly Tyr
1 5

<210> 948
<211> 4
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 948

Arg Arg Arg Tyr
1

<210> 949
<211> 4
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 949

Tyr Arg Arg Arg
1

<210> 950
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 950

Arg Arg Arg Arg Tyr
1 5

<210> 951

<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 951

Tyr Arg Arg Arg Arg
1 5

<210> 952
<211> 4
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 952

Glu Glu Glu Tyr
1

<210> 953
<211> 4
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 953

Tyr Glu Glu Glu
1

<210> 954
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 954

Glu Glu Glu Glu Tyr
1 5

<210> 955
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 955

Tyr Glu Glu Glu Glu
1 5

<210> 956
<211> 7
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 956

Glu Asn Leu Tyr Phe Gln Gly
1 5

<210> 957
<211> 7
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 957

Glu Asn Leu Tyr Thr Gln Ser
1 5

<210> 958
<211> 9
<212> PRT

<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 958

Glu Asn Leu Tyr Phe Gln Gly Gly Tyr
1 5

<210> 959
<211> 7
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 959

Glu Asn Leu Tyr Phe Gln Ser
1 5

<210> 960
<211> 11
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<220>
<221> MISC_FEATURE
<222> (6)..(6)
<223> Xaa is any amino acid and may be repeated 0 to 40 times.

<400> 960

Tyr Glu Glu Glu Glu Xaa Arg Arg Arg Arg Tyr
1 5 10

<210> 961
<211> 11
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<220>
<221> MISC_FEATURE
<222> (6)..(6)
<223> Xaa is any amino acid and may be repeated from 0 to 40 times.

<400> 961

Tyr Asp Asp Asp Asp Xaa Lys Lys Lys Lys Tyr
1   5   10

<210> 962
<211> 11
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<220>
<221> MISC_FEATURE
<222> (6)..(6)
<223> Xaa at position 6 may be any amino acid and may be repeated 0 to
       40 times.

<400> 962

Tyr Lys Lys Lys Lys Xaa Asp Asp Asp Asp Tyr
1   5   10

<210> 963
<211> 11
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<220>
<221> MISC_FEATURE
<222> (6)..(6)
<223> Xaa at position 6 may be any amino acid and may be repeated 0 to
       40 times.

<400> 963

Tyr Arg Arg Arg Arg Xaa Glu Glu Glu Glu Tyr
1 5 10

<210> 964
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 964

Asp Asp Asp Asp Tyr
1 5

<210> 965
<211> 4
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 965

Lys Lys Lys Tyr
1

<210> 966
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 966

Lys Lys Lys Lys Tyr
1 5

<210> 967

<211> 8
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 967

Gly Gly Gly Gly Ser Gly Gly Tyr
1 5

<210> 968
<211> 10
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 968

Glu Ala Ala Ala Lys Glu Ala Ala Ala Lys
1 5 10

<210> 969
<211> 8
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 969

Glu Ile Lys Arg Thr Gly Gly Tyr
1 5

<210> 970
<211> 382
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 970

```
Ser Leu Leu Ala Thr Val Gly Pro Thr Gly Gly Val Lys Asn Arg Leu
1               5                  10                  15

Asp Ile Val Asp Phe Val Arg Asp Glu Lys Phe Phe Thr Leu Tyr Ile
            20                  25                  30

Arg Ala Leu Gln Ala Ile Gln Asp Lys Asp Gln Ser Asp Tyr Ser Ser
        35                  40                  45

Phe Phe Gln Leu Ser Gly Ile His Gly Leu Pro Phe Thr Pro Trp Ala
    50                  55                  60

Lys Pro Lys Asp Thr Pro Thr Val Pro Tyr Glu Ser Gly Tyr Cys Thr
65                  70                  75                  80

His Ser Gln Val Leu Phe Pro Thr Trp His Arg Val Tyr Val Ser Ile
                85                  90                  95

Tyr Glu Gln Ile Leu Gln Glu Ala Ala Lys Gly Ile Ala Lys Lys Phe
            100                 105                 110

Thr Val His Lys Lys Glu Trp Ala Gln Ala Ala Glu Asp Leu Arg Gln
        115                 120                 125

Pro Tyr Trp Asp Thr Gly Phe Ala Leu Val Pro Pro Asp Glu Ile Ile
    130                 135                 140

Lys Leu Glu Gln Val Lys Ile Thr Asn Tyr Asp Gly Thr Lys Ile Thr
145                 150                 155                 160

Val Arg Asn Pro Ile Leu Arg Tyr Ser Phe His Pro Ile Asp Pro Ser
                165                 170                 175

Phe Asn Gly Tyr Pro Asn Phe Asp Thr Trp Lys Thr Thr Val Arg Asn
            180                 185                 190

Pro Asp Ala Asp Lys Lys Glu Asn Ile Pro Ala Leu Ile Gly Lys Leu
```

```
        195                 200                 205

Asp Leu Glu Ala Asp Ser Thr Arg Glu Lys Thr Tyr Asn Met Leu Lys
    210                 215                 220

Phe Asn Ala Asn Trp Glu Ala Phe Ser Asn His Gly Glu Phe Asp Asp
225                 230                 235                 240

Thr His Ala Asn Ser Leu Glu Ala Val His Asp Asp Ile His Gly Phe
                245                 250                 255

Val Gly Arg Gly Ala Ile Arg Gly His Met Thr His Ala Leu Phe Ala
            260                 265                 270

Ala Phe Asp Pro Ile Phe Trp Leu His His Ser Asn Val Asp Arg His
        275                 280                 285

Leu Ser Leu Trp Gln Ala Leu Tyr Pro Gly Val Trp Val Thr Gln Gly
    290                 295                 300

Pro Glu Arg Glu Gly Ser Met Gly Phe Ala Pro Gly Thr Glu Leu Asn
305                 310                 315                 320

Lys Asp Ser Ala Leu Glu Pro Phe Tyr Glu Thr Glu Asp Lys Pro Trp
                325                 330                 335

Thr Ser Val Pro Leu Thr Asp Thr Ala Leu Leu Asn Tyr Ser Tyr Pro
            340                 345                 350

Asp Phe Asp Lys Val Lys Gly Gly Thr Pro Asp Leu Val Arg Asp Tyr
        355                 360                 365

Ile Asn Asp His Ile Asp Arg Arg Tyr Gly Ile Lys Lys Ser
    370                 375                 380

<210>  971
<211>  391
<212>  PRT
```

<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 971

```
Ser Asp Lys Lys Ser Leu Met Pro Leu Val Gly Ile Pro Gly Glu Ile
1               5                  10                  15


Lys Asn Arg Leu Asn Ile Leu Asp Phe Val Lys Asn Asp Lys Phe Phe
            20                  25                  30


Thr Leu Tyr Val Arg Ala Leu Gln Val Leu Gln Ala Arg Asp Gln Ser
        35                  40                  45


Asp Tyr Ser Ser Phe Phe Gln Leu Gly Gly Ile His Gly Leu Pro Tyr
    50                  55                  60


Thr Glu Trp Ala Lys Ala Gln Pro Gln Leu His Leu Tyr Lys Ala Asn
65                  70                  75                  80


Tyr Cys Thr His Gly Thr Val Leu Phe Pro Thr Trp His Arg Ala Tyr
                85                  90                  95


Glu Ser Thr Trp Glu Gln Thr Leu Trp Glu Ala Ala Gly Thr Val Ala
            100                 105                 110


Gln Arg Phe Thr Thr Ser Asp Gln Ala Glu Trp Ile Gln Ala Ala Lys
        115                 120                 125


Asp Leu Arg Gln Pro Phe Trp Asp Trp Gly Tyr Trp Pro Asn Asp Pro
    130                 135                 140


Asp Phe Ile Gly Leu Pro Asp Gln Val Ile Arg Asp Lys Gln Val Glu
145                 150                 155                 160


Ile Thr Asp Tyr Asn Gly Thr Lys Ile Glu Val Glu Asn Pro Ile Leu
                165                 170                 175
```

```
His Tyr Lys Phe His Pro Ile Glu Pro Thr Phe Glu Gly Asp Phe Ala
            180                 185                 190

Gln Trp Gln Thr Thr Met Arg Tyr Pro Asp Val Gln Lys Gln Glu Asn
        195                 200                 205

Ile Glu Gly Met Ile Ala Gly Ile Lys Ala Ala Ala Pro Gly Phe Arg
    210                 215                 220

Glu Trp Thr Phe Asn Met Leu Thr Lys Asn Tyr Thr Trp Glu Leu Phe
225                 230                 235                 240

Ser Asn His Gly Ala Val Val Gly Ala His Ala Asn Ser Leu Glu Met
                245                 250                 255

Val His Asn Thr Val His Phe Leu Ile Gly Arg Asp Pro Thr Leu Asp
            260                 265                 270

Pro Leu Val Pro Gly His Met Gly Ser Val Pro His Ala Ala Phe Asp
        275                 280                 285

Pro Ile Phe Trp Met His His Cys Asn Val Asp Arg Leu Leu Ala Leu
    290                 295                 300

Trp Gln Thr Met Asn Tyr Asp Val Tyr Val Ser Glu Gly Met Asn Arg
305                 310                 315                 320

Glu Ala Thr Met Gly Leu Ile Pro Gly Gln Val Leu Thr Glu Asp Ser
                325                 330                 335

Pro Leu Glu Pro Phe Tyr Thr Lys Asn Gln Asp Pro Trp Gln Ser Asp
            340                 345                 350

Asp Leu Glu Asp Trp Glu Thr Leu Gly Phe Ser Tyr Pro Asp Phe Asp
        355                 360                 365

Pro Val Lys Gly Lys Ser Lys Glu Glu Lys Ser Val Tyr Ile Asn Asp
```

370 375 380

Trp Val His Lys His Tyr Gly
385 390

<210> 972
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 972

Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1 5 10 15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
20 25 30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
35 40 45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
50 55 60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65 70 75 80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
85 90 95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
100 105 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
115 120 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
130 135 140

```
Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Val Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 973
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 973

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                  10                  15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
```

```
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Val Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 974
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 974

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45
```

```
His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Val Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255
```

```
Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 975
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 975

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
```

```
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Gly Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300
```

His
305

<210> 976
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 976

Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1   5   10   15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20   25   30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35   40   45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
    50   55   60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65   70   75   80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85   90   95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100   105   110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115   120   125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
    130   135   140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145   150   155   160

```
Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Phe Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 977
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 977

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
```

```
1               5                   10                  15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205
```

```
His Trp Val Gly Gly Gln Met Gly Val Val Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 978
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 978

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60
```

```
Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Gly Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255
```

```
Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 979
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 979

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110
```

```
Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Phe Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
```

305

<210> 980
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 980

Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1 5 10 15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
20 25 30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
35 40 45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
50 55 60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65 70 75 80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
85 90 95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
100 105 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
115 120 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
130 135 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145 150 155 160

```
Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Gly Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 981
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 981

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15
```

```
Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Phe Pro Thr Ala Pro Asn Asp
```

```
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 982
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 982

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60
```

```
Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Gly Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270
```

```
Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285


Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300


His
305


<210>  983
<211>  305
<212>  PRT
<213>  Bacillus megaterium

<400>  983

Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15


Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30


Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45


His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60


Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80


Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95


Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110


Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
```

```
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Phe Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 984
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 984

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15


Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30


Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45


His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60


Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80


Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95


Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110


Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125


Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
    130                 135                 140


Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160


Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175
```

```
Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190


Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205


Arg Trp Val Gly Gly Gln Met Gly Val Val Pro Thr Ala Pro Asn Asp
    210                 215                 220


Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240


Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255


Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270


Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285


Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300


His
305


<210>  985
<211>  305
<212>  PRT
<213>  Bacillus megaterium

<400>  985

Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15


Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
```

```
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Val Pro Thr Ala Pro Asn Asp
    210                 215                 220
```

```
Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240


Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255


Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270


Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285


Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300


His
305
```

<210> 986
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 986

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15


Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30


Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45


His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60


Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80
```

```
Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Val Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270
```

```
Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285


Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300


His
305


<210>  987
<211>  305
<212>  PRT
<213>  Bacillus megaterium

<400>  987

Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15


Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30


Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45


His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60


Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80


Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95


Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110


Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125
```

```
Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Gly Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 988

<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 988

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                  10                  15


Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30


Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45


His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60


Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80


Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95


Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110


Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125


Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
    130                 135                 140


Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160


Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175
```

```
Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Phe Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 989
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 989

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30
```

```
Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Val Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
```

225 230 235 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
245 250 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
260 265 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
275 280 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
290 295 300

His
305

<210> 990
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 990

Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1 5 10 15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
20 25 30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
35 40 45

His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
50 55 60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65 70 75 80

```
Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Gly Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285
```

```
Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300


His
305


<210>  991
<211>  305
<212>  PRT
<213>  Bacillus megaterium

<400>  991

Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15


Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30


Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45


His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60


Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80


Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95


Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110


Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125


Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
```

```
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Phe Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 992
<211> 305
<212> PRT

<213> Bacillus megaterium

<400> 992

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15


Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30


Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45


His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60


Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80


Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95


Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110


Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125


Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
    130                 135                 140


Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160


Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175


Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190
```

```
Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Gly Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 993
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 993

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
```

```
        35                  40                  45

His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Phe Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240
```

```
Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 994
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 994

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95
```

```
Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Gly Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285
```

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
290 295 300

His
305

<210> 995
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 995

Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1 5 10 15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
20 25 30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
35 40 45

His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
50 55 60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65 70 75 80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
85 90 95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
100 105 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
115 120 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
130 135 140

```
Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Phe Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 996
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 996

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                  10                  15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190
```

```
Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Val Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 997
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 997

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45
```

```
His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Val Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
```

```
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305


<210>  998
<211>  305
<212>  PRT
<213>  Bacillus megaterium

<400>  998

Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95
```

```
Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Val Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300
```

His
305

<210> 999
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 999

Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1   5   10   15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20   25   30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35   40   45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
    50   55   60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65   70   75   80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85   90   95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100   105   110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115   120   125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130   135   140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro

```
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Gly Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 1000
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 1000

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                  10                  15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205
```

```
Arg Trp Val Gly Gly Gln Met Gly Val Phe Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 1001
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 1001

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
```

```
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Val Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255
```

```
Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 1002
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 1002

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110
```

```
Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Gly Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300
```

His
305

<210> 1003
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 1003

Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1 5 10 15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
20 25 30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
35 40 45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
50 55 60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65 70 75 80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
85 90 95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
100 105 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
115 120 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
130 135 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145 150 155 160

```
Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Phe Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 1004
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 1004

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15
```

```
Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205
```

```
His Trp Val Gly Gly Gln Met Gly Val Gly Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 1005
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 1005

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60
```

```
Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Phe Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
```

260 265 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
275 280 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
290 295 300

His
305

<210> 1006
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 1006

Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1 5 10 15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
20 25 30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
35 40 45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
50 55 60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65 70 75 80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
85 90 95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
100 105 110

```
Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Gly Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
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<210> 1007
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 1007

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15


Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30


Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45


His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60


Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80


Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95


Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110


Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125


Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140


Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160


Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
```

```
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Phe Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 1008
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 1008

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15
```

```
Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Val Pro Thr Ala Pro Asn Asp
    210                 215                 220
```

```
Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240


Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255


Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270


Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285


Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300


His
305
```

<210> 1009
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 1009

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15


Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30


Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45


His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60


Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
```

```
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Val Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270
```

```
Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285


Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300


His
305


<210>  1010
<211>  305
<212>  PRT
<213>  Bacillus megaterium

<400>  1010

Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15


Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30


Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45


His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60


Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80


Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95


Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110


Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125
```

```
Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Val Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 1011
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 1011

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                  10                  15


Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30


Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45


His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60


Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80


Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95


Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110


Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125


Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140


Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160


Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175
```

```
Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190


Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205


Arg Trp Val Gly Gly Gln Met Gly Val Gly Pro Thr Ala Pro Asn Asp
    210                 215                 220


Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240


Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255


Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270


Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285


Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300


His
305


<210>  1012
<211>  305
<212>  PRT
<213>  Bacillus megaterium

<400>  1012

Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15


Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30
```

```
Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Phe Pro Thr Ala Pro Asn Asp
    210                 215                 220
```

```
Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240


Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255


Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270


Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285


Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300


His
305
```

<210> 1013
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 1013

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15


Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30


Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45


His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60


Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80
```

```
Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Val Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
```

275 280 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
290 295 300

His
305

<210> 1014
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 1014

Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1 5 10 15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
20 25 30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
35 40 45

His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
50 55 60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65 70 75 80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
85 90 95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
100 105 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
115 120 125

```
Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Gly Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 1015
<211> 305

<212> PRT
<213> Bacillus megaterium

<400> 1015

Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1 5 10 15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
20 25 30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
35 40 45

His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
50 55 60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65 70 75 80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
85 90 95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
100 105 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
115 120 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
130 135 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145 150 155 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
165 170 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn

```
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Phe Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 1016
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 1016

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30
```

```
Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Gly Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240
```

```
Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255


Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270


Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285


Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300


His
305


<210>  1017
<211>  305
<212>  PRT
<213>  Bacillus megaterium

<400>  1017

Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15


Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30


Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45


His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60


Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80


Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
```

```
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Phe Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285
```

```
Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300


His
305


<210>  1018
<211>  305
<212>  PRT
<213>  Bacillus megaterium

<400>  1018

Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                   10                  15


Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30


Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45


His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60


Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80


Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95


Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110


Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125


Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140
```

```
Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Gly Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 1019
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 1019

```
Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1               5                  10                  15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
            20                  25                  30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
        35                  40                  45

His Thr Pro Pro Gly Ser Lys Arg Asn Ala Ala His Met Ser Ser Ala
    50                  55                  60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65                  70                  75                  80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
                85                  90                  95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
            100                 105                 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
        115                 120                 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Lys Gln Gly Asn
    130                 135                 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145                 150                 155                 160

Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190
```

```
Gln Leu Glu Gly Ala Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

His Trp Val Gly Gly Gln Met Gly Val Phe Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
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<210> 1020
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1020

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Gly Tyr Gly Gly Ser
1               5
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<210> 1021
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<212> PRT

<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1021

Met Tyr Gly Gly Ser
1   5

<210> 1022
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1022

Ser Phe Gly Phe Pro
1   5

<210> 1023
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1023

Gly Gly Gly Gly Tyr
1   5

<210> 1024
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1024

Arg Gly Gly Gly Tyr

1 5

<210> 1025
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1025

Arg Gly Arg Gly Tyr
1 5

<210> 1026
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1026

Arg Arg Arg Gly Tyr
1 5

<210> 1027
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1027

Arg Arg Arg Arg Tyr
1 5

<210> 1028
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1028

Glu Gly Gly Gly Tyr
1   5

<210> 1029
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1029

Glu Gly Glu Gly Tyr
1   5

<210> 1030
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1030

Glu Glu Glu Gly Tyr
1   5

<210> 1031
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1031

Glu Glu Glu Glu Tyr
1   5

<210> 1032
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1032

Gly Gly Gly Trp Tyr
1 5

<210> 1033
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1033

Gly Gly Trp Gly Tyr
1 5

<210> 1034
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1034

Arg Arg Arg Trp Tyr
1 5

<210> 1035
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1035

Arg Arg Trp Arg Tyr
1 5

<210> 1036
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1036

Glu Glu Glu Trp Tyr
1 5

<210> 1037
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1037

Glu Glu Trp Glu Tyr
1 5

<210> 1038
<211> 15
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1038

Gly Gly Phe Met Thr Ser Glu Lys Ser Gln Thr Pro Leu Val Thr
1 5 10 15

<210> 1039

<211> 6
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1039

Ser Gly Gly Gly Gly Tyr
1 5

<210> 1040
<211> 7
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1040

Lys Lys Val Asp Gly Leu Pro
1 5

<210> 1041
<211> 18
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1041

Gly Gly Gly Gly Ser Gly Gly Gly Gly Ser Gly Gly Gly Gly Ser Gly
1 5 10 15

Gly Tyr

<210> 1042
<211> 15
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1042

Ala Glu Ala Ala Ala Lys Glu Ala Ala Ala Lys Ala Gly Gly Tyr
1   5   10   15

<210> 1043
<211> 9
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1043

Ala Pro Ala Pro Ala Pro Gly Gly Tyr
1   5

<210> 1044
<211> 24
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1044

Ala Asn Asn Asn Asn Asn Asn Asn Asn Asn Asn Asn Asn Asn Asn Asn
1   5   10   15

Asn Asn Asn Asn Asn Gly Gly Tyr
            20

<210> 1045
<211> 8
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1045

Glu Ile Lys Arg Thr Gly Gly Tyr
1   5

<210> 1046
<211> 23
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1046

Ala Asn Asn Asn Asn Asn Asn Asn Asn Asn Asn Asn Asn Asn Asn Asn
1   5   10   15

Asn Asn Asn Asn Asn Gly Gly
            20

<210> 1047
<211> 10
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1047

Ala Pro Ala Pro Ala Pro Ala Pro Gly Tyr
1   5   10

<210> 1048
<211> 244
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1048

Met His His His His His His Arg Lys Gly Glu Glu Leu Phe Thr Gly
1   5   10   15

```
Val Val Pro Ile Leu Val Glu Leu Asp Gly Asp Val Asn Gly His Lys
            20                  25                  30

Phe Ser Val Arg Gly Glu Gly Glu Gly Asp Ala Thr Asn Gly Lys Leu
        35                  40                  45

Thr Leu Lys Phe Ile Cys Thr Thr Gly Lys Leu Pro Val Pro Trp Pro
    50                  55                  60

Thr Leu Val Thr Thr Leu Thr Tyr Gly Val Gln Cys Phe Ala Arg Tyr
65                  70                  75                  80

Pro Asp His Met Lys Gln His Asp Phe Phe Lys Ser Ala Met Pro Glu
                85                  90                  95

Gly Tyr Val Gln Glu Arg Thr Ile Ser Phe Lys Asp Asp Gly Thr Tyr
            100                 105                 110

Lys Thr Arg Ala Glu Val Lys Phe Glu Gly Asp Thr Leu Val Asn Arg
        115                 120                 125

Ile Glu Leu Lys Gly Ile Asp Phe Lys Glu Asp Gly Asn Ile Leu Gly
    130                 135                 140

His Lys Leu Glu Tyr Asn Phe Asn Ser His Asn Val Tyr Ile Thr Ala
145                 150                 155                 160

Asp Lys Gln Lys Asn Gly Ile Lys Ala Asn Phe Lys Ile Arg His Asn
                165                 170                 175

Val Glu Asp Gly Ser Val Gln Leu Ala Asp His Tyr Gln Gln Asn Thr
            180                 185                 190

Pro Ile Gly Asp Gly Pro Val Leu Leu Pro Asp Asn His Tyr Leu Ser
        195                 200                 205

Thr Gln Ser Val Leu Ser Lys Asp Pro Asn Glu Lys Arg Asp His Met
```

```
    210                 215                 220

Val Leu Leu Glu Phe Val Thr Ala Ala Gly Ile Thr His Gly Met Asp
225                 230                 235                 240

Glu Leu Tyr Lys
```

<210> 1049
<211> 387
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1049

```
Met His His His His His His Gly Gly Ser Gly Gly Ser Asp Tyr Lys
1               5                   10                  15

Asp Asp Asp Asp Lys Lys Ile Glu Glu Gly Lys Leu Val Ile Trp Ile
            20                  25                  30

Asn Gly Asp Lys Gly Tyr Asn Gly Leu Ala Glu Val Gly Lys Lys Phe
        35                  40                  45

Glu Lys Asp Thr Gly Ile Lys Val Thr Val Glu His Pro Asp Lys Leu
    50                  55                  60

Glu Glu Lys Phe Pro Gln Val Ala Ala Thr Gly Asp Gly Pro Asp Ile
65                  70                  75                  80

Ile Phe Trp Ala His Asp Arg Phe Gly Gly Tyr Ala Gln Ser Gly Leu
                85                  90                  95

Leu Ala Glu Ile Thr Pro Asp Lys Ala Phe Gln Asp Lys Leu Tyr Pro
            100                 105                 110

Phe Thr Trp Asp Ala Val Arg Tyr Asn Gly Lys Leu Ile Ala Tyr Pro
```

```
        115                 120                 125

Ile Ala Val Glu Ala Leu Ser Leu Ile Tyr Asn Lys Asp Leu Leu Pro
    130                 135                 140

Asn Pro Pro Lys Thr Trp Glu Glu Ile Pro Ala Leu Asp Lys Glu Leu
145                 150                 155                 160

Lys Ala Lys Gly Lys Ser Ala Leu Met Phe Asn Leu Gln Glu Pro Tyr
                165                 170                 175

Phe Thr Trp Pro Leu Ile Ala Ala Asp Gly Gly Tyr Ala Phe Lys Tyr
            180                 185                 190

Glu Asn Gly Lys Tyr Asp Ile Lys Asp Val Gly Val Asp Asn Ala Gly
        195                 200                 205

Ala Lys Ala Gly Leu Thr Phe Leu Val Asp Leu Ile Lys Asn Lys His
    210                 215                 220

Met Asn Ala Asp Thr Asp Tyr Ser Ile Ala Glu Ala Ala Phe Asn Lys
225                 230                 235                 240

Gly Glu Thr Ala Met Thr Ile Asn Gly Pro Trp Ala Trp Ser Asn Ile
                245                 250                 255

Asp Thr Ser Lys Val Asn Tyr Gly Val Thr Val Leu Pro Thr Phe Lys
            260                 265                 270

Gly Gln Pro Ser Lys Pro Phe Val Gly Val Leu Ser Ala Gly Ile Asn
        275                 280                 285

Ala Ala Ser Pro Asn Lys Glu Leu Ala Lys Glu Phe Leu Glu Asn Tyr
    290                 295                 300

Leu Leu Thr Asp Glu Gly Leu Glu Ala Val Asn Lys Asp Lys Pro Leu
305                 310                 315                 320
```

Gly Ala Val Ala Leu Lys Ser Tyr Glu Glu Glu Leu Ala Lys Asp Pro
325 330 335

Arg Ile Ala Ala Thr Met Glu Asn Ala Gln Lys Gly Glu Ile Met Pro
340 345 350

Asn Ile Pro Gln Met Ser Ala Phe Trp Tyr Ala Val Arg Thr Ala Val
355 360 365

Ile Asn Ala Ala Ser Gly Arg Gln Thr Val Asp Glu Ala Leu Lys Asp
370 375 380

Ala Gln Thr
385

<210> 1050
<211> 266
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1050

Met Lys Tyr Leu Leu Pro Thr Ala Ala Ala Gly Leu Leu Leu Leu Ala
1 5 10 15

Ala Gln Pro Ala Met Ala Glu Val Gln Leu Val Glu Ser Gly Gly Gly
20 25 30

Leu Val Gln Pro Gly Gly Ser Leu Arg Leu Ser Cys Ala Ala Ser Gly
35 40 45

Phe Asn Ile Lys Asp Thr Tyr Ile His Trp Val Arg Gln Ala Pro Gly
50 55 60

Lys Gly Leu Glu Trp Val Ala Arg Ile Tyr Pro Thr Asn Gly Tyr Thr
65 70 75 80

```
Arg Tyr Ala Asp Ser Val Lys Gly Arg Phe Thr Ile Ser Ala Asp Thr
                85                  90                  95

Ser Lys Asn Thr Ala Tyr Leu Gln Met Asn Ser Leu Arg Ala Glu Asp
            100                 105                 110

Thr Ala Val Tyr Tyr Cys Ser Arg Trp Gly Gly Asp Gly Phe Tyr Ala
        115                 120                 125

Met Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr Val Ser Ser Gly Gly
    130                 135                 140

Gly Gly Ser Gly Gly Gly Gly Ser Gly Gly Gly Gly Ser Asp Ile Gln
145                 150                 155                 160

Met Thr Gln Ser Pro Ser Ser Leu Ser Ala Ser Val Gly Asp Arg Val
                165                 170                 175

Thr Ile Thr Cys Arg Ala Ser Gln Asp Val Asn Thr Ala Val Ala Trp
            180                 185                 190

Tyr Gln Gln Lys Pro Gly Lys Ala Pro Lys Leu Leu Ile Tyr Ser Ala
        195                 200                 205

Ser Phe Leu Tyr Ser Gly Val Pro Ser Arg Phe Ser Gly Ser Arg Ser
    210                 215                 220

Gly Thr Asp Phe Thr Leu Thr Ile Ser Ser Leu Gln Pro Glu Asp Phe
225                 230                 235                 240

Ala Thr Tyr Tyr Cys Gln Gln His Tyr Thr Thr Pro Pro Thr Phe Gly
                245                 250                 255

Gln Gly Thr Lys Leu Glu Ile Lys Arg Thr
            260                 265
```

<210> 1051

<211> 371
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1051

```
Met His His His His His His Lys Glu Glu Thr Pro Glu Thr Pro Glu
1               5                  10                  15


Thr Asp Ser Glu Glu Glu Val Thr Ile Lys Ala Asn Leu Ile Phe Ala
            20                  25                  30


Asn Gly Ser Thr Gln Thr Ala Glu Phe Lys Gly Thr Phe Glu Lys Ala
        35                  40                  45


Thr Ser Glu Ala Tyr Ala Tyr Ala Asp Thr Leu Lys Lys Asp Asn Gly
    50                  55                  60


Glu Tyr Thr Val Asp Val Ala Asp Lys Gly Tyr Thr Leu Asn Ile Lys
65                  70                  75                  80


Phe Ala Gly Lys Glu Lys Thr Pro Glu Glu Pro Lys Glu Glu Val Thr
                85                  90                  95


Ile Lys Ala Asn Leu Ile Tyr Ala Asp Gly Lys Thr Gln Thr Ala Glu
            100                 105                 110


Phe Lys Gly Thr Phe Glu Glu Ala Thr Ala Glu Ala Tyr Arg Tyr Ala
        115                 120                 125


Asp Ala Leu Lys Lys Asp Asn Gly Glu Tyr Thr Val Asp Val Ala Asp
    130                 135                 140


Lys Gly Tyr Thr Leu Asn Ile Lys Phe Ala Gly Lys Glu Lys Thr Pro
145                 150                 155                 160


Glu Glu Pro Lys Glu Glu Val Thr Ile Lys Ala Asn Leu Ile Tyr Ala
```

```
                165                 170                 175

Asp Gly Lys Thr Gln Thr Ala Glu Phe Lys Gly Thr Phe Glu Glu Ala
            180                 185                 190

Thr Ala Glu Ala Tyr Arg Tyr Ala Asp Leu Leu Ala Lys Glu Asn Gly
        195                 200                 205

Lys Tyr Thr Val Asp Val Ala Asp Lys Gly Tyr Thr Leu Asn Ile Lys
    210                 215                 220

Phe Ala Gly Lys Glu Lys Thr Pro Glu Glu Pro Lys Glu Glu Val Thr
225                 230                 235                 240

Ile Lys Ala Asn Leu Ile Tyr Ala Asp Gly Lys Thr Gln Thr Ala Glu
                245                 250                 255

Phe Lys Gly Thr Phe Ala Glu Ala Thr Ala Glu Ala Tyr Arg Tyr Ala
            260                 265                 270

Asp Leu Leu Ala Lys Glu Asn Gly Lys Tyr Thr Ala Asp Leu Glu Asp
        275                 280                 285

Gly Gly Tyr Thr Ile Asn Ile Arg Phe Ala Gly Lys Lys Val Asp Glu
    290                 295                 300

Lys Pro Glu Glu Lys Glu Gln Val Thr Ile Lys Glu Asn Ile Tyr Phe
305                 310                 315                 320

Glu Asp Gly Thr Val Gln Thr Ala Thr Phe Lys Gly Thr Phe Ala Glu
                325                 330                 335

Ala Thr Ala Glu Ala Tyr Arg Tyr Ala Asp Leu Leu Ser Lys Glu His
            340                 345                 350

Gly Lys Tyr Thr Ala Asp Leu Glu Asp Gly Gly Tyr Thr Ile Asn Ile
        355                 360                 365
```

Arg Phe Ala
370

<210> 1052
<211> 305
<212> PRT
<213> Bacillus megaterium

<400> 1052

Met Ser Asn Lys Tyr Arg Val Arg Lys Asn Val Leu His Leu Thr Asp
1 5 10 15

Thr Glu Lys Arg Asp Phe Val Arg Thr Val Leu Ile Leu Lys Glu Lys
20 25 30

Gly Ile Tyr Asp Arg Tyr Ile Ala Trp His Gly Ala Ala Gly Lys Phe
35 40 45

His Thr Pro Pro Gly Ser Asp Arg Asn Ala Ala His Met Ser Ser Ala
50 55 60

Phe Leu Pro Trp His Arg Glu Tyr Leu Leu Arg Phe Glu Arg Asp Leu
65 70 75 80

Gln Ser Ile Asn Pro Glu Val Thr Leu Pro Tyr Trp Glu Trp Glu Thr
85 90 95

Asp Ala Gln Met Gln Asp Pro Ser Gln Ser Gln Ile Trp Ser Ala Asp
100 105 110

Phe Met Gly Gly Asn Gly Asn Pro Ile Lys Asp Phe Ile Val Asp Thr
115 120 125

Gly Pro Phe Ala Ala Gly Arg Trp Thr Thr Ile Asp Glu Gln Gly Asn
130 135 140

Pro Ser Gly Gly Leu Lys Arg Asn Phe Gly Ala Thr Lys Glu Ala Pro
145 150 155 160

```
Thr Leu Pro Thr Arg Asp Asp Val Leu Asn Ala Leu Lys Ile Thr Gln
                165                 170                 175

Tyr Asp Thr Pro Pro Trp Asp Met Thr Ser Gln Asn Ser Phe Arg Asn
            180                 185                 190

Gln Leu Glu Gly Phe Ile Asn Gly Pro Gln Leu His Asn Arg Val His
        195                 200                 205

Arg Trp Val Gly Gly Gln Met Gly Val Val Pro Thr Ala Pro Asn Asp
    210                 215                 220

Pro Val Phe Phe Leu His His Ala Asn Val Asp Arg Ile Trp Ala Val
225                 230                 235                 240

Trp Gln Ile Ile His Arg Asn Gln Asn Tyr Gln Pro Met Lys Asn Gly
                245                 250                 255

Pro Phe Gly Gln Asn Phe Arg Asp Pro Met Tyr Pro Trp Asn Thr Thr
            260                 265                 270

Pro Glu Asp Val Met Asn His Arg Lys Leu Gly Tyr Val Tyr Asp Ile
        275                 280                 285

Glu Leu Arg Lys Ser Lys Arg Ser Ser Leu Glu His His His His His
    290                 295                 300

His
305
```

<210> 1053
<211> 4
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<220>
<221> misc_feature
<222> (2)..(3)
<223> Xaa can be any naturally occurring amino acid

<220>
<221> MISC_FEATURE
<222> (4)..(4)
<223> Xaa at position 4 is a hydrophobic residue.

<400> 1053

Pro Xaa Xaa Xaa
1

<210> 1054
<211> 4
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1054

Cys Gly Gly Cys
1

<210> 1055
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1055

Cys Gly Gly Gly Cys
1   5

<210> 1056
<211> 5
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<220>
<221> MISC_FEATURE
<222> (1)..(1)
<223> Xaa at position 1 is any natural (coded) or unnatural (non-coded)
       amino acid and may be repeated 0 to 5000 (or more) times.

<220>
<221> MISC_FEATURE
<222> (3)..(3)
<223> Xaa at position 3 is any natural (coded) or unnatural (non-coded)
       amino acid and may be repeated 0 to 10 times.

<220>
<221> MISC_FEATURE
<222> (5)..(5)
<223> Xaa at position 5 may be any natural (coded) or unnatural
       (non-coded) amino acid and may be repeated 0 to 5000 (or more)
       times.

<400> 1056

Xaa Cys Xaa Cys Xaa
1   5

<210> 1057
<211> 7
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<220>
<221> misc_feature
<222> (2)..(3)
<223> Xaa can be any naturally occurring amino acid

<220>
<221> misc_feature
<222> (5)..(5)
<223> Xaa can be any naturally occurring amino acid

<220>
<221> MISC_FEATURE

<222> (7)..(7)
<223> Xaa at position 7 may be Gly or Ser.

<400> 1057

Glu Xaa Xaa Tyr Xaa Gln Xaa
1   5

<210> 1058
<211> 4
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1058

Asn Asn Asn Tyr
1

<210> 1059
<211> 6
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1059

Gly Gly Tyr Asn Asn Asn
1   5

<210> 1060
<211> 11
<212> PRT
<213> Artificial sequence

<220>
<223> synthetic sequence

<400> 1060

Ala Pro Ala Pro Ala Pro Ala Pro Gly Gly Tyr
1   5   10